

Appendix C Written Comments on the SWAP Document

Subject: SWAP Comments**Date: Fri, 18 Sep 1998 11:43:33 EDT****From: Tby2@aol.com****To: martinw@UDel.Edu**

Hi Martin -

Here are some of my comments regarding the SWAP meeting earlier this week

Delineation

Surface Water Delineation - I believe the technique proposed for delineating the Surface Water SWAP areas (i.e. the technique used for the NCC surface water WSPA) does not go far enough for delineating the areas that should be considered for analysis. The recent barn fire runoff episode in Pennsylvania and its impact on the White Clay Creek is an excellent example of why the delineation needs to incorporate more "runoff considerations" beyond that of the floodplain or erosion-prone slope (EPS) areas.

Mapping of the areas served by major storm sewers (6 inches? 12 inches?) or stormwater management facilities (# of retention/detention basins?), for example, that directly discharge to the surface water bodies (e.g. within some distance -500 feet? 1000 feet?) should be considered to expand beyond the NCC criteria of floodplain and EPS. Although not probably not necessary in all land use areas, areas that are zoned commercial, industrial, livestock, should be a focus to consider for stormwater mapping areas. This task could be daunting, but the importance of runoff is not sufficiently addressed in the NCC technique. This area probably requires additional discussion.

Recharge Issues - I believe that two categories of recharge mapping should be considered.

Category 1 would be a recharge area that is specifically related to a specific water supply aquifer in a given area (e.g. a recharge area overlying the subcrop of a confined aquifer), or can be specifically hydrologically related to a specific wellfield. These types of recharge areas are most important for protection, as they are truly source water areas for these confined aquifer types or specific wellfields. This type of recharge mapping could also facilitate the incorporation of "private water supply" wells into the SWAP context, as areas with high concentrations of private wells, which do not meet the definition of public or community or non-community, could still be protected if they had high recharge potential

Category 2 recharge areas would be the typical excellent recharge areas (as currently mapped) that are not specifically related to a subcrop area or wellfield. Although important, they should not require the same level of protection (and land use restriction) as the Category 1 type. In New Castle County, there are various mapped recharge areas (such as minor "bulls-eye" areas located in the middle of some farmers property) which have no relation to a specific well field or aquifer area that is being used for water supply - consequently the implementation of land use restrictions and development controls on these areas can be misdirected, and the true benefit to the water resources in these types of areas is hard to quantify, or ultimately justify (from a property owners perspective).

As I stated during the meeting, this mapping exercise will ultimately lead to the development of maps, that at some point in the future, will be used to support the land use protection measures and restrictions that will be developed in Kent and Sussex County. Therefore, it is important that the true source water recharge areas be identified for proper protection. But it is also important that the "other recharge areas" be differentiated, as these areas probably do not deserve the same level of protection and land use restrictions afforded to the primary recharge areas.

The importance of this will become even more apparent once the discussions proceed to contaminant source reduction measures. Much more needs to be done in the future to address "existing" land uses and activities, which are not typically affected by new ordinances/codes. With limited resources, the most

critical areas deserve the most attention. Therefore, including every recharge area into the SWAP may be too much to effectively implement.

Potential Water Supply Areas - I did not get a sense that "potential future water supply areas" are being sufficiently investigated as part of the SWAP program. Given that the SWAP will set a stage for the future, and given all the mapping and delineation that is being conducted, I think it is very important that consideration be given to going beyond the present location of water systems and identifying the areas that could reasonably be expected to be developed for water supply in the future. This may be a way of using the "excellent" recharge area mapping approach to identify "potential water supply areas" instead of excellent recharge areas. These areas would subsequently be extremely important to protect.

Trying to identify future water supply areas is a complicated task - this would include looking at proposed development areas (such as approved development plans for projects which have not yet been built, especially in Kent and Sussex County), and working with the water purveyors to identify the areas that they have targeted for water supply development currently or in the future! (its also critical that all of the major water supply purveyors, both public and private be incorporated into the SWAP committee in some way) - it will be a challenge to convince the water purveyors to disclose their long term plans for business reasons, but this could be accommodated through "area" mapping instead of property specific mapping, to sufficiently screen specific locations at this time.

Boundary Water Situations - As stated during the meeting, I think the DRBC should be a major player in developing an agreement between states as it relates to SWAP issues - any other agreements do not seem to have sufficient power. With respect to recharge areas, I think that such agreements should be pursued only if there are critical Category 1 recharge areas (as described above) that extend beyond Delaware boundaries.

Hopefully you will find these comments useful. Should you have any questions, please contact me at 302-738-7551, x2251

Tad Yancheski
Tetra Tech

Subject: SWAP Chap 3**Date:** Tue, 13 Oct 1998 10:11:39 -0400**From:** Chris Brown <chris@dnsashland.org>**To:** "martinw@udel.edu" <martinw@UDel.Edu>

Comments on Chapter 3. Apologies for the delay.

1. I think it was mentioned in first meeting: a Glossary of technical terms and acronyms will be very helpful.

2. Section 3.4 Groundwater Source Delineation - last sentence, in parentheses, describe recharge area as where water

3. Figures 1, 3 - could use larger symbols, and perhaps a key to who the suppliers are, and to whom the water is supplied

4. Figures 2, 4, 5, 6 - perhaps use "major surface waters" instead of "major hydrology"

Thanks for your efforts on this.

Chris Brown
DE Nature Society

water will pass into AQUIFERS, not just into the ground.

Subject: Chapter 4 Comments - SWAP**Date: Sat, 24 Oct 1998 16:19:15 EDT****From: Tby2@aol.com****To: jerryk@UDel.Edu**

Hi Jerry -

These are my comments regarding Chapter 4: Contaminant Source Inventory, and related issues.

Note that I will not be able to attend the next two meetings, as I will be out of town. However, Betsy Rogers will hopefully attend in my absence.

1. Contaminant Source Inventory Items - I recommend that additional data sources be reviewed for inclusion in the list of items/sites that will be considered as "contaminant sources".

Namely, facilities which must comply with SARA Title III reporting and emergency response planning requirements (Community Right to Know) should be considered for inclusion, as these facilities use or store large quantities of hazardous materials, which if released become a contaminant source. Under SARA, emergency and hazardous chemical inventory forms are required to be submitted annually to state and local authorities, which includes a "general location of hazardous materials." Other known facilities that are exempt from Title III (such as gas stations, other bulk petroleum storage/handling facilities, including AST locations, major transportation routes (rail and rail sidings, highways and parking/rest areas), etc.) should be considered as well.

2. Nature of Contaminant Source - contaminant sources should be considered for characterization in a way that illustrates the "chronic" or "acute" nature of the source. For example, a leaking UST is more likely to be a chronic source of contamination, whereas a chemical spill at one of the SARA Title III reporting facilities would more likely be an "acute" source of contamination. Perhaps definitions of chronic or acute could be derived (e.g., chronic locations contain known contaminant sources which provide a long term source of contamination to the water supply vs. acute locations contain no active contaminant sources, but the nature of the facility or operation could result in a spill that could provide a short-term/immediate source of contamination to the water supply. This could be useful to differentiate, as chronic vs. acute sources have quite different management and reduction/elimination approaches.

3. Agricultural Lands as Contaminant sources - the problem of agricultural lands is difficult to resolve with respect to identification as a contaminant source. Although certain agricultural operations are obvious, such as livestock operations, others are not so obvious.

Correlation of crop type and pesticide/herbicide/fertilizer use (if possible) should be considered, and agricultural lands mapped accordingly based on the potential chemical use. This could result in the development of crop type/chemical use maps, which could then be compared to well head and recharge areas. This type of mapping activity could support future initiatives to plant only low chemical use crops in wellhead and recharge areas for protection of the water supply.

4. Mapping of Contaminant Sources - Although there is great benefit to mapping discrete contaminant sources, polygonal mapping of similar contaminant sources or combined contaminant sources should be considered in addition to discrete mapping. Polygonal mapping could delineate "areas," for example, with low, medium, and high density of contaminant source areas/source types (i.e., chronic vs. acute) or contribution, which could be correlated to the level of water supply protection that should be considered within a given area for all activities that can impact water quality. This could become an important tool for identifying contaminant reduction/ elimination methods in a given area for both the obvious and less obvious contaminant sources. For example, residents in areas associated with a high density of contaminant sources might be solicited for voluntary reductions in the use of lawn

chemicals as part of an effort to decrease the "contaminant contribution" of the area.

That's it!!!

Should you have any questions, please contact me at 302-738-7551 x2251 or Tby2@aol.com

Tad Yancheski
Tetra Tech



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October 9, 1998

Mr. Martin Wollaston
Senior Planner
Water Resources Agency
of the University of Delaware
704 Brook Drive
Newark, Delaware 19713

Re: Source Water Assessment Program Report

Dear Mr. Wollaston:

We have reviewed the draft of Chapter 3, Delineation of Public Water Supply Sources, of the Delaware Source Water Assessment Program Report. Please accept our comments as provided below.

3.1: Surface Water Supply Sources in Delaware

We believe it is important to note how little of the surface water supply watersheds are located in Delaware – in other words, how little control Delaware has of the water quality of its surface water supplies. The only watershed totally within Delaware's jurisdiction is Hoopes Reservoir. In contrast, the Octorora Creek watershed is totally within Pennsylvania. This issue is addressed all too briefly. A table delineating for each watershed the area in Delaware, total watershed area, and percent of watershed under Delaware control would highlight this fact.

3.4: Groundwater Source Delineation

The State (DNREC) policy, as applied in Kent and Sussex Counties, should be presented first, and then the New Castle County policy presented. The State's policy deserves prominence in this document.

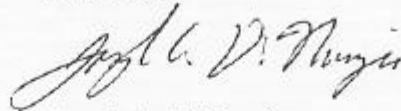
We believe that DNREC's policy for groundwater source delineation should be adopted as part of the State's Source Water Assessment Program. Rather than the arbitrary basis of designation of a 300 foot radius as adopted by New Castle County for Class A wellhead areas, DNREC's delineation has a scientific basis for large public supply wells located in unconfined aquifers. In addition, as in New Castle County, a radius of 150 feet has been considered appropriate for wells in confined aquifers. The other requirements in New Castle County are specific applications of

Mr. Martin Wollaston
October 9, 1998
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the DNREC policy which should be presented after that policy in the document.

We appreciate the opportunity to offer our comments and look forward to their incorporation within the document. If you have any questions, please let me know.

