EXHIBIT Q1

AVONDALE'S ACT 537 PLAN (BOOK 1)

ACT 537 PLAN
BOROUGH OF AVONDALE
CHESTER COUNTY, PENNSYLVANIA

SEWAGE FACILITIES PLAN

May 1999

5685-005

BOROUGH OF AVONDALE
CHESTER COUNTY, PENNSYLVANIA
ACT 537 PLAN

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BOROUGH OF AVONDALE
CHESTER COUNTY, PENNSYLVANIA

ACT 537 PLAN
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PLAN SUMMARY

A. Identify the proposed service areas and major problems evaluated in the Plan.

The Borough of Avondale, located in the southeastern quadrant of Chester County, is the owner and operator of an existing wastewater treatment plant having a capacity of 300,000 gpd. The treatment facility serves nearly all of the Borough residents, in addition to a portion of New Garden Township. In recent years, the facility has been hydraulically overloaded, which has led both of the contributing municipalities to implement a voluntary ban on new connections. This ban has, to some degree, stifled growth and revitalization of the Avondale area due to the lack of available sewer connections. Without additional connections, the Borough will not be able to effectively serve as a revitalized urban area, which is the goal of the local and county planning commissions.

Because of the hydraulic overloads, the treatment facility cannot always meet the loading requirements for some of its monitored permit parameters. Therefore, the purpose of this plan is to evaluate the current and future requirements for additional sewage flows from projected growth within the two municipalities. In addition, the capacity and efficiency of the various components of the treatment facility will be evaluated to determine which of these need modification, enlargement, or replacement.

B. Identify the alternative chosen to solve the problems and service the areas of need identified in the Plan. Also include any institutional arrangements necessary to implement the chosen alternative.

The alternative chosen to solve the problems within the defined service area is to expand the sewage treatment facility from its current capacity of 0.3 mgd to 0.420 mgd. This expansion will provide capacity for projected growth within the Borough of Avondale and the contributing portion of New Garden Township, as well as allow the upgrade of various components of the treatment system to improve their efficiency.

It will not be necessary to implement any new institutional arrangements to implement the selected alternative. Avondale Borough has sufficient staff and administrative resources in place to properly operate and maintain its existing facility, as well as the proposed expanded facility. Moreover, the Borough has experience with construction projects of this type, as it completed the installation of an equalization basin in 1993.

C. Present the estimated cost of implementing the proposed alternative and the proposed funding method.

The estimated cost for implementing this alternative is $1.14 million.

Several funding methods are being reviewed for the implementation of this alternative. They include:

Conventional Bond Issue (guaranteed by the Municipality or revenues)
Bank Loan
PENNVEST Loan
Rural Development Administration Loan
Conventional Loan

There are several complex issues dealing with finance that must be addressed prior to the acceptance of funding. These issues are currently being investigated. Upon acceptance of this Plan by the Pennsylvania Department of Environmental Protection, the Borough will negotiate financing.

Please note: For planning purposes, Revenue Bonds were used to calculate present worth and outline funding. The use of Revenue Bonds are a conservative method of evaluating various finance options. However, the Borough has accepted no commitment to the use of Revenue Bonds.

D. Identify the municipal commitments necessary to implement the Plan.

The following is a list of municipal commitments that must be met to implement the Plan.

1. This Plan must be reviewed and officially adopted by New Garden Township. New Garden Township must also provide a commitment to provide financing for their portion of the treatment plant expansion. At this time, the estimated distribution of projects costs is as follows:

Avondale Borough	62.5%
New Garden Township	37.5%

E. Provide a schedule of implementation for the project which identifies the MAJOR milestones with dates necessary to accomplish the project to the point of operational status.

See Schedule A included in this Section.

SCHEDULE A

SCHEDULE A
IMPLEMENTATION MILESTONES
(PRELIMINARY)

	Activity	Target Date
1.	Submit Adopted Act 537 Plan to PA DEP	May 31, 1999
2.	Receive PA DEP approval of Act 537 Plan	October 1, 1999
3.	Submit Part I NPDES Permit Application to PA DEP	December 31, 1999
4.	Complete analysis of financing alternatives for project	March 31, 2000
5.	Receive Part I NPDES Permit Amendment from PA DEP	April 28, 2000
6.	Submit Part II NPDES Permit Application to PA DEP	December 29, 2000
7.	Receive Part II NPDES Permit from PA DEP	April 30, 2001
8.	Receive bids for Upgrade/Expansion Project	September 2001
9.	Award Contract for Upgrade/Expansion Project	January 2002
10.	Begin Construction	April 2002
11.	Complete Construction	February 2003
12.	Place upgraded and expanded facility on line	April 2003

RESOLUTION OF ADOPTION

ORIGINAL

RESOLUTION NO. 99-05-03
(Non-Legislative)

AVONDALE BOROUGH
CHESTER COUNTY, PENNSYLVANIA

A RESOLUTION OF AVONDALE BOROUGH, CHESTER COUNTY, PENNSYLVANIA, APPROVING AN ACT 537 SEWAGE FACILITY PLAN.

WHEREAS, §5 of the Act of January 24, 1966, P.L. 1535, No. 537, as amended, commonly known as the "Pennsylvania Sewage Facilities Act" (the "Act") and the regulations of the Commonwealth of Pennsylvania, Department of Environmental Protection (the "DEP") authorized by the Act and promulgated by the DEP in Chapter 71 of Title 25 of the Pennsylvania Code (the "Regulations") require a municipality to adopt an Official Sewage Facilities Plan to provide adequate sewage services, to prevent contamination of the waters of the Commonwealth, and environmental health hazards caused by sewage effluent and/or wastes; and

WHEREAS, the Act and the Regulations require a municipality to revise its Official Sewage Facilities Plan whenever a revision is necessary to meet the changing disposal needs of a municipality; and

F. The implementation of the project during a period of approximately 42 months following approval of the Plan by the DEP, as more fully described in the Plan; and

WHEREAS, the Borough Council of the Borough of Avondale has determined that the Plan, as described above, conforms with applicable zoning, subdivision, land development and other municipal ordinances and plans and is a comprehensive program of pollution control and water quality management.

NOW, THEREFORE, it is hereby RESOLVED that:

1. The Borough of Avondale, through the Avondale Borough Council, hereby adopts and submits to the Commonwealth of Pennsylvania, Department of Environmental Protection for its approval as a revision to the "Official Plan" of Avondale Borough, the Act 537 Sewage Facilities Plan described above.

BE IT FURTHER RESOLVED that Avondale Borough hereby assures the Commonwealth of Pennsylvania, Department of Environmental Protection, of the complete and timely implementation of the Act 537 Sewage Facilities Plan as required by §5 of the Act of January 24, 1966, P.L. 1535, as amended.

WHEREAS, Avondale Borough has prepared an Act 537 Sewage Facilities Plan (the "Plan") which provides for sewage facilities within the municipal limits of the Borough of Avondale and in a portion of New Garden Township, Chester County, Pennsylvania; and

WHEREAS, the Plan contains several alternative choices, and the alternative of choice to be implemented is:

A. The expansion and upgrading of the Avondale Borough Wastewater Treatment Plant by 120,000 gallons per day above the current capacity of 300,000 gallons per day, resulting in a total increased capacity of approximately 420,000 gallons per day; and

B. The allocation of the future total treatment capacity between Avondale Borough and New Garden Township as follows:

1. Avondale Borough 201, 750 gallons per day

2. New Garden Township 218, 250 gallons per day; and

C. The allocation of the expanded portion of the treatment capacity (i.e., 120,000 gallons per day) as follows:

1. Avondale Borough 75,000 gallons per day

2. New Garden Township 45,000 gallons per day; and

D. The acknowledgment by Avondale Borough that 40,000 gallons per day of Avondale Borough's portion of the expansion allocation is for the replacement of existing New Garden Township capacity currently being used by Avondale Borough; and

E. The allocation of the expansion and upgrade Project Costs by contributions from Avondale Borough and New Garden Township in the following proportions:

1. Avondale Borough 62.5%

2. New Garden Township 37.5%; and

ADOPTED this 18th day of May, 1999.

ATTEST:

Becky McAleer

BECKY McALEER, Secretary
Avondale Borough

AVONDALE BOROUGH COUNCIL

BY: R N. McC

ROBERT N. McCUE, PRESIDENT

ORIGINAL

ATTESTATION AND CERTIFICATION BY AVONDALE BOROUGH SECRETARY

I, BECKY McALEER, Secretary of the Borough of Avondale, in accordance with the provisions of §1111 of the Borough Code, hereby certify that the following Resolution is a true and correct copy of Resolution No. 99-05-03 (Non-Legislative) adopted by the Avondale Borough Council on May 18, 1999.

Date: May 25, 1999

Becky McAleer
BECKY McALEER, Secretary
Avondale Borough

Borough Seal

REVISED 5-11-99

RESOLUTION NO. 466

RESOLUTION OF ADOPTION

AVONDALE BOROUGH SEWAGE FACILITIES PLAN

RESOLUTION OF THE SUPERVISORS OF NEW GARDEN TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA, (hereinafter "the municipality").

WHEREAS, Section 5 of the Act of January 24, 1966, P.L. 1535, No. 537, known as the "Pennsylvania Sewage Facilities Act," as amended, and the Rules and Regulations of the Department of Environmental Protection (Department) adopted thereunder, Chapter 71 of Title 25 of the **Pennsylvania Code,** requires the municipality to adopt an Official Sewage Facilities Plan providing for sewage services adequate to prevent contamination of waters and/or environmental health hazards with sewage wastes, and to revise said plan whenever it is necessary to meet the sewage disposal needs of the municipality, and

WHEREAS, Avondale Borough has prepared an Act 537 Sewage Facilities Plan which provides for sewage facilities in a portion of New Garden Township and Avondale Borough, and

The alternative of choice to be implemented is:

1. To expand and upgrade the Avondale Borough wastewater treatment facility to a capacity of approximately 420,000 gallons per day. This would be an increase of 120,000 gallons per day above the current capacity of 300,000 gallons per day.

2. To allocate the total treatment capacity in the following manner:

Avondale Borough	201,750 gallons per day
New Garden Township	218,250 gallons per day

3. To allocate the expansion portion of the treatment capacity (120,000 gallons per day) in the following manner:

Avondale Borough	75,000 gallons per day
New Garden Township	45,000 gallons per day

From the Avondale Borough portion of the expansion allocation, 40,000 gallons per day of flow is for the replacement of existing New Garden Township capacity that is currently being utilized by Avondale Borough.