Sincerely,

A handwritten signature in dark ink, appearing to read "Joseph A. DiNunzio". The signature is fluid and cursive, with the first name "Joseph" and last name "DiNunzio" clearly legible.

Joseph A. DiNunzio
Vice President & Secretary

JAD/shf

Date: Tue, 17 Nov 1998 13:31:14 -0500
From: Chris Brown <chris@dnsashland.org>
To: "'jerryk@udel.edu'" <jerryk@UDel.Edu>
Subject: SWAP Chapt. 5 Comments

Here are comments on Chapter 5. Keep up the good work!

Chris Brown
DE Nature Society

Chapt. 5 Comments

Section 5.3, #1 - "If monitoring determines that the aquifer...is impaired..." I interpret this as if the aquifer shows contamination in any location, even if out of the zone of contribution of well, that the given well is automatically susceptible. Is this the intent, and is it reasonable? Also, "impaired" may need a specific definition.

Section 5.3, #3 - Not sure of the definition of "wellhead" here and throughout the document. Isn't wellhead just the top of the well itself, and the "wellhead protection area" the area around the wellhead to be protected. For this section I would use the "zone of influence" or "zone of contribution" as wording to describe the area around wells with reference to susceptibility.

Section 5.3, #4 - Could a well built before 1969, but found to still be structurally sound during inspection, have low susceptibility? If wells built before 1969 are automatically deemed more susceptible, then there is no need to inspect the wells built before 1969. Also, unfortunately there are many poorly constructed or deteriorated wells built AFTER 1969. Should newer wells be inspected, unless recent records show reason not to?

Section 5.4, #1 - "Contaminated" is used here rather than "impaired" as in Section 5.3. A difference?

TABLES 5-2, 5-3: Another column for "Well Integrity" between the last 2 columns will help clarify.



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1 December 1998

Gerald J. Kauffman, P.E.
Water Resources Agency
DGS Annex
University of Delaware
Newark, DE 19716

Dear Mr. Kauffman:

Thank you for allowing the Delaware Department of Agriculture to participate in the Source Water Assessment Program (SWAP). Foremost, I would like to offer my support for the methodology for determining susceptibility/vulnerability presented at the November 18th meeting. Obviously, there are "pitfalls" associated with reducing a complex vulnerability assessment into simple categories (i.e. high, medium, and low). But, given the circumstances, I feel the methodology presented is a good compromise, and meets the needs of the program. I would strongly suggest including caveats with the methodology, informing the eventual "end-user" of its limitations, intended use, etc.

I believe a more important issue is how all of this information and data will be presented to the public. This issue may prove to be the most challenging and contentious issue that will face the Committee. I realize this subject is a topic for discussion at future CTAC meetings, however, I would like to preempt those discussions while my thoughts are fresh.

I think everyone supports the notion of "public awareness and education" in principle. However, there also exist the potential for an unintended outcome. Distribution of unqualified or incomplete information can become divisive, and serve to separate communities as opposed to uniting them. People too often focus on "fixing the blame, not the problem", to paraphrase an ancient Chinese proverb. The pfisteria issue of the past few years is a good example. With regard to the Internet, there are already numerous sites with "lures" such as "find the polluter in your neighborhood" (simply click on the map to identify them). I would caution the Committee to be mindful of this unintended use.


The Committee may also want to get a legal opinion from the Attorney General's office concerning potential litigation (defamation of character) arising from identification of an individual's property as a "potential contaminant source", or resulting property devaluation from such classification.

I think it is important that we also identify pollution prevention measures as vigorously as we identify potential pollutant sources. Specifically, with regard to agriculture, many farmers participate in land stewardship programs (ie. BMPs, IPM, etc.) in the state. I would encourage the Committee to consider giving credit to these individuals wherever possible. Therefore, when the curious "Internet surfer" finds the SWAP page and "clicks" on the poultry house or cropland near their house, they can see that this "potential source of contamination" is making a good faith effort to reduce their share. This may also apply to "hazardous waste" sites that are undergoing remediation. I believe the Committee should give credit where it's due, if we want to keep the public positively involved in the program.

Finally, I would like to mention data quality, metadata, etc. The SWAP will be providing a large amount of information and data to the public. I would caution the Committee on adopting a "data is data" policy. This invites the layperson to unintentionally misinterpret information. And perhaps more calculating, it allows "radical" groups to "spin" data to spawn erroneous conclusions in order to alarm the public. I believe any data presented to the public should be thoroughly qualified, researched, referenced, and its limitations and uses clearly outlined. The Committee should ensure the end-users of SWAP information cannot interpret or extrapolate information to false or misleading conclusions. I suggest the Committee consider adopting some type of Quality Management Plan (QMP) or Quality Assurance Project Plan (QAPP) to support the information and data presented as part of the SWAP.

Thank you again for the opportunity to participate and comment, and if you have any questions concerning these comments, please feel free to contact me.

Respectfully,



Scott C. Blaier, P.G.

Hydrologist, Delaware Department of Agriculture



WATER AND WASTE WATER DEPARTMENT
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December 4, 1998

Mr. John Barndt
DNREC
P. O. Box 1401
Dover, DE 19903

Dear Mr. Barndt:

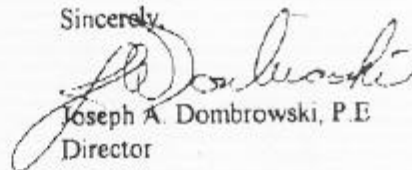
I have reviewed the November 12 draft of Chapter 5, Susceptibility Determination, of the Delaware Source Water Assessment and Protection Program Report and I have the following comments:

1. With the proposed rating methodology, practically every source will be rated HIGH with no differentiation as to the degree of susceptibility. If the end result is to address the most susceptible sources first and the least susceptible last, this methodology does not yield a prioritized listing. I suggest a numerical scale from 0 to 5 to yield a prioritized list.
2. With the wording "contamination", "high susceptibility", and "toxics", the media will splash doom across the headlines and cause unnecessary and unwarranted alarm among the customers. We need to be careful concerning the words used and the slant of the final report.
3. Treatment of problem source waters needs to be addressed and figured into the methodology. A source with radon or radium is difficult to treat and would receive a 5 rating. A source water with iron would receive a 2 or 3 rating.
4. Using the Maximum Contaminant Level (MCL) is a better assessment than the background levels. There is not necessarily a health risk if a source water has a parameter above the background level. There is a health risk if the level is above the MCL. A risk rating from 0 to 5 could be based on the percentage of the MCL, with 5 representing a parameter at or greater than the MCL.

5. The sensitivity of a well would better be evaluated by the time of travel of a contaminate rather than the depth of screen or into which aquifer it is screened. A contaminate with a time of travel measured in years would have a risk rating of 0 or 1. A time of travel measured in months would have a risk rating of 5.
6. I hesitate to accept that just because a well was constructed before 1969, it will be categorized as more susceptible than a well constructed after 1969. Each well needs to be evaluated based on its own condition and with a degree of risk rating from 0 to 5.
7. With all of the above categories, a weighting value would provide a way to place emphasis based on certain categories.

If you have any questions, do not hesitate to contact me.

Sincerely,



Joseph A. Dombrowski, P.E.
Director

United Water



-Mar-12-

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December 7, 1998

John Barndt, P.G.
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89 Kings Highway
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Dover DE 19903

RE: Chapter 5 - Susceptibility Determination

Dear Mr. Barndt:

After reviewing Chapter 5, Susceptibility Determination, of the Source Water Assessment and Protection Program we would like to make the following comments.

Using just three categories (high, medium, and low) to rate all source water oversimplifies the situation. This also makes differentiation of the susceptibility of all of Delaware's source water difficult. The four factors (chapter 5, page 1) used in defining susceptibility are good, but perhaps they should be weighted.

We have a great deal of concern about how this information will be presented to the public by the press. Information concerning treatment of surface waters should appear very early in the document and should be emphasized.

Although we recognize that the focus of this legislation is source water *before* treatment, there are factors, which we believe lessen the vulnerability of surface water systems. These include source flexibility (different intakes and different sources), system storage and treatment capabilities.

We also feel that listing inactive or "no further action" Superfund or HSCA sites, or showing them on a map will serve to unnecessarily alarm the public.

We thank you for the opportunity to comment on the document and for the opportunity to participate in the process.

Very truly yours,

Sheila A. Dolan
Manager of Water Quality

cc: M. Wollaston
N. J. Trushell



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December 8, 1998

Mr. Martin Wollaston
Senior Planner
Water Resources Agency
of the University of Delaware
704 Brook Drive
Newark, Delaware 19713

Re: Source Water Assessment and Protection Program Report

Dear Mr. Wollaston:

We have reviewed the draft of Chapter 5, Susceptibility Determination, of the Delaware Source Water Assessment and Protection Program Report. Please accept our comments as provided below.

The determination of a water source's susceptibility to contamination is perhaps the key component of the Source Water Assessment and Protection Program. **Any source is susceptible to some risk of contamination; however, the degree of risk ranges from negligible to a known presence of contamination.** The purpose of the Source Water Assessment and Protection Program is to encourage communities to take appropriate action to protect source waters from future contamination. This is an admirable and desirable goal; however, risk of contamination, like most risks, can never realistically and cost effectively be entirely eliminated. In fact, even today, we find that treatment of contaminated water is sometimes a more cost effective approach to meeting the water needs of the community than attempting to identify and remove the source of contamination. **As discussed in our last meeting, treatment of source water before it is provided to the customer should be clearly addressed in the final document and in any media releases.**

Vulnerability

In searching for the proper balance, we should not use any language that unnecessarily alarms the community. It seems that we all agree that water from a confined aquifer would have a lesser probability of contamination and that surface water sources and water from an unconfined aquifer, particularly from relatively shallow depths, would have a greater probability of contamination. The term we have agreed to apply to this probability of contamination is "vulnerability". However, the use of "high", "medium" and "low" vulnerability as currently

drafted fails to clearly reflect the range of risk. **An alternative approach that would better reflect the range of risk (vulnerability) would be to use a numerical scale of 0 to 5 as Mr. applied to each of the four factors noted in paragraph 5.1 of the draft.** Vulnerability would then range across a scale of risk. This approach will also permit source waters to be more clearly prioritized in terms of susceptibility, better achieving the ultimate goal of determining which sources require the most immediate attention. We will specifically address two of the four factors below and note how this approach might be applied.

Influences of Human Activity and Natural Features

The question was appropriately raised in our last meeting regarding the use of "background levels" to assess contamination of groundwater sources versus Maximum Contaminant Levels (MCL's) for surface water sources. Since MCL's are generally viewed and accepted as the levels above which some health risk might exist, it is understandable and reasonable to use them to determine if a source is contaminated. **The fact that a groundwater source has a contaminant above a "background level" does not appropriately lead to the conclusion that there is a health risk.** It will also be a difficult mark to properly assess since establishing the "background level" is not an exact matter. We also understand the concern raised that using the MCL would mean that contamination exists at an unacceptable level, unless treatment is applied, and that the purpose of this Program is to try to prevent such contamination. This same rationale should equally apply to surface waters. **In assessing the vulnerability of source water to the influence of human activity and natural features, we believe the use of a rating system as in the following table would improve the assessment:**

<u>% of MCL</u>	<u>Risk Rating</u>
< 20%	0
20% - 39%	1
40% - 59%	2
60% - 79%	3
80% - 99%	4
> 99%	5

Hydrogeologic Sensitivity

One decision point noted in the Vulnerability Determination was "Is the well screen less than 150' deep?" As was discussed in our last meeting, the 150' screen level was an arbitrary decision. **We would suggest that a more appropriate assessment of hydrogeologic**

sensitivity could be based on time of travel of a contaminant to the well, regardless of actual screen depth. For instance, the following table could be applied:

<u>Time of Travel (months)</u>	<u>Risk Rating</u>
>12	0
9 to 12	1
6 to 9	2
4 to 6	3
2 to 4	4
< 2	5

The Vulnerability Determination uses the term "semi-confined" well in one of its decision points. **Using the above time of travel criteria eliminates any debate over whether or not a well is screened in a confined, unconfined, or semi-confined aquifer. Additionally, using time of travel as the vulnerability criterion eliminates the need to separately characterize the Coastal Plain and the Piedmont physiographic provinces.** Since all wells in the Piedmont are directly connected to the surface through cracks and fissures, no differentiation should be made between Cockeysville and other rock types.

Pumping Zones of Influence

In section 5.3, wellheads have been redefined as "pumping zones of influence." This definition directly conflicts with the definition presented in earlier chapters. **The parenthetical in paragraph 3 should be deleted. The zone of influence does not identify or indicate where a well is deriving its water, and is of little utility in this program.**

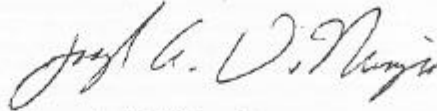
Susceptibility

If the risk rating scale we have proposed is used, an overall level of susceptibility would then be determined for each source of supply based upon the total of the risk ratings assigned to each of the four factors. It may be appropriate to give more weight to one or more of the four factors and less weight to others (such as "integrity of the surface water intake or well"). **The result of this approach would be to more clearly present the susceptibility of Delaware's source waters.** It will also permit future efforts to better focus on those water sources needing the most attention to measures of protection.

Mr. Martin Wollaston
December 8, 1998
Page 4

We appreciate the opportunity to offer our comments and look forward to discussion of these matters at our next meeting. If you have any questions, please let me know.

Sincerely,

A handwritten signature in cursive script, reading "Joseph A. DiNunzio".

Joseph A. DiNunzio
Vice President & Secretary

JAD/shf

cc: Bruce P. Kracuter
John Barndt
Doyle Brown

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December 8, 1998

Gerald J. Kauffman, P.E.
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RE: Delaware Source Water Assessment and Protection Program
Comments on Draft Chapter 5 – Susceptibility Determination

Dear Gerry:

Before giving my comments and suggestions on Chapter 5, first let me express my recognition of the efforts on the part of your staff and the DNREC personnel working with you. I think that your work has been helpful and has provided a good basis for not only the discussion within the CTAC committee, but also the final deliverable of the committee. However, on the issue of susceptibility, I am concerned that there are deficiencies in the approach and, as a result, we may be exposing both the committee and water supply providers to unnecessary criticism from the general public. Accordingly, outlined below, are suggestions regarding an alternative approach to some of the issues stated in Chapter 5.

On page 1, susceptibility is defined as the potential for a public water supply system to draw water contaminated at concentrations that would pose a *drinking water* concern. The EPA definition, as set forth in the *State Source Water Assessment and Protection Programs Guidance* document omits the words, "drinking water." It may be better to revert to the EPA's version since drinking water is technically, and should only be considered as, post-treatment water; not raw water. Thus, the definition, as given in the draft document, automatically links the contaminant threats to drinking water without reminding the reader that monitoring and treatment are an integral part of the supply of drinking water.

The four factors used to further define susceptibility on page 1 may not be appropriate (and are not used consistently throughout the chapter). The first category is defined on page 1 as, "Influences of human activity such as contamination of raw water supplies" and on pages 2 and 3 as, "Influences of human activity and natural factors". I submit that, what is being discussed is existing parameter concentrations exceeding what is considered to be natural background levels. This is a confusing category which does not clearly address whether water wells/intakes currently treat the water for these parameters (thus removing the concern) nor does it establish the basis for determining background levels. The remaining three categories correspond to the source (potential contaminant source), pathway (hydrogeologic sensitivity) and receptor (intake/well); common designations from risk analysis. Given that the first category is only an indication of current conditions in the contaminant pathway between sources and receptors, it is semi-

redundant to list it separately from “potential contaminant sources”. Instead, measured source water concentration areas should be connected to known sources or considered as sources by themselves.

It may be clearer to rephrase and reorganize the factors within the context of these risk analysis categories with the pathway divided into the physical characteristics of the water source and the fate and mobility characteristics of the contaminants within that source. The suggested factors are as follows:

1. Characteristics of potential contaminant sources (location, likelihood of release, potential release volumes, effectiveness of mitigation measures)
2. Hydrologic and/or hydrogeologic factors (travel time, dispersion, dilution)
3. Inherent contaminant characteristics (e.g., toxicity, environmental fate and transport)
4. Integrity of the surface water intake or well (survivability, construction, reliability)

A physical approach to considering susceptibility on the basis of the above categories is probably not consistent with the proposed approach of determining susceptibility from vulnerability (as defined in the handout at the last meeting) and proximity of potential contaminant sources. However, because of balance between the sensitivity of the issue of water supply (and its integrity) in Delaware, and the importance of assessing and protecting our water supplies, I suggest that we take the approach of;

1. proposing a detailed, more physically based and defensible method of determining susceptibility, and
2. refraining from giving examples of susceptibility calculations in the report.

While it might be nice to provide a methodology that is simple and understandable by the general public, the factors truly affecting vulnerability are highly complex and this goal may not be achievable. Instead, it may be better for this committee to choose accuracy over simplicity. This is certainly allowed for, and even encouraged, by the EPA which states in its *State Source Water Assessment and Protection Programs Guidance* document (Page 2-18),

“A susceptibility determination does not necessarily require modeling or monitoring in the source waters to determine which potential sources of contamination are significant. Nonetheless, EPA encourages states to undertake such modeling and monitoring, ... where necessary to provide a basis for good source management measures.”

Again, instead of proceeding further with the current methodology, I believe that some portion of the group should convene to more fully consider this matter with the intent of devising a

Gerald J. Kauffman, P.E.

RE: Comments on Draft Chapter 5 – Susceptibility Determination

December 9, 1998

Page 3

DUFFIELD
ASSOCIATES

methodology that is both accurate and achievable. We, at Duffield Associates, have some ideas regarding such a methodology and would be willing to be involved in such a forum.

In addition to the above considerations, I have the following concerns with the information contained within the draft document.

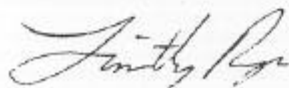
The definition for susceptibility is changed for surface waters without sufficient explanation. In my opinion, the potential for a public water supply(s) to draw contaminated water is not only dependent upon many of the factors given above and in draft chapter 5 presented to the committee, but also on the duration of the potential contaminant release relative to the ability of the PWS to refrain from using the source. Thus, in the event of a release of contamination into a water supply, a surface water source may typically be affected on the order of hours versus a groundwater source which may be affected over a longer period. Given that most, if not all, of Delaware's public water suppliers using surface water supplies have the ability to provide water to their customers while refraining from using their surface water sources for extended periods, it seems to me that "High" is perhaps not a suitable rating for susceptibility of their intakes.

Since the definition of susceptibility is based on the "potential" for contamination of water supplies, we should carefully consider whether the designations of "High", "Medium" and "Low" is appropriate. For instance, does the assignment of "High Susceptibility" to a water supply truly mean that the water supply has a high potential for contamination? Or, do we mean that it is relatively high when compared to other water supply sources? If we are taking the absolute approach and mean that the potential is "High", then we had better be very sure that we are right. If, on the other hand, we mean "Relatively High", then we should use other terms such as "More", "Average", and "Less" and the number in the "More" category should equal the number in the "Less" category. An alternative approach, more consistent with the definition of susceptibility, would be to assign a percentage to each intake or well that indicates the probability that it could be impacted at levels of concern. This approach would be technically more accurate (and therefore defensible) and would also yield results that are readily understandable by the general public.

I trust this information will be helpful to you as you continue to refine the documents and approach. If you have any questions or wish to discuss these issues further, please call me.

Very truly yours,

DUFFIELD ASSOCIATES, INC.



Timothy Ruga, P.E.

DUFFIELD ASSOCIATES

DUFFIELD ASSOCIATES, INC.
CONSULTANTS IN THE GEOSCIENCES
5400 THURSTONE ROAD
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TEL: (302) 291-6634 • FAX: (302) 291-8055
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December 8, 1998

Via Facsimile

Mr. Martin W. Wollaston, Senior Planner
Water Resources Agency
DGS Annex
Newark, Delaware 19716

RE: Comments - Draft Chapter 5
Delaware Source Water Assessment
and Protection Program.

Dear Mr. Wollaston:

We appreciate this opportunity to offer comments on the Draft of Chapter 5 – Susceptibility Determination for the Delaware Source Water Assessment and Protection Program (SWAP). The enclosed comments are also being offered on behalf of Tidewater Utilities, Inc., The City of Wilmington and Delaware City, all of whom are not members of SWAP. We have also discussed these comments with representatives of Artesian Water Company, United Water Delaware and the City of Newark and believe that they are in general concurrence with views offered herein. It is acknowledged that the issue of a water source's susceptibility to impacts, which affect its ultimate quality and potability, is the key component of the Source Water Assessment and Protection Program.