4. To allocate the project cost by contributions from the participating municipalities in the following proportions:

Avondale Borough	62.5%
New Garden Township	37.5%

5. To implement the project in approximately 42 months following the approval of the Plan by PA DEP, as more fully described in the Act 537 Plan.

WHEREAS, New Garden Township finds that the Facility Plan described above conforms to applicable zoning, subdivision, other municipal ordinances and plans and to a comprehensive program of pollution control and water quality management.

NOW, THEREFORE, BE IT RESOLVED that the Supervisors of the Township of New Garden hereby adopt and submit to the Department of Environmental Protection for its approval as a revision to the "Official Plan" of the municipality, the above-referenced Facility Plan. The municipality hereby assures the Department of the complete and timely implementation of the said plan as required by law to the extent of the necessary involvement and participation by New Garden Township. (Section 5, Pennsylvania Sewage Facilities Act as amended).

I, Joan F. Kelleher, Secretary, New Garden Township Board of Supervisors, hereby certify that the foregoing is a true copy of the Township's Resolution No. 466, adopted May 11, 1999.

AUTHORIZED SIGNATURE

Robert N. Taylor for P.D. 1998

Chairman

TOWNSHIP SEAL

PROOF OF PLANNING AGENCIES REVIEW

SSM

March 2, 1999

VIA CERTIFIED MAIL, RETURN RECEIPT

Chester County Planning Commission
Government Services Center
601 Westtown Road
West Chester PA 19382-6515

Re: Avondale Borough, Chester County
Act 537 Plan Study
Review Document
SSM File No. 5685-005

Dear Planning Commission Members:

On behalf of Avondale Borough and in accordance with the requirements of the Pennsylvania Sewage Facilities Act, we are hereby submitting for your review a copy of the Act 537 Plan for Avondale Borough. The Borough respectfully requests that the Planning Commission complete its review of this document within the 60 day review period as allotted by PA DEP, and that written comments regarding the plan be provided within that timeframe. The Borough would greatly appreciate any effort that could be made to complete the review of its Act 537 Plan ahead of the 60 day deadline.

Please direct any comments to the Borough of Avondale at the following address, with copies provided to Spotts, Stevens and McCoy, Inc.:

Avondale Borough
P.O. Box 247
Avondale, PA 19311

Spotts, Stevens and McCoy, Inc.
P.O. Box 6307
Reading, PA 19610-0307
ATTN: Darryl Jenkins

Please do not hesitate to contact us should you have any questions, or require any additional information.

Very truly yours,

Darryl A. Jenkins

Darryl A. Jenkins, P.E.
Project Manager

darryl.jenkins@ssmgroup.com

MS:clm

Enclosure

cc: Avondale Borough
G. Michael Poyner

Z 175 635 269

US Postal Service

Receipt for Certified Mail

No Insurance Coverage Provided.

Do not use for International Mail (See reverse)

Chester County Planning Commission
Government Services Center
601 Westtown Road
West Chester PA 19382-6515

Postage	$ 6.50
Certified Fee	1.40
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	1.25
Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	$ 9.15
Postmark or Date	

PS Form 3800, April 1995

5685-005 DAT

Fold at line over top of envelope to

Is your RETURN ADDRESS completed on the reverse side?

SENDER:

- Complete items 1 and/or 2 for additional services.
- Complete items 3, 4a, and 4b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write *'Return Receipt Requested'* on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Chester County Planning Commission
Government Services Center
601 Westtown Road
West Chester PA 19382-6515

4a. Article Number: Z 175 635 269

4b. Service Type

☐ Registered ☑ Certified
☐ Express Mail ☐ Insured
☐ Return Receipt for Merchandise ☐ COD

7. Date of Delivery: 12/19

5. Received By: *(Print Name)*

8. Addressee's Address *(Only if requested and fee is paid)*

6. Signature: *(Addressee or Agent)*

X

PS Form 3811, December 1994 102595-97-B-0179 Domestic Return Receipt

Thank you for using Return Receipt Service.

THE COUNTY OF CHESTER

COMMISSIONERS:
Colin A. Hanna, Chairman
Karen L. Martynick
Andrew E. Dinniman

WILLIAM H. FULTON, AICP
Executive Director

PLANNING COMMISSION
Government Services Center, Suite 270
601 Westtown Road
P.O. Box 2747
West Chester, PA 19380-0990
(610) 344-6285
FAX: (610) 344-6515

April 19, 1999

BOROUGH OF AVONDALE RECEIVED
APR 22 1999

Mr. Robert McCue, President
Avondale Borough Council
P.O. Box 247
Avondale, PA 19311

Re: Borough of Avondale Act 537 Plan

Dear Mr. McCue

The Chester County Planning Commission (CCPC) has reviewed the Borough of Avondale Act 537 Plan (the Plan) dated Februrary1999 as required by Section 71.53(a)(2) of the Pennsylvania Sewage Facilities Act (Act 537). The Plan was prepared by Spotts, Stevens and McCoy, Inc., and submitted for our review on March 4, 1999.

After careful consideration of the information presented in the Plan, we find that we cannot support approval of the document as the official sewage facilities plan of the Borough at this time.