Given the importance of this mission, we are troubled about the speed with which this subject and ranking system are being addressed. It is our recommendation, based in part upon the comments and observations contained herein, that an appropriate level of technical discussion and effort be expended to develop a susceptibility determination system which is accurate and which fairly represents the real susceptibility of our State's water supply. We all are in agreement that any system which is developed will have wide use among customers, regulators and those seeking to locate or expand in Delaware. The current proposal, which utilizes criteria which are not weighted based upon relative importance and which relies upon data parameters, many of which do not represent conditions capable of impacting source supplies, needs careful consideration and revision. Finally, the culmination of this approach into a system which ranks source supplies as having low, medium or high susceptibility is neither appropriately discerning nor fair. The presently proposed draft, in our opinion, significantly overstates the potential for impact to the State's source waters and, if not revised, has the potential to create undue and unfounded concerns. We believe the following observations and the accompanying recommendations need to be discussed and acted upon by the SWAP Committee and technical support staff. These comments will be grouped using the suggested susceptibility factors outlined in Draft Chapter 5.

Before outlining our comments on the suggested susceptibility factors we would like to reiterate the comment which we made at our November 18, 1998 meeting. That comment was the need to clearly and strongly state, in the context of any report which comes from the Committee's activity, that Delaware's Water Utilities provide a level of treatment which is appropriate for the source water being treated and which meets State and Federal standards, thereby insuring that the citizens of our State have a safe water supply at their tap.

Accordingly, we offer the following observations, grouped by the proposed susceptibility ranking factors.

Influences of Human Activity and Natural Features

In our recent meeting, a suggestion was made that the use of background levels to assess the impact on source water was a difficult benchmark to properly use as an assessment tool. It is our opinion that a weighted ranking system which utilizes maximum contaminant levels (MCLs) and which is based upon the concentration, persistence (repeatability/duration), currency of impact, and number of substances exceeding MCLs would be a more appropriate ranking methodology. We would note, for instance, that an intermittent and/or ephemeral exceedance of a particular substance's MCL should be viewed very differently than a substance whose MCL has been consistently exceeded over a long period of time.

Hydrogeologic Sensitivity

We are of the opinion that utilizing well depth and age of construction are not necessarily appropriate factors to assess the susceptibility of a well to be impacted by "constituents of concern" (we suggest that this term be used throughout the SWAP document in lieu of the overused and hypersensitive term "contamination"). We know of many older wells which were constructed to more rigorous standards than post 1969 wells, for example.

We suggest that a more appropriate measure of a well's susceptibility might be related to the time of travel from a source of constituents of concern to the well. It is widely accepted that travel time coupled with the nature of the constituent character and source is a more reliable and more uniformly applicable metric. This approach allows an assessment of the ability for a constituent of concern to be naturally remediated or for mitigating measures to be taken during the intervening period of travel to the receptor well. Weight also needs to be given to whether the potential volume of the constituent of concern, whether it is, for example, a salt or a solvent, and whether its location has active management (e.g. monitoring, secondary containment, etc.). To do anything less is far too elementary of an assessment.

One final comment on this factor is appropriate. If this factor approach is to allow surface water sources to be compared to groundwater sources in terms of susceptibility, can this factor be unilaterally applied to wells without a comparable and equivalently weighted factor being developed for surface water sources?

Potential Sources of Contamination

We understand from prior draft chapters and discussions that databases which include leaking underground tank sites, superfund (CERCLA and HSCA) sites, NPDES locations and other similar data are being equated to sources of contamination (sources of constituents of concern). We believe that such an approach is faulty and overstates the potential for impact to a source supply. For instance, the examples utilized in the draft Table 5.4 list a number of leaking underground storage tank sites in the watershed. Most, if not all, of these sites were investigated, remediated and classified as needing no further action by DNREC over the last several years. Do they, therefore, even pose any risk? And what about a landfill or superfund site which has been closed or remediated under DNREC/EPA supervision? Does it pose the same risk as a "new site" or does it even pose a measurable risk? Doesn't the Delaware DNREC and the US EPA use threat to water supply as a criterion in its no further action decision?

Does a 500-gallon gasoline tank pose the same level of risk as a heating oil tank of the same capacity? Shouldn't the nature of the location/installation and distance of the source water intake be considered? Does a double lined construction and demolition landfill pose the same risk as an older unlined, but closed, municipal landfill with an elaborate closure monitoring program? If the approach proposed in the draft is to be used, a far more discerning and time sensitive evaluation needs to be employed along with a far more sophisticated risk ranking system.

At this juncture it seems appropriate to make the point that the susceptibility assessment which takes into account monitoring data or which relies upon regulatory databases represents a point in time assessment. The risk threat changes with time as constituents of concern sites are mitigated and source water quality monitoring data changes. This ephemeral nature of the susceptibility rating needs to be stressed in any document which results from this effort.

At a minimum we recommend that any CERCLA, HSCA and LUST sites which have been closed by regulatory agencies or which have been designated for no further action should not be used in the susceptibility ranking.

Integrity of the Intake/Well

It is not clear from the draft report how this factor will be applied to surface water intakes. We have commented earlier on the well integrity criteria presented in the draft report. Again, it is apparent that an oversimplified methodology, whether applied to a well or surface intake, does not result in a reliable assessment. If this factor is to be utilized, we suggest that a great deal more investigation needs to be done for each source water facility. For instance, how much more susceptible is a double cased well screened at 100 feet than a single cased well screened at 150 feet if both are in a leaky aquifer with similar nearby sources of constituents of concern?

Does a surface water intake whose intake waters are frequently monitored for quality and which can be closed in the event of a problem have a greater integrity than an intake which does not have the same degree of flow control or quality monitoring? We would also submit that a water utility's ability to detect a potential source problem, appropriately react to the problem (e.g. close an intake or shut off a well) and to continue to operate its system (storage) until the surface water problem passes should be scored as having a low range susceptibility.

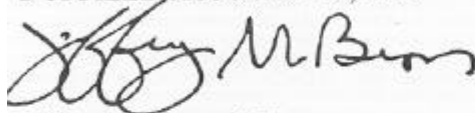
We strongly recommend that a relative weighting be assigned to each of the proposed four rating factors to reflect the importance of each to the assessment. It is recognized that the proposed changes contained in this letter will require considerable additional effort and possible expertise beyond that available on staff. To not make the effort required to do the susceptibility rating correctly would be unfortunate. The future importance of this effort to Delaware's citizens is, we believe, worth the effort.

To facilitate the recommendations discussed herein it may be appropriate to convene a smaller task group comprised of the water purveyors, the Delaware Geological Survey and appropriate technical representatives with expertise in hazardous waste water resources and risk analysis. It may also be appropriate to engage a technical consultant to work with this task group. The task group could then bring forward its ranking system to the full committee for consideration.

Thank you for this opportunity to offer comments. If you have any questions concerning the enclosed please contact us.

Very truly yours,

DUFFIELD ASSOCIATES, INC.



Jeffrey M. Bross, P.E.
President

JMB:cbf
WORD/Draft Chapter 5.doc

cc: Sheila Dolan – United Water Delaware
Joe DiNunzio – Artesian Water Company
Matt Demo, P.E. – City of Wilmington
Joe Dombrowski, P.E. – City of Newark
Gerry Esposito – Tidewater Utilities
Paul Morrill - Delaware City
John Barndt – DNREC
Doyle Brown – DNREC
Tim Ruga – Duffield Associates, Inc.



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Mr. Jerry Kauffman, P.E.
Water Resources Agency
DGS Annex, University of Delaware
Newark, DE 19716

December 18, 1998

Dear Jerry:

SUBJECT: CTAC COMMENTS - CHAPTER 5, SUSCEPTIBILITY ANALYSIS

Upon review of the draft meeting minutes from 11/18/98, I find that the minutes accurately reflect areas where Tetra Tech, on behalf of the Committee of 100, has concerns. While we are all united in our primary concern for high integrity sources of drinking water, we are also concerned that the urgency to meet regulatory time lines not impose a system that is not well thought out in regard to the long-term ramifications upon the regulation of private lands. There is a relatively high potential that the assessment of vulnerability and susceptibility of SWAP areas will lead directly into a regulatory scenario wherein the rights of private landowners are limited by the delineation effort. It is unlikely that the majority of property owners will be versed on the technical water-related characteristics of their properties. Collective CTAC concerns center around the technical soundness of the susceptibility assessments; Tetra Tech is further concerned that the assessment document is accessible to the general public (written in understandable language), and that the methods used to make the assessments contain flexibility for integrating site-specific data and professional judgement in the ultimate classification of lands.

The related issues include:

There are several "yes/no" decision trees in the Susceptibility Determination (Fig. 5-4). This is a good method of illustrating the conceptual approach. If this is our mandate at this time, then the current descriptions suffice. However, the real world is rarely so black and white. There are likely to be intermediate gray areas which may represent areas of potential disagreement, including what constitutes GWUDI, what is good versus poor well construction, and cases of multiple or unknown screened intervals. Rather than two choices per juncture ("yes" or "no"), the analysis would be more representative of reality if there were points assigned for encountered conditions, such as a scorecard approach.

It is doubtful that visual inspection will reveal anything conclusive about subsurface well construction and integrity. Consider scoring the well integrity factor to include: date of installation, whether installed by a licensed well driller, whether completion reports and/or drilling logs were filed with DNREC to indicate screened interval(s) or construction specifications, and a current visual inspection of the surface as an indicator of potential for hydrologic connection to the surface (e.g., concrete pad sloped away for drainage?, any grout or caving visible? etc.)

Similarly, the depth to the well screen could be scored in intervals rather than a single arbitrary cutoff value. Similarly the thickness of fine-grained sediments forming confining beds/aquitards could be scaled, rather than a single term. For example, this would allow Columbia wells constructed in interbedded, heterogeneous fluvial deposits to score differently from those in a fairly homogeneous granular unit.

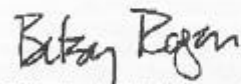
There will probably be implications of, or public perceptions created by, using "high, medium, and low" to describe vulnerability and contaminant potential; possible alternatives include expanding of the susceptibility matrix to include more categories labeled using Class A, Class B, Class C, etc. as in the UST nomenclature, and/or using a numerical ranking system (as above) to minimize word associations.

The switch to use of the 50% MCL value (for both SW and GW?) is not explained. I gather this is used in other states? The use of the term "non-naturally occurring" (p.3) again raises the very important issue of background conditions. How will this be addressed? Again, if this document is meant to be a general overview, this type of language is fine and can be refined in the subsequent "cookbook". But if details need to be provided here, then this issue needs some careful thought.

Protection and or maintenance of high quality water sources should also include consideration of mitigation of current water quality detriments (source remediation, water treatment, etc.), rather than focusing purely on future actions such as land use regulation to attain.

Due to time constraints, the consulting community has a comparatively limited opportunity to participate in the CTAC, however we wanted to restate some areas of concern. Again, the greatest concerns with the current version(s) are that: (1) the proposed assessments use language that connotes extremes of conditions, (2) the criteria are conceptually accurate but perhaps overly simplistic in application, and (3) the document makes no reference to tailoring the simplistic desktop assessment using site-specific data and professional judgement to yield the most representative classification of lands.

Sincerely,



Elizabeth W. Rogers, P.G.

jp

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18 December 1998

Gerald J. Kauffman, P.E.
Water Resources Agency
DGS Annex
University of Delaware
Newark, DE 19716

Dear Mr. Kauffman:

Thank you for allowing the Delaware Department of Agriculture to participate in the Source Water Assessment Program (SWAP). I would like to offer the following comments on the latest draft of the Source Water Assessment Program document.

Page 1-5: typographic error in last paragraph, "toassimilatee", to assimilate.

Page 2-2: first complete sentence at top of page is awkward; suggest "The committee contains representatives from all interest groups recommended by EPA, including concerned citizens and technical experts."

Table 4.1, Pesticides: Why the separate group of herbicides at the end of this list? Both are listed elsewhere in 4.1, though with different MCLs. Also, toxaphene is spelled incorrectly.

Page 4-3: list of programs; if referring to the DDA's Pesticide Program, please change Pesticide Control Program to Pesticide Program.

Page 4-6, and Map 4.3: Number 3. Nonpoint Sources; The text discusses nonpoint sources of contamination, and refers to Map 4.3. With regard to Animal Operations and Pesticide Loading, Mixing, and Storage Facilities, please note that these represent POTENTIAL contaminant sources. Unless an investigation has been done for a specific site or operation, we can not assume they are releasing contaminants and classify them as a (known) nonpoint sources of contaminants. This same argument may apply to the other categories as well, unless they are known (through investigation) to be a nonpoint source of contaminants.

Page 4-7: Ditto the above comment concerning potential and known nonpoint sources of contamination.

Page 4, Section 5.3, and Figure 5.4: The document's text and figures should indicate that the percentage of land use in a given category does not necessarily correlate to an equivalent amount of nonpoint source contamination.

For example, if 50.34 percent of a source water protection area is used for agricultural, one can not assume (or be allowed to deduce in the case of public presentation) that agricultural land use accounts for 50.34 percent of the pesticide and nutrient contaminant threat. And quantitatively, if the water in the source water protection area (through SDWA sampling of a PWS) is found to have a nitrate concentration of 10 mg/L, one can not assume that 5.034 mg/L of it is attributable to agriculture land use. I have seen this type of intuitive logic applied in other instances.

I believe a brief statement (caveat) cautioning against this type of "intuitive extrapolation" of the information is worthwhile to prevent any misunderstanding.

Also, I think this section needs an explanation of how the categorized percentages (i.e. <5%, 5-20%, etc.) of croplands are assigned their rating (negligible, low, etc.). It appears arbitrary as presented. The text correctly points out that actual contaminant loading is slaved to many variables, few, if any, that can be estimated with any precision. The University of Delaware Agricultural Sciences Department, Cooperative Extension Service, or NRCs, may have research, information, or existing rating system will allow you to present ratings based on research.

I do think that land use is very useful for identifying the "types" of contaminants that may originate from a particular land use. However, I am not sure about the rating system, since there is no explanation of how they are determined.

Table 5.2:

Pesticide MLS facilities; these facilities often store and distribute bulk "commercial" (non-manure type) liquid (i.e. nitrogen) and solid fertilizers. And since we are considering all "possible contaminants", it seems reasonable to place a "P" rating under nutrients.

I suggest we consider adding golf courses to this list. They are well-defined areas that can be considered "discrete". I understand from the last meeting that they are considered under recreational land use in Table 5.3. However, perhaps this potential source should be "broken out" here. The acres of land used for this purpose is increasing rapidly in the state, probably exceeding land used for tire piles, pesticide mixing, storage, and loading sites, etc. Potential contaminants would be pesticides and nutrients.

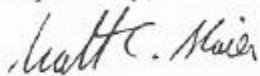
During the December 16th meeting, some discussion arose on railroads, and their contamination potential. From a pesticide standpoint, railroads belong to the category including right of ways and easements (for roads, power lines, etc.). These areas are generally treated with herbicides one or more times per year, perhaps less frequently. Any number of herbicides, and combinations,

can be used. In regard to Table 4.1, the herbicides most likely used for this type of weed control are: diquat, 2,4D, glyphosate, picloram, and simazine.

Also, during the meeting, Til Purnell brought up the subject of "time of travel, and wellhead delineation. This could become a variable if a well owner was to change their allocation significantly. Would the delineation need to be redone? And if so, would the source contaminant inventory, and consequently susceptibility determination, be revised to reflect the new boundary and its contents? This scenario may be worth mentioning in the report in Section 5.6, "Opportunities for Refinement of ...".

Thank you again for the opportunity to participate and comment. If you have any questions concerning these comments, please feel free to contact me.

Respectfully,



Scott C. Blaier, P.G.

Hydrologist, Delaware Department of Agriculture

Subject: Comments re. SWAP Draft Report

Date: Mon, 21 Dec 98 13:42:30 EST

From: "Hassan Mirsajadi" <hmirsajadi@state.de.us>

To: <jerryk@UDel.Edu>

Jerry,

The following are my comments regarding the Draft Source Water Assessment Program Report dated December 16, 1998:

1. Surface water delineation classification hierarchy (page 3-7):

A. Category 1A. Since the 100-year flood plains and erosion-prone slopes may not always overlap, I suggest modifying the definition for this category to indicate "the 100-year flood plains or erosion-prone slopes, whichever is the largest." In addition I suggest that category 1A include all areas that have a combined overland/instream travel time of less than 3 hours from the water intakes. This is to provide all areas with a short travel time to the surface water intakes, the highest priority for delineation and protection.

B. I suggest modifying definition for category 1B so that it refers to "200-foot buffer zone (setback) from the edge of the level 1A areas or from the blue line streams, whichever is the largest." This will provide a reasonable delineation hierarchy from the most sensitive areas (level 1A) to the least sensitive areas (level 2).

2. Contaminant sources affecting surface water supplies (page 4-4):

I suggest changing the text on Page 4-4, line 5 to the following:
"This data was compiled as input to the receiving stream and watershed models of the Christina Basin that will be used for Total Maximum Daily Load (TMDL) analysis."

3. Susceptibility determination (page 5-5):

The report assigns "high susceptibility" classification to several contaminant potentials and vulnerability levels. I suggest the use of an additional category such as "critical" to identify the highest susceptibility and priority ranking determination.

Please give me a call if you have any questions or need clarification.

Have a nice holiday and see you on January 6.

Hassan Mirsajadi



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Stuart Lovell, Program Manager
Division of Water Resources
Delaware Department of Natural Resources and Environmental Control
89 Kings Highway
Dover, DE 19901

MAY 28 1999

Dear Mr. Lovell:

Enclosed are our comments on Delaware's Source Water Assessment Program. This program has a high priority in our agency, and will be important to protecting the drinking water of Delaware's citizens.

Delaware's SWAP plan is quite comprehensive, and we have no major concerns with this plan. There are only a few issues of clarification which need to be addressed. Thank you for your support of this important program and your staff's strong efforts in its development.

We would like to remind you that we believe that it is critical to the success of this program that you coordinate your assessment and data gathering efforts very closely with Delaware's Department of Health and Social Services (DHSS).

If you have any questions, or would like to discuss this matter further, you may call me at 215-814-5757.

Sincerely,

A handwritten signature in cursive script that reads "Dale E. Long (for)".

Richard Rogers, Chief
Drinking Water Branch

Enclosure

EPA Comments on Delaware's SWAP

I HIGHLIGHTS

1. EPA commends Delaware on their exemplary public participation in the development of their Source Water Assessment Program (SWAP).
2. From the perspective of the Delaware Inland Bays National Estuary Program (NEP), the SWAP is comprehensive and also well linked with the Inland Bays Whole Basin Management Team. EPA's NEP program is a member of the Whole Basin team and are working closely with the Whole Basin Team through Tributary Action Teams in the development of an implementation strategy to achieve the Inland Bays TMDLs.

II SIGNIFICANT ISSUES

There are no significant issues.

III CLARIFICATION ISSUES

A. Public Participation (Chapter 2)

1. Please provide a State Response Summary that summarizes public comment during the last several public, non-CTAC meetings, and how these comments were addressed in the SWAP. It is EPA's understanding that Appendix B, "Delaware Citizen and Technical Advisory Committee Meeting Summaries" shows how significant public comments and opinions were used in developing the Delaware SWAP.
2. Please include information on how DNREC will work with the Delaware Department of Health to ensure that the Consumer Confidence Reports summarize the SWAP.

B. State Approach:

I. Delineations (Chapter 3)

1. Section 3.3 EPA Please further explain the two-zone classification approach. A graphic explanation would be helpful.
2. Does Delaware have cases where "a protection area contiguous to the well or well field would alone be inadequate to provide for the protection and benefit of the PWS (pg. 2-13, SWAP guidance)?" If so, please explain how the remote needs of a well or well field will be handled.
3. It is EPA's understanding that the entire Cockeysville aquifer is considered highly vulnerable, as shown in Figure 5-1, and has been delineated to address this vulnerability. However, a discussion of how a well in this aquifer would be protected from potential contaminant impacts from surface water (such as microbial) would be helpful.