CCPC does understand the need to provide additional sewage treatment capacity to meet needs and encourage economic development in the Borough and in New Garden Township, and we support your efforts in this regard. However, the Commission has two main issues about the Plan, and we raise them now because we believe the PA Department of Environmental Protection (PADEP) will also raise them in the course of their review. These issues are explained in detail in this letter. The Commission also offers other recommendations to improve the quality and completeness of the document.

1. Future Needs Estimates

The first issue regarding the Plan is the manner in which estimates of future needs are presented. The document contains a number of statements regarding land development and growth in the Borough. Pages 38 and 46 state "Significant growth is not likely to occur within the Borough." A 37 percent increase in the capacity of the WWPT can be a significant incentive for economic development and new growth. Page 74 states "There is little unused property within the Borough borders. The Borough is built out." Yet, the Projected Future Allocation Needs presented on page 52 indicates a need for an additional 121 EDU's or 33,275 gallons per day in the Borough.

The Plan contains little documentation or explanation as to how this Projected Need was developed. Page 46 states: "At the present time, it is unknown what types of land development projects will be proposed for the remaining parcels of open land within the half mile square area that makes up the Borough." This information is critical to the land use and sewage facilities plans of the Borough. This issue was raised in the Planning Commission's *Landscapes* Phase I Vision Partnership Program Consistency Review dated February 26, 1998. As a result of that review we concluded that the Borough's Future Land Use Plan did not contain sufficient

information to determine how the Borough's projected population will be accommodated, and recommended that a vacant parcel analysis be conducted. A vacant parcel/developable land analysis would provide a sound basis that would support the population projections on page 51 and the Projected Future Allocation Needs shown on page 52. This information should also generated for the areas of the New Garden Township that will be served by the Avondale sewerage system and should support the statements on page 49 concerning projected new sewage flows. The "projects on the waiting list" mentioned on page 59 should be listed, and all of the projects that have purchased or reserved capacity should be mapped. This information is typically contained in a vacant parcel analysis. This list should also distinguish projects that are expected to be connected to the sewerage system within 5 years and those likely to be connected within 10 years.

2. Selection and Evaluation of Alternatives

Our second area of concern is the content of Chapter V. This chapter identifies alternatives to providing new or improved wastewater disposal facilities. This section has a narrow focus and only identifies possible alternatives that can be completed within the boundaries of the Borough. We suggest there may be alternatives outside of the Borough that should be evaluated. One opportunity recently presented to the Borough was diverting some sewage to the new system in London Grove Township. This alternative was not mentioned in the Plan and should be examined along with any other possibilities.

Also related are possible treatment and disposal alternatives. Regarding the use of spray irrigation, the Planning Commission disagrees with the conclusion stated on page 84 that spray irrigation is not a viable alternative. The Plan assumes that land for spray irrigation would have to be located within the borders of the Borough. Land inside and outside of the Borough limits could be used for this purpose. We also have concerns with the cost estimates for a spray irrigation system presented on pages 83-84. The cost to expand an existing wastewater treatment system or build a new system is not the only cost that should be considered. Long term operating costs should also be considered in a full life cycle cost evaluation. A number of municipalities in Chester County have determined that the life cycle costs of treatment lagoons and spray irrigation are less than those of a "conventional" treatment and disposal system.

The Planning Commission supports the Borough's Comprehensive Plan and Zoning Ordinance. They are good documents because they contain policies and provisions that strive to protect the water and other natural resources in the Borough. However, this Plan does not mention the environmental benefits of converting from a stream discharge system to a land application system. The Commission is not suggesting that Avondale's treatment plant be abandoned and replaced by a lagoon treatment system. We do believe that this Plan should contain a more thorough evaluation of the potential to divert some or all of the existing plant's effluent to a

land application disposal process, particularly in view of the environmental benefits and the commitment made by your neighbors in New Garden Township.

The following are other recommendations that we suggest will improve the quality and accuracy of the Plan document:

- The Plan document contains a number of references to *Landscapes* and the Chester County Comprehensive Plan. The County Commissioners in July of 1996 adopted the Chester County Comprehensive Plan Policy Element known as *Landscapes*. This Policy Element supercedes the 1988 Chester County Land Use Plan; therefore, all references to the 1988 County plan should be removed from the document. References to the outdated County Land Use Plan can be found on pages 63, 68-70 and 87. Additionally, page 38 contains the statement: "As a designated suburban center, Avondale Borough has many existing land use patterns". The Livable Landscapes for Chester County - 2020 map contained in *Landscapes* designates the Borough as an Urban Landscape.

- The Commission agrees with your use of the *Landscapes* Policies listed on page 94 for the Borough's consistency with this Act 537 Plan and *Landscapes*. Urban Landscapes such as Avondale Borough are envisioned as the focal points for growth and development. At this time the land use plans and ordinances of New Garden Township are somewhat inconsistent with the Livable Landscapes for Chester County - 2020 map. However, this is a separate issue that we hope to resolve with the Township.

- Chapter V identifies alternatives to provide new or improved wastewater disposal facilities. We believe that Section B. of this chapter does not address PADEP plan content guidelines. This section of the document should address "the use of individual sewage disposal systems including individual residential spray irrigation systems." for new homes that may be built in the Borough. The text only addresses the potential of using spray irrigation as part of the municipal wastewater system. Section C. should address the use of small flow or package treatment units to serve individual homes or clusters of homes. Section C. should address the use of community on-lot disposal alternatives, and Section E. should address the use of retaining tanks.

- Page 97 states that the Borough's zoning ordinance and subdivision and land development ordinance support the goals of the storm water management plan for Chester County. There is no countywide storm water management plan for Chester County.

- CCPC agrees that a formal wastewater management plan for the 10 individual on-lot sewage systems in the Borough is not necessary at this time. However, a map depicting the location of the individual sewage systems would be helpful for planning purposes. The Chester County Health Department does have helpful literature that could be distributed to those system owners. We suggest that you contact

Mr. Ralph DeFazio at (610) 344-6526 for free copies of their Owner's Manual to On-Lot Sewage Systems.

The Chester County Planning Commission is not necessarily opposed to the proposed expansion of the Avondale Borough wastewater treatment plant. However, in our view, the Plan document needs to present a more thorough and convincing case.

Please contact me if you have any questions regarding this review.

Sincerely,

William H. Fulton, AICP
Secretary

WHF/REI/kp
cc: Molly Morrison, County Commissioners Office
Ralph DeFazio, Chester County Health Department
Glenn Stinson, PADEP
Rebecca McAleer, Borough Secretary
Robert Taylor, New Garden Township Board of Supervisors
Joan Kelleher, New Garden Township Secretary
Daryl Jenkins, Spotts, Stevens and McCoy, Inc.

SSM

FILE

March 2, 1999

VIA FEDERAL EXPRESS

Avondale Borough Planning Commission
110 Pomeroy Street
P.O. Box 247
Avondale PA 19311

Re: Avondale Borough
Act 537 Plan Study
SSM File No. 5685-005

Dear Planning Commission Members:

On behalf of Avondale Borough and in accordance with the requirements of the Pennsylvania Sewage Facilities Act, we are hereby submitting for your review a copy of the Act 537 Plan for Avondale Borough. The Borough respectfully requests that the Planning Commission complete its review of this document within the 60 day review period as allotted by PA DEP, and that written comments regarding the plan be provided within that timeframe. The Borough would greatly appreciate any effort that could be made to complete the review of its Act 537 Plan ahead of the 60 day deadline.

Please direct your written comments to the Borough, with copies provided to Spotts, Stevens and McCoy, Inc. at the following address:

Spotts, Stevens and McCoy, Inc.
P.O. Box 6307
Reading, PA 19610-0307
ATTN: Darryl Jenkins

Please do not hesitate to contact us should you have any questions, or require any additional information.

Very truly yours,

Darryl A. Jenkins

Darryl A. Jenkins, P.E.
Project Manager

darryl.jenkins@ssmgroup.com

DAJ:clm

Enclosure

cc: Avondale Borough
G. Michael Poyner

BOROUGH OF AVONDALE
Post Office Box 247
Avondale, Pennsylvania 19311

610-268-8501

April 21, 1999

Mr. Darryl Jenkins
Spotts, Stevens and McCoy, Inc.
P.O. Box 6307
Reading, PA 19610-0307

Re: Act 537 Plan of Study
SSM File No. 5685-005

Dear Darryl:

The Avondale Planning Commission has review the Borough Act 537 Plan and have the following comments:

1. Page 5 - "Old Baltimore Pike" should be "Baltimore Pike".

2. Page 10, 3rd Paragraph - Strike "State Road" and change "Old Baltimore Pike" to "Baltimore Pike".

3. Page 15, 3rd Paragraph, 3rd line, "filing" should be "filling".

4. a. Paragraph 33 - "Ellicott Ave., south of PA Rte 41". "Ellicott Ave" only is needed as it is all south Rte 41.
   b. Same page - "Church Ave., North of PA Rte. 41" Church Street only is needed as it is all north of Rte. 41. Also change "Church Avenue." to "Church Street".
   c. Same page - Old Baltimore Pike" also ends at Rte. 41. Also strike "Old" in Old Baltimore Pike.

5. Page 34 - "West State Streeet., west of PA Rte. 41". West State Street only is needed as it ends at Rte. 41.

6. Page 44, 2nd Paragraph. - Change "Old Baltimore Pike" to "Baltimore Pike". This should also be done on page 48, 4th paragraph.; Appendix 2,4,6,8.

7. Page 87 - Item 1, first sentence 4th word - "revised" should be changed to "completed". (see page 92)

8. Appendix 3 - "State Road" should be changed to "Baltimore Pike". Also add "Cook Court" to the map.

9. Appendix 5 - Change "State Rd. (Rte. 1)" to "Baltimore Pike". Also "Avon Mohr" should be added to the map.

Sincerely,

Lou Kirkaldie, Chairman
Avondale Borough Planning Commission

LK/bm

PROOF OF PUBLIC NOTICE

SSM

FILE

March 2, 1999

Ms. Becky McAleer, Secretary
Avondale Borough
110 Pomeroy Street
P.O. Box 247
Avondale PA 19311

Re: Public Comment Period for
the Borough's Act 537 Plan
SSM File No. 5685-005

Dear Becky:

Attached to this letter is a legal notice that should be advertised in the *Daily Local News* in the legal section beginning March 8, 1999. Please ask the newspaper to provide you with a notarized proof of publication notice when they send you the advertising invoice.

Also enclosed are two copies of the Borough's Act 537 Plan. One should be made available for review by the public during normal business hours. The second copy is for use by the members of Borough Council.