IV OTHER COMMENTS

1. It would be helpful to number the figures and tables in Appendix H that are referenced in the Medium Town Example text (where is Table H-1 and figure h-1, etc.?). It would be helpful to include the key (ex., N=negligible, bd aquifer=?) in each figure or table.
2. Will notice of the availability of the source water assessments be advertised in the bills of water supplier's?
3. The UIC Program needs to play an integral role in the source water assessment program, especially in identifying potential sources of ground water contamination. The UIC program also provides preventative ground water protection regulations at the federal level.
4. Definitions, pg vii - Confined Aquifer - please change this definition to "An aquifer bound above and below"
5. Definitions, pg vii - Contaminant - this definition would make fish contaminants. We suggest that you re-word this definition.
6. In Section 6.2 - wouldn't the timeline in Table 6-1 for public availability of susceptibility assessments follow the timeline for susceptibility assessments - the table shows the susceptibility assessments extending into 2005 but the public availability of the assessments being completed in 2003.
7. To support source water protection, can a link be made from the Delaware source water protection website to a Delaware wellhead protection website?
8. For RCRA corrective action, source water protection areas should be available in map form so that distance and direction to nearest groundwater or surface water users can be easily determined. Identifying the locations of private groundwater users is critical to identifying potential receptors of RCRA corrective action. The Source Inventories should include RCRA corrective action sites and specific units (i.e., permitted units as well as Solid Waste Management Units within or nearby the WHPP/ZOCC area). Delaware should use data from RCRA Facility Investigations or other RCRA sources to identify contaminants of concern and significant potential sources at these sites.
9. LUSTs have accounted for a significant amount of releases to groundwater and their impacts need to be seriously considered. The recent use of the additive MTBE in petroleum-based fuels has raised new concerns about the potential for underground storage tanks to impact groundwater. The persistence and high mobility of MTBE are causing significant impacts to groundwater on the West Coast and are also expected to be

problematic here. Although EPA does not maintain a national database of UST facilities, each state UST office has tank records that may be beneficial to the states in conducting the assessments.

To: John T. Barndt@Water@DNREC
Cc:
Bcc:
From: "Lorraine Fleming" <lorraine@dnsashland.org>
Subject: FW: farmer/water utility workshop
Date: Friday, June 25, 1999 at 11:15:41 am EDT
Attach: Headers.822
Certify: N

John: FYI below. Also, I reviewed carefully the EPA comments on the SWAP, and have to believe that Delaware's submission must be among the most exemplary. I pretty much heartily agree with the comments and minor corrections offered. Re: the LUST impacts and MTBE comment I was wondering what EPA has to suggest. Otherwise looks great, and CONGRATULATIONS!
Lorraine Fleming

From: Mark Muller[SMTP:mmuller@iatp.org]
Sent: Thursday, June 24, 1999 10:46 PM
To: cwn-feedlots@igc.org; sanet-mg@ces.ncsu.edu; rивernet-info@igc.apc.org
Subject: farmer/water utility workshop

<paraindent><param>left</param>Dear agricultural and environmental
activists,

Please consider attending our workshop on cooperative agreements between farmers and drinking water providers. The workshop is part of our promotion of multifunctional agriculture -- in addition to food, agriculture can provide clean water, clean air, employment, viable rural economies, a buffer to suburban sprawl, and attractive landscapes. Recognizing these other functions can benefit the farmer and our communities.

Several people from the water supplier, agricultural, and environmental communities will gather to discuss the benefits and risks of farmer-led watershed initiatives. Examples from the Netherlands, New York City/Catskills, Columbus, and Des Moines will be explored. The workshop will take place on July 26 & 27 in Columbus, Ohio. See our website at <http://www.iatp.org/watershed> Please contact me with questions, suggestions, or to register.

thanks,

Mark

Creating Incentives for Farmer-led Source Water Protection

A Workshop on Cooperative Agreements between

Drinking Water Providers and Farmers

July 26-27, 1999

Fawcett Center at Ohio State University

Columbus, Ohio

Sponsored by the American Water Works Association and the

Institute for Agriculture & Trade Policy

To register or for more information, go to www.iatp.org/watershed or

Contact:

Institute for Agriculture & Trade Policy

2105 First Avenue South

Minneapolis, Minnesota 55404

</paraindent><paraindent><param>left,left</param>Phone: (612) 870-3420

Fax: (612) 870-4846

Email: mmuller@iatp.org

</paraindent>

To: John T. Barndt@Water@DNREC
Cc:
Bcc:
From: "Chris Brown" <chris@dnsashland.org>
Subject: Source Water
Date: Friday, June 25, 1999 at 11:54:09 am EDT
Attach: Headers.822
Certify: N

John:

I cannot attend the June 30 meeting.

I concur with the USEPA comments on the Draft Report & feel that the comments are reasonable. I will be particularly interested in responses to comments in Public Participation, and comment #2 in Other Comments.

It is important that the availability of source water assessments, and the reasons WHY it is important to be aware of them, be presented to consumers in as many reasonable means possible, first of which are water utility bill inserts. Perhaps an "abstract" or "digest" in an easily understood format could be included with the announcements.

In general, the link between Consumer Confidence Reports and Source Water Assessment/Protection needs to be as obvious as possible.

I feel that there is a need to continue the CTAC, to provide guidance on the implementation of the SWAP, and would be glad to remain on the committee.

Chris Brown
Delaware Nature Society

JUNE 23, 1999

Mr. John T. Barndt, PG.
DNREC Water Supply Division.
89 Kingsway.
Dover, Delaware 19901.

Dear Mr. Barndt:

I regret not having been able to attend several of the SWAP meetings but I've tried to keep abreast through the telephone with Mr. Doyle Brown. If I can't make the meeting on the 30th of June, I want to say I'm very proud to be able to help in these endeavors and to thank you for the opportunity.

I have gained a very good feeling about the quality of the SWAP participation in the DNREC's report to EPA's request.

As a citizen of Delaware as well as an experienced public health physician, I feel that the serious current and growing problems in the public drinking water area for Delaware citizens are being very well studied and reflect the attention of experienced engineers and management professionals. I continue to strongly recommend employment of accumulating State, National and Worldwide "Standard Methods" for sources of up to date information on providing safe and healthy public drinking water for our citizens.

I have recently had the opportunity to see the Sussex County operation of the Delaware Solid Waste Authority and I must say that I am deeply impressed with the quality of it's contribution to our citizen's good health and welfare.

Sincerely,

Eugene P. Campbell
Eugene P. Campbell, MD, MPH.

CC. Delaware Public Health Association.

Mr. Dan Short, Mayor of Seaford, Delaware.

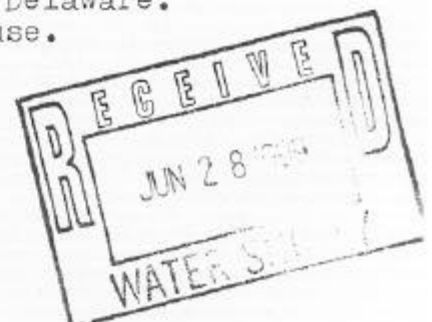
Mr. NC. Vasuki, Director Solid Waste Authority, Delaware.

Mrs. Linda Sauder, Executive Director Manor House.

Mr. Doyle Brown, DNREC.



Eugene P. Campbell
1001 Middleford Road
Seaford, DE 19973



Delaware Source Water Assessment Program
Public comments to the Draft

Submitted to: John Barndt
Department of Natural Resources and Environmental Control
89 Kings Highway
Dover, Delaware

Submitted by: Hilda Amacker, Clean Water Action,
Douglas T. Kuzmiak, Independent Consultant

Date: February 5, 1999

Introduction:

Clean Water Action is a national, grass-roots, citizen's organization headquartered in Washington, D.C. which for more than 25 years has been successfully dedicated to ensuring clean, affordable, drinking water, the prevention of health-threatening pollution and dedicated to the prevention pollution at its source.

We, along with the other organizations listed below, welcome this opportunity to address the draft of the State of Delaware Source Water Assessment Program (SWAP) that was made available to the public at the meeting in Bear on January 20, 1999 by the Delaware Department of Natural Resources and Environmental Control (DNREC) and The Delaware Citizen and Technical Advisory Committee.

We are presenting our observations and suggestions on a chapter by chapter basis regarding both concerns and questions raised by consumers, environmentalists and members of the community. Our intention is to be constructive and we hope this will serve as a vehicle for achieving greater accord within the community.

We appreciate this opportunity for citizen participation in such a fundamental yet vital aspect of health safety. We would also appreciate future opportunities to review and comment on further revisions which may be made to the SWAP. It is our sincerest hope that the questions and comments contained herein will serve to improve the implementation of an initiative for which we have great expectations.

We also wish to take this opportunity to say that we are very impressed with the depth of commitment that the State of Delaware has shown in regards to their Source Water Assessment Proposal. There is much useful information, both basic and technical, contained within this draft and it was found to be as readable by the professional hydrologist or environmental engineer as the layperson interested in the SWAP initiative. However, as will be shown in the successive pages, we have some questions and comments about draft.

Clean Water Action

Hilda Amacker
Kye Briesath
Paul Schwartz

Chapter 1 - Overview of the Source Water Assessment Program:

1.3 We noted with interest DNREC's outline of the Public Supply Wells and Water Systems located within the State, and the draft's comprehensive Public Well Data for the State of Delaware as contained in Appendix C. This will undoubtedly serve to heighten awareness about the Public Water Systems in a given area. This information will facilitate consumer awareness and encourage public interest. DNREC's decision to operate a website dedicated to SWAP is also commendable and useful. **This should not be substituted for the other public outreach programs (at least fifty per cent of the state's population is not on the web).**

1.6 Regarding funding for SWAP, in addition to the Drinking Water State Revolving Fund, has the state planned to explore other sources of funding for these activities from the Clean Water Act Revolving Fund, the USDA programs and others? Loans and grants for improvement of drinking water systems in Delaware are an excellent means to accomplish the mission. **We urge the State to enlist, towards this end, independent contractors at every opportunity in order to avoid conflicts of interest or self-serving results.** We assume that you will make the projects being supported, their cost and the recipients of DWSRF funds publicly available. We see this oversight of the SWAP progress as a viable ongoing role for a citizens committee.

Chapter 2 - Public Participation

2.1 We commend the State of Delaware on its efforts to be inclusive. The CTAC membership list is an appreciated and appropriate part of the SWAP document. As regards other outreach efforts, it would be good to give more specific details about both efforts made and the results of those efforts (names and places). Clean Water hopes you will keep us apprised and involved in further outreach activities.