Please call me if you have any questions regarding any of the above items.

Very truly yours,

Darryl A. Jenkins

Darryl A. Jenkins, P.E.
Project Manager

darryl.jenkins@ssmgroup.com

DAJ:clm

Enclosures

SPOTTS, STEVENS and McCOY, Inc
[illegible]
tel 610 376 6581 fax 610 376 6950

NOTICE

To the residents and taxpayers of Avondale Borough, Chester County, Pennsylvania.

The proposed Act 537 Plan for Avondale Borough will be available for public inspection for a period of 30 days beginning March 8, 1999 at the Borough Municipal Building located at 110 Pomeroy Street, P.O. Box 247, Avondale PA 19311. The proposed plan examines the feasible alternatives for the possible upgrade and expansion of the Borough's existing wastewater treatment facility. The existing facility serves both the Borough of Avondale, as well as a portion of New Garden Township.

Anyone wishing to inspect the plan may do so during the Borough's regular business hours. Written comments regarding the plan may be submitted to the Borough at the above-referenced address during the 30 day comment period.

Robert N. McCue, President
Avondale Borough Council

Proof of Publication of Notice in Daily Local News

Under Newspaper Advertising Act No. 587, Approved May 16, 1929

State of Pennsylvania { *ss:* { No. 228453 Term, 19 99
County of Chester

Debra S. Wood, Legal Advtsg. Rep. of the Daily Local News Company, a corporation, of the County and state aforesaid, being duly affirmed, deposes and says that the Daily Local News, a newspaper of general circulation, published at 250 N. Bradford Ave., West Chester, PA, County and State aforesaid, was established November 19, 1872, and Incorporated December 11, 1911, since which date the Daily Local News has been regularly issued in said county, and that the printed notice or publication attached hereto is exactly the same as printed and published in the regular editions and issues of the said Daily Local News on the following dates viz

March 8 A.D. 19 99

Affiant further deposes that he/she is the proper person duly authorized by the Daily News Company, a corporation, publishers of said Daily Local News, a newspaper of general circulation, to verify the foregoing statement under oath, and that affiant is not interested in the subject matter of the aforesaid notice or advertisement, and that all allegations in the foregoing statements as to time, place and character of publication are true.

Debra S. Wood

COPY OF NOTICE OR PUBLICATION

affirmed to and subscribed before me this 8th

day of March 19 99

Beverly A. Walker
Notary Public

My Commission Expires:

Notarial Seal
Beverly A. [illegible] Notary Public
East Fallowfield Twp., Chester County, PA
My Commission Expires June 4, 2001

NOTICE

To the residents and taxpayers of Avondale Borough, Chester County, Pennsylvania:

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Anyone wishing to inspect the plan may do so during the Borough's regular business hours. Written comments regarding the plan may be submitted to the Borough at the above-referenced address during the 30 day comment period.

Robert N. McCue, President
Avondale Borough Council

Statement of Advertising Costs

Borough of Avondale

P.O. Box 247

Avondale, PA 19311

To DAILY LOCAL NEWS COMPANY, Dr.
For publishing the notice or publication attached

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By

WRITTEN COMMENTS TO BOROUGH OF AVONDALE

SSM

FILE

March 2, 1999

VIA FEDERAL EXPRESS

Mr. Spencer Andress, President
Government Specialists, Inc.
P.O. Box 336
59 S. Third St., 2nd Floor
Oxford PA 19363-0336

Re: Avondale Borough
Act 537 Plan Document
SSM File No. 5685-005

Dear Spence:

On behalf of Avondale Borough, we are providing you with two copies of the Act 537 Plan for the Avondale Borough Wastewater Treatment facility. As the point of contact for the New Garden Township Supervisors and Authority, we request that you provide these documents to the respective boards for their review. If you require additional copies, please call me.

We have already provided a copy of the plan to the Chester County Planning Commission. Their 60-day review period will end on April 30, 1999, at which time they must provide written comments to the Borough regarding the plan. The Borough also requests that New Garden Township provide written comments regarding the plan by that time, or earlier, so that any plan revisions can be completed in a timely manner. Once you have had an opportunity to review the plan, it would probably be helpful to schedule a meeting (perhaps in late March or early April), between Avondale and New Garden Township to discuss any questions or concerns that anyone may have. Please contact us to follow-up on this issue.

The information that you provided to us for inclusion in the plan indicated that New Garden Township would purchase 45,000 gpd of additional capacity at the Avondale facility if the price for this capacity is reasonable. The Borough must have a definitive answer on this issue before it can submit the Act 537 Plan to PA DEP for review in May of this year. Therefore, it is critical that New Garden Township make a decision on this matter and communicate its specific needs to the Borough. Please note that the Borough does not plan to provide any excess capacity in the proposed expansion of the treatment facility beyond its own requirements if New Garden Township decides that it does not wish to purchase the 45,000 gpd allocation at this time.

SPOTTS, STEVENS and McCOY, Inc.
[illegible]
[illegible]
[illegible]

Please contact us should you have any questions, or require any additional information.

Very truly yours,

Darryl A. Jenkins

Darryl A. Jenkins, P.E.
Project Manager

darryl.jenkins@ssmgroup.com

MS:clm

Enclosure

cc: Avondale Borough
G. Michael Poyner

Government Specialists, Inc.

PHONE: (610) 932-5563
FAX: (610) 932-3295

Mr. Darryl A. Jenkins, P. E.
SSM
345 N. Wyomissing Boulevard
P. O. Box 6307
Reading, PA 19610-0307

RE: Avondale Borough
Act 537 Plan Document

March 23, 1999

Dear Darryl,

I received your letter dated March 2, 1999 and a copy of the Act 537 Plan Document and offer the following official response on behalf of New Garden Township. The comments generally fall into two categories; first, editorial and clarifying; second, substantive effecting underlying assumptions or philosophy.

First, I will present comments in the order of the page on which the text appears.

Page 30: New Garden Township has purchased and owns 495 EDU's not 494 as stated. This was discussed and, I thought, confirmed by the Borough after the DEP meeting. Consequently, the flow allocation is 173,250 gpd for New Garden and 126,700 gpd for Avondale. The same corrections will need to be made throughout the entire document.

Page 53: The allocations must be adjusted as stated above.

Page 54: The figure of 56,481 gpd is presented, which reflects the amount of flow that Avondale has been generating above its allocated capacity of 126,700 gpd. Thereafter, it is stated that 40% of that amount is some form of I & I which can be removed. I believe the assumption that 40% of the flow is I & I which can be removed is flawed, for several reasons. First, the January 1999 data shows an increase in average daily Avondale flow for each of the four weeks in January from a low of 208,389 gpd to a high of 258,726 gpd; a variation of 24.2%, or an average flow of 217,471 gpd for the month compared to an average daily flow of 166,270 gpd for the period August 21, 1998 through December 25, 1998 or a 30.8% increase. Similarly, for the month of February, the average flow was 246,136 gpd or a 48% increase. Since there have not been new connections made to the system, one can assume the increase is due to I & I. Making the same comparison for New Garden Township, the January through February 1999 average daily flow 49,885 gallons compared to 52,357 gpd for the period August 21, 1998 through December 25, 1998 or a 4.7% decrease.

Second, the Avondale collection system is, for the most part, almost 30 years old. One could assume that once the major I & I problems are identified and fixed, there will be new sources continuing to develop as the system ages year by year. Therefore, to say that 40% of the excess flow is I & I which can be eliminated permanently may be very optimistic. Third, since completion of the I & I work by the Borough the weather has remained rather dry and the water table has been low. These conditions make it difficult to accurately determine how successful these I & I remediation efforts have been. Since early January the weather has been more wet and the flows have increased. New Garden Township will be conducting a "wet weather" I & I study to supplement its I & I study that was done last summer. I suggest that Avondale and New Garden both conduct simultaneous studies this spring.

While we all hope that significant sources of I & I can be found and eliminated, it may be somewhat optimistic to predicate the design of the proposed expansion on consistently and permanently removing 40% of the I & I from this system. On the positive side, if the design assumes a lower percentage of I & I elimination and more than that amount is actually eliminated, then additional treatment capacity becomes available.

Page 58: In paragraph 4 there is a reference to Appendix 19; this should be Appendix 17.

Page 61: In paragraph 1 there is reference to 34,000 gpd; this should be 39,520 gpd based on the data presented in Appendix 17.

Again at the bottom of page 61, 34,000 gpd is mentioned which should be 39,520 gpd.

Also at the bottom of page 61, the statement is made that "New Garden Township will require 45,000 gpd". While New Garden Township has expressed interest in an additional 45,000 gpd, if the cost is reasonable, there is no specific projected need for additional capacity as detailed on pages 58 through 61.

Page 62: The New Garden Township allocation should be increased to 173,250 gpd, the Avondale allocation decreased to 126,700 gpd and the New Garden Township replacement allocation should be changed to 39,250 gpd.

Page 72: The flow figures should be adjusted as stated above.

Page 100: While it is acceptable for planning purposes at this point in the process, it should be noted that the cost estimates provided are + or – 27%.

Page 117: In two places there is specific reference to the expansion capacity which is stated as 0.412 mgd. On page 62 there is the following statement "the hydraulic capacity for the expanded facility will be assumed at 420,000 gpd."

It appears the treatment component capacity calculation are based on 412,000 gpd as are other calculations. Does this suggest the useable capacity will be 420,000 gpd? Should the reference to 420,000 gpd be stricken from the text entirely?

Page 118: Paragraph 3 and paragraph 4 do not give any details about the method of computing the present worth such as the discount rate.

Page 120: The value of 7.0 percent is stated as the current interest rate. It would be more appropriate to use a value of 5.0 percent based on the current market.

Page 128: The ratio of Avondale flow to New Garden Township flow will change based on the points raised above, therefore, the cost allocation will change accordingly.

Second, I will present an analysis, based on my interpretation and application of the data, regarding future needs and sharing the cost of additional capacity.

Using data presented in Appendix 17, for the period after Avondale's completion of its initial I & I elimination efforts and after the Toughkenamon flow was diverted to the east end, the following summary was prepared.