Chapter 3 - Source Water Assessment Delineation

3.1 Of great concern to us is the existence of the incinerator in Chester, Pennsylvania, and the impact it could have on drinking water viability for the people of Delaware. **Because this major facility is located in the Susquehanna River Basin of Pennsylvania -- from which 8mgd of drinking water enters Delaware -- we feel that this is a significant source of potential pollution and that should it be monitored by the proper investigating authorities of both Pennsylvania and Delaware.**

3.2 Also, in regards to the cooperation between the states of Delaware and Pennsylvania, has a time line for TMDL remediation for the Christina Basin Water Quality Management Program been established? How does this time line fit into the two year period? The TMDL time line as is presented looks extremely long. What exists to expedite the TMDL remediation time line? We recognize that the TMDL remediation will improve water quality, but question if TMDL standards will satisfy drinking water source requirements.

3.3 We welcome the maps included in the draft and the wealth of supporting data provided by the State in their draft. However, much of the data cited is now eight years old; is this data still viable especially in rapidly changing areas, and what are your plans for updating this information?

Page 3-4 contains a paragraph about CTAC members' concerns regarding stormwater pipes and outfalls within the State. We would suggest that these concern be addressed more strongly. The final sentence of this paragraph should read: **"Therefore, the actual mapping of these structures will not be included in the delineation, but the outfalls will be part of the identification of existing or potential sources of contamination, and these outfalls will be catalogued as to location."** This eliminates the word "considered" and includes outfalls as sources of contamination. We feel very strongly about outfalls being identified and the potential contaminants being ascertained.

By means of clarification for the general public, could DNREC in the future give an explanation of how much volume of water would constitute 50,000gpd, for example how many families use 50,000gpd?

Mention was made on Page 3-6 of the circular wellhead radius of 150 feet. While we are aware that this falls within the EPA specified guidelines we would appreciate it if DNREC would again review this guideline and **revise the State's minimum circular wellhead area radius from 150 feet to 200 feet for all public wells pumping at or less than 50,000gpd as is the situation with well pumping >50,000gpd.** We believe that this could be done without interference to already established businesses and that a plan could be implemented, over time, for the radius to be extended.

* With reference to Recharge Potential areas and Mapping as highlighted on Page 3-7 it is our belief that all known recharge areas should be protected. If in the future the recharge areas could be identified and described in some greater detail, this would help to identify potential areas of concern. We would suggest that a zone of secondary protection be established for entire recharge areas.

Chapter 4 - Contaminant Source Inventory:

4.2 The contaminant listings for both regulated and unregulated contaminants appear to be pretty complete. Our main area of concern has to do with the removal from, and addition to, unregulated contaminant lists for example how is this done? Is there a monitoring program that defines how long a contaminant has to be missing before it is eliminated, and once it is eliminated do you stop looking for it? Will you continue to monitor for what was once there and could now be in the time-travel stage? How often will the current contaminant list be updated?

Because of the persistence of problems in coastal groundwater in Delaware, we believe that saltwater intrusion needs to be addressed more fully and specifically in the SWAP draft. Elevated levels of sodium have negative indications for many populations in untreated or treated water. There is current evidence of negative aspects of salt water intrusion being exacerbated by treatment. These indicators heighten the importance of addressing this ongoing area of concern as a part of any protection and prevention initiative. Saltwater intrusion does not appear to be addressed in the Delaware SWAP draft, which leads us to request that this aspect of contaminants be more fully explained. We noted on Page 4-2 that Sodium is listed as a Secondary MCL Substance but we are of the opinion that saltwater intrusion be addressed more clearly as an ongoing potential problem in coastal groundwater.

4.4 This section also leads us to comment that when drinking source water turns out to be waters that the State already has identified as impaired under the Clean Water Act TMDL mandated levels, it becomes even more important to enlist the aid of independent expertise in identifying both the types and sources of contamination in these waters.

The list of point and non-point contaminant sources, while probably complete by intent, does not specifically mention some areas that are of concern to us. This would include hazardous waste from hospitals, incinerators in or near the State water supply, and the PCB production from utilities -- notably electric generating plants.

Chapter 5 - Susceptibility Determination

Overall, the amount of information, the use of extensive graphs and tables and the inclusion of the Whole Basin Assessment Time line were very useful inclusions which further point to the conscientious approach DNREC took in preparing the SWAP draft. There are, however, a couple of points which we would like to raise regarding

this section.

5.5 In view of the tremendous residential and concomitant infrastructural growth in the past nine years in groundwater sensitive areas, what adjustments or updates have been made to the 1990 Wellhead Protection Program to address these changes? **What updates are planned considering the amount of development that has and continues to take place?**

5.6 We encourage the State of Delaware to pay close attention to the susceptibility of surface and ground water contamination from, as mentioned before, hospitals, public utilities and incinerators. We note with interest and appreciation the State's commitment to utilize a more refined approach to determining the relative importance of CAFOs and hope that you will closely investigate the effluent run-off from these agricultural sectors of the state's economy, particularly in view of the outbreaks of *Pfisteria* neighboring states.

Chapter 6 Prioritization of Source Water Assessments

6.1 Clean Water Action reviewers of SWAP documents nationwide have expressed concern about the pervasive lack of intent on the part of the state SWAP plan drafters to implement these plans in a timely fashion. In view of the level of interstate cooperation, the ongoing innerstate systems for water quality assessment, and given the small geographical size of the State we were disappointed to see that even Delaware does not intend to complete the work in the two years allocated.

Direct requests from consumers should have equal weight with direct requests from purveyors as regards to the statement: "sources where contaminants of concern have been detected," (P6-1).

6.2 As per our comment in 6.1, are there plans to utilize any of Delaware's resources under the Drinking Water State Revolving Fund to expedite the completion of Whole Basin Assessment work (see figure 5.2)?

6.3 Clean Water Action requests to be included in the mailing lists to receive copies of these reports. We are most appreciative of the State's willingness to make the benefits of the entire SWAP effort available to domestic well owners throughout the State. We believe any efforts that the State can make to go beyond the "by request assistance to private well owners" would only enhance the overall SWAP program.

Appendices:

The Appendices are a welcome addition to the Delaware SWAP Draft and contain a great deal of useful information. Some of this information, particularly that which is within Appendix B (Delaware Citizen and Technical Advisory Committee Summaries) for September 16, 1998, contains information and lines of questioning which we, too, have considered and which we feel should be included in the SWAP draft. For example, Although John Barnes (P.3) explained that wells <50,000gpd are given a 150' radius, there is no further indication as to what prompted this question or the response given. As noted in the Chapter 3 comments, we also have raised questions about this radius.

Arising from the meeting held on October 14, 1998, is a question about saltwater intrusion which is something we, also raised in our Chapter 4 comments. Although we understand that the State wishes to pursue this issue on a site-specific basis if it sees a problem, this nevertheless is something of concern to the community and there are potentially many sites which could be of concern. As noted in these minutes, CAFOs represent a question for members of the community as they do for ourselves and we again wish to encourage the State to pay close attention to this potentially lethal issue.

We are, however, pleased to see that Saltwater intrusion is listed as a Significant Source of Contamination in Appendix material arising from the SWAP CTAC meeting in Dover, Delaware on November 18, 1998, and

contained in the Appendices accompanying the SWAP Draft presented at Bear, Delaware, in January.

The question of whether non-SDWA regulated contaminants be part of the State's Swap program is an intriguing one, especially because it came from a CTAC member representing the Delaware Public Health Association and because this is something that the State should also give close attention to. If not already being done, information should be distributed state-wide about unregulated contaminants because an informed public is a healthy public. Also, what impact could-- or does-- the Cathcart Bill have on the Delaware SWAP? The question regarding contaminants that are manufactured in Delaware in large quantities that may soon be regulated echoes our own sentiments and we would appreciate an answer to this question.

The inclusion of Appendices H and I make for interesting and informative reading, and with a few calculations partially answer our questions regarding how much gpd flow constitute the consumption of some Delaware cities, but nevertheless, actual volumes and more "real-life" situations would be appreciated.

To: John T. Barndt@Water@DNREC
Steven M. Smaller@Water@DNREC
Cc:
Bcc:
From: "Yancheski, Tad -- Tt, Inc." <Tad.Yancheski@tetratech.com>
Subject: June 30 SWAP Meeting
Date: Tuesday, June 29, 1999 at 3:36:16 pm EDT
Attach: Headers.822
Certify: N

Hi John/Steve -

Unfortunately, I will not be able to attend the June 30, 1999 SWAP meeting because of other out-of-town commitments. However I wanted to commend DNRECs' and all other party efforts on the final draft SWAP document. I view the EPA comments as being minor, which indicates the initial effort was outstanding.

I wanted to share my thoughts on the future of the CTAC and a continued role in the Source Water Assessment and Protection Program. I believe the CTAC should continue to have a role in the SWAP Program. There is considerable technical and administrative talent in that group that could be very beneficial to SWAP in the long term.

I would recommend at least semiannual or annual meetings to provide the group with an update on new maps/guidelines/and other products/initiatives that DNREC and WRA have generated with respect to the SWAP. These meetings would provide a good communication outlet to share the status and results of SWAP activities to the major parties impacted by the products/initiatives.

Maintaining the CTAC could also provide a means of on-going "peer review" of the SWAP products, thereby enhancing their acceptance with the community that will be most impacted by the conclusions drawn from the SWAP products. The idea of outside "peer review" of government produced technical documents is not a new concept, but I believe its appropriate for this subject matter. Early resolution of some of the technical issues will benefit all in the long run.

Again, I regret not being able to attend the meeting, but have appreciated the opportunity to participate in the CTAC. Please call with any questions.

Tad Yancheski
Tetra Tech
302-738-7551

Water Table: The surface between the vadose zone and the ground water; that surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Transmissivity: The rate at which water is transmitted through a unit width of an aquifer under unit hydraulic gradient.

Porosity: The percentage of the bulk volume of a rock or soil that is occupied by interstices, whether isolated or connected. It can be expressed quantitatively as the ratio of the volume of the interstices to the total volume.

Infiltration: The act of water seeping or filtering through the soil or rock.

Infiltration Rate: The amount of infiltration per unit of time expressed in depth of water per unit time (cm/sec; in/hr.).

Hydraulic Gradient: The rate of change of total head per unit of distance of flow at a given point in a given direction.

Worlddocs\dnrec\swppdefs.doc


Agitation See Water Well Pgs. -
Contaminant. See Water Well Pgs.
Domestic Well - See Water Well Pgs.
Ground Water. See Water Well Pgs.

John Talley

FAX TRANSMISSION

CABE ASSOCIATES INCORPORATED

144 S. GOVERNORS AVENUE
DOVER, DE 19903-0877
(302) 674-9280
FAX: (302) 674-1099

To: John Barndt Date: February 24, 1999
Fax #: 302-739-2296 Pages: 3, including this cover sheet.
From: Lee J. Beetschen 
Subject: Source Water Assessment Plan

COMMENTS:

At the request of several clients, we have been reviewing the January 1999 draft of the referenced document. On the chance that you and your committee members may not be aware, I thought it appropriate to bring to your attention the existence of two historical reports that may be relevant to your important work. *PUBLIC WATER SYSTEMS IN DELAWARE* is an inventory of ground water supply wells in Delaware as compiled by the Division of Water Resources in the late seventies. It includes date drilled, diameter, depth, screened interval, etc.

ASSESSMENT OF THE PRESENCE OF SYNTHETIC ORGANIC COMPOUNDS IN DELAWARE'S SOURCES OF WATER SUPPLY was a joint effort between my firm, the Division of Water Resources and the Division of Public Health. The report tabulates analytical results on 87 samples of raw and finished public water supplies, industrial sources as well as surface water and ground water monitoring wells. The obvious purpose behind the initiative was to establish a

...state investigators might draw conclusions as to contamination trends. The report includes general water quality indicators, chlorinated pesticides/organics as well as synthetic organic compounds.

If you are interested in reviewing either, or both, of the documents, DNREC staffer Mike Apgar may have retained copies. In the alternative, you may contact me.

By the way, Pedar Hansen gave me the fax number. I hope it is reasonably close to your office.

605/

ASSESSMENT OF THE PRESENCE OF
SYNTHETIC ORGANIC COMPOUNDS IN DELAWARE'S
SOURCES OF WATER SUPPLY

Prepared

For

Water Supply Branch

Division of Environmental Control

DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

June 25, 1980

CABE Associates, Inc.
Consulting Engineers
1679 S. duPont Highway
DOVER, DELAWARE 19901

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PUBLIC WATER SYSTEMS IN DELAWARE



1978

DEFINITIONS

AQUIFER : a water-bearing geological formation that will yield water to a well or spring.
Aquifers can be classified as confined, semi-confined or unconfined.

BASIN : the surface area that drains into a surface water system.

BACKGROUND LEVEL : Generally, the amount of a substance that occurs naturally in the environment.

BEST MANAGEMENT PRACTICES : Structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means to control nonpoint source pollutants yet are compatible with the productive use of the resource to which they are applied. These are used in both urban and agricultural areas.

CHLORINATION : One method of disinfecting water (either drinking water or wastewater).
using chlorine
yes or chlorine
brand chlorine
There is some concern that chlorine used in wastewater disinfection may be harmful to sensitive aquatic organisms inhabiting the waters that receive the treated wastewater.
not related to definition of chlorination

COMBINED SEWER OVERFLOW : Flow of wastewater and runoff in a combined sewer in excess of the sewer capacity. It represents the flow that cannot be treated immediately and is frequently discharged directly to a receiving stream without treatment, or to a holding basin for subsequent treatment and disposal.

COMMUNITY PUBLIC WATER SUPPLY : *Defined by the USEPA as* A public water supply which serves at least fifteen (15) service connections used by year round residents or regularly serves at least twenty-five (25) year round residents.

CONFINED AQUIFER : An aquifer bounded above *and* below by impermeable beds (such as silt or clay) or beds of distinctly lower permeability than that of the aquifer itself and containing ground water which is everywhere at a pressure greater than atmospheric and from which water in a well will rise to a level above the top of the aquifer.

CONTAMINANT : Any *non-detectable* physical, chemical, biological, or radiological substance in matter or water, excluding hydrogen and oxygen.

CONTAMINANT SOURCE INVENTORY : A list of possible contaminant sources within the delineated source water assessment areas. The inventory process includes: reviewing existing data on the locations of potential contaminant sources, identifying likely sources for further information, and verifying the accuracy and reliability of data sets.

DELINEATION : The process of defining and/or mapping a boundary that approximates the areas that contribute water to a particular water source used as a public water supply.

DOMESTIC WELL : A well primarily used for potable water supply purposes which serves 3 or fewer dwelling units.

porosity
EFFECTIVE POROSITY: The volume of void spaces through which water or other fluids can travel in a rock or sediment divided by the total volume of the rock or sediment.

EROSION : Wearing away of soil by running water, wind, or ice; erosion is the process by which the earth's surface is shaped and occurs even in remote, uninhabited areas at a slow rate (geologic erosion); of more concern is accelerated erosion caused by people's activities.

EROSION-PRONE SLOPE : These are areas consisting of lands with soils that are easily eroded.

contained in soil or rock units
GROUND WATER : Water beneath the earth's surface at varying depths; ~~in reservoirs~~ called aquifers.

(Ground water under the direct influence of surface water)
GWUDI : Any water beneath the surface of the ground with (i) significant occurrence of insects or other macroorganisms, algae, or large diameter pathogens such as Giardia lamblia or (ii) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlates to climatological or surface water conditions. *(recharge zone?)*

HAZARDOUS WASTE : Any waste material that is potentially dangerous, including explosives, radioactive materials, and chemicals.

HYDRAULIC GRADIENT: The change in total head of water with a change in distance in a given direction.

A gravity or pressure gradient which controls the lateral flow of ground water through an aquifer from the surface or snow/melt
INFILTRATION : The entry of water (from precipitation, irrigation, and runoff) into the soil profile.

rate at which applied to the surface of the ground
INFILTRATION RATE : The quantity of water that can enter the soil surface in a specified time interval. *If water application rate exceeds infiltration rate, runoff occurs.*


MISCELLANEOUS PUBLIC WATER SYSTEM : A public water system that is neither community, non-community or non-transient non-community. These systems typically serve less than 25 people and 15 service connections, but more than 3 service connections.

NON-TRANSIENT NON-COMMUNITY WATER SYSTEM : A public water system that is not a community water system and that regularly serves at least twenty-five (25) of the same persons over six (6) months per year.

NON-COMMUNITY PUBLIC WATER SUPPLY: A public water supply which has at least fifteen (15) service connections or regularly serves an average of at least twenty-five (25) individuals daily at least sixty (60) days out of the year. Also referred to as a Transient Non-Community Public Water Supply.

NONPOINT SOURCE POLLUTION: Pollution of surface or ground water supplies originating from landuse activities and/or the atmosphere, having no well-defined point of entry.

PERCOLATION: Downward movement of water through the ^{unsaturated portion of the} soil profile or other substance. *rock units to the water table.*

PERCOLATION RATE: The rate at which water moves through ⁱⁿ saturated granular material, such as soil or rock, toward the water table. 

POINT SOURCE POLLUTION: Pollution of surface or ground water supplies at well-defined, usually manufactured "points" or locations; discharges of treated wastewater from municipal and industrial treatment plants are common point sources of pollution.

PUBLIC DRINKING WATER SYSTEM: A community, non-community, or non-transient non-community water system, which provides piped water to the public for human consumption. The system must have at least 5 service connections or regularly serve at least 25 individuals daily for at least 60 days.

RECHARGE AREA: Land area over which precipitation infiltrates into the soil and percolates downward to replenish an aquifer

SALINITY: The quality of water based in its salt content; seawater contains approximately 18,000 ^{parts} of salt in each million parts of water. *→ salinity is usually expressed in parts per thousand i.e. 18‰*

SATURATED THICKNESS: The thickness of an aquifer that is fully filled with water, at a ~~pressure greater than atmospheric~~ *pressure has nothing to do with saturation*

SEMI-CONFINED AQUIFER: An aquifer which is overlain by a layer of sufficiently less permeability (such as very fine sand) than the aquifer itself but through which significant amounts of water can pass into the aquifer.

SEPTIC SYSTEM: An onsite system designed to treat and dispose of domestic sewage; a typical sewage system consists of a tank that receives wastes from a residence or business and a system of tile lines or a pit for disposal of the liquid effluent remains after decomposition of the solids by bacteria in the tank.

SITE INDEX DATABASE: The DNREC database developed for whole basin assessments that is used to characterize the relative environmental release potential of a discrete potential source of contamination.

SOURCE WATER: Any aquifer or surface water body from which water is taken either periodically or continuously by a public water system for drinking or food processing purposes.

SOURCE WATER ASSESSMENT AREA: The delineated area which contributes water to a public water supply system. This is called a wellhead protection area for a well and a watershed or basin for a surface water intake.

SUSCEPTIBILITY: The relative likelihood that a public water supply might draw water contaminated at concentrations at levels of public health concern to public health.

SUSCEPTIBILITY DETERMINATION: An evaluation of conditions in the source water assessment area to determine the potential for contaminants to impact public drinking water quality.

SURFACE WATER: Lakes, ponds, streams, rivers, and other water bodies, which lie on the surface of the land; ~~may be partially or fully~~ supplied by ground water.

generally *A combination of precipitation and*
TRANSMISSIVITY: The rate at which water is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient; ~~also known as hydraulic conductivity~~

UNCONFINED AQUIFER: An aquifer in which no relatively impermeable layer exists between the water table and the ground surface and an aquifer in which the water surface is at atmospheric pressure.

UNSATURATED ZONE: *Partially saturated soil and rock units above the water table*

VULNERABILITY: The relative ease with which contaminants, if released into a source water area, could move and enter a public water supply well or intake at concentrations of concern. Vulnerability includes consideration of such factors as aquifer characteristics, well or surface water intake integrity, and well screen depth.

bounded by drainage divides, which *in a stream network*
WATERSHED: An area of land that contributes runoff to ~~one~~ specific delivery point; large watersheds may be composed of several smaller "subsheds", each of which contributes runoff to different locations that ultimately combine at a common delivery point.

WATER SUPPLY PROTECTION AREA: any surface and subsurface area designated by DNREC as possessing physical characteristics related to water supply protection, that render it worthy of special protection.

below the *ground*
WATER TABLE: The upper level of a saturated zone below the soil surface, often the upper boundary of a water table aquifer.

WELLHEAD PROTECTION AREA: the surface and subsurface area surrounding a water well or wellfield supplying a public water system through which contaminants are likely to move toward a reach such well or wellfield.