Avondale flow 8/21/98 through 12/25/98 average gallons per day =		166,270
Avondale flow allocation average gallons per day =		126,700
New Garden Township flow used by Avondale average gallons per day =		39,570
Avondale replacement flow average gallons per day =		39,570
Avondale future needs average gallons per day =		33,275
Total flow capacity needed by Avondale =		72,845
Cost of additional capacity = $1,140,000	+27%=	$1,447,800
	-27% =	$ 832,200

Capacity resulting from the upgrade/expansion =	112,000 gpd	(100%)
Capacity allocation to Avondale	72,845 gpd	(65%)
Resulting capacity available to New Garden	39,155 gpd	(35%)

Allocation of costs:

$1,447,800 (high estimate)

@ 65% =	$941,070	Avondale's share
@ 35% =	$506,730	New Garden's share

$832,200 (low estimate)

@ 65% =	$540,930	Avondale's share
@ 35% =	$291,270	New Garden's share

The analysis above, as stated, is based on the flows from August through December 1998. The January and February 1999 data indicate the average daily flow for Avondale is now 230,211 gpd or a 38.5% increase over the August through December flow. A copy of the January and February data is enclosed.

Based on the average January and February flows, Avondale is now using 63,941 gpd of the New Garden Township capacity as compared to the 39,570 gpd for the August/December period.

THE JANUARY AND FEBRUARY INCREASE IS MOST TROUBLING. FURTHER EVALUATION WOULD APPEAR TO BE IN ORDER BEFORE A DECISION CAN BE MADE CONCERNING THE AMOUNT OF NEW CAPACITY THAT IS NEEDED AND THE COST SHARING FOR SUCH CAPACITY.

Again, I suggest that Avondale and New Garden plan to conduct simultaneous flow measurements this spring as a method of further defining the magnitude of the I & I problems.

If you would like clarification of the comments provided, please do not hesitate to contact me.

Sincerely,

Spencer J. Andress
President
Project Consultant

Cc: Supervisors
Sewer Authority
Secretary
Anthony D'Onofrio, Esquire
George Brutscher, Esquire
Chester County Planning Commission
Chester County Health Department
Glenn Stinson, DEP
John Veneziale, DEP
Jim Newbold, DEP
Steve O'Neil, DEP

Encl.
614011

NEW GARDEN TOWNSHIP
WEST END FLOW ANALYSIS -1999

Date		Period		Meter Readings			Total Flow				Percentage Flow				Average Flow Week(s)/Days			
Calendar	Julian	Week(s)	Days	Rt 41	RR	Plant	Rt 41	RR	Avon	Plant	Rt 41	RR	Avon	Plant	Rt 41	RR	Avon	Plant
		Rt 41 = Route 41 Force Main					RR = Railroad Gravity Main				Avon = Avondale Borough				Plant = Avondale WWTP			
12/25/98	8359			63,741,250	43,604,760	529,722,000												
01/01/99	9001	1		63,932,400	43,696,000	531,277,000	191,150	91,240	1,272,610	1,555,000	12.3%	5.9%	81.8%	100.0%				
			7												27,307	13,034	181,801	222,143
01/08/99	9008	1		64,128,520	43,805,160	533,041,000	196,120	109,160	1,458,720	1,764,000	11.1%	6.2%	82.7%	100.0%				
			7												28,017	15,594	208,389	252,000
		2													193,635	100,200	1,365,665	1,659,500
			14												27,662	14,314	195,095	237,071
01/15/99	9015	1		64,334,770	43,925,700	534,711,000	206,250	120,540	1,343,210	1,670,000	12.4%	7.2%	80.4%	100.0%				
			7												29,464	17,220	191,887	238,571
		3													197,840	106,980	1,358,180	1,663,000
			21												28,263	15,283	194,026	237,571
01/22/99	9022	1		64,544,070	44,095,320	536,901,000	209,300	169,620	1,811,080	2,190,000	9.6%	7.7%	82.7%	100.0%				
			7												29,900	24,231	258,726	312,857
		4													200,705	122,640	1,471,405	1,794,750
			28												28,672	17,520	210,201	256,393
01/29/99	9029	1		64,756,290	44,282,240	539,026,000	212,220	186,920	1,725,860	2,125,000	10.0%	8.8%	81.2%	100.0%				
			7												30,317	26,703	246,551	303,571
		5													203,008	135,496	1,522,296	1,860,800
			35												29,001	19,357	217,471	265,829
02/05/99	9036	1		64,970,320	44,437,010	541,103,000	214,030	154,770	1,708,200	2,077,000	10.3%	7.5%	82.2%	100.0%				
			7												30,576	22,110	244,029	296,714
		6													204,845	138,708	1,553,280	1,896,833
			42												29,264	19,815	221,897	270,976
02/12/99	9043	1		65,165,170	44,588,730	543,105,000	194,850	151,720	1,655,430	2,002,000	9.7%	7.6%	82.7%	100.0%				
			7												27,836	21,674	236,490	286,000
		7													203,417	140,567	1,567,873	1,911,857
			49												29,060	20,081	223,982	273,122
02/19/99	9050	1		65,368,790	44,760,650	545,240,000	203,620	171,920	1,759,460	2,135,000	9.5%	8.1%	82.4%	100.0%				
			7												29,089	24,560	251,351	305,000
		8													203,443	144,486	1,591,821	1,939,750
			56												29,063	20,641	227,403	277,107
02/26/99	9057	1		65,583,360	44,905,370	547,368,000	214,570	144,720	1,768,710	2,128,000	10.1%	6.8%	83.1%	100.0%				
			7												30,653	20,674	252,673	304,000
		9													204,679	144,512	1,611,476	1,960,667
			63												29,240	20,645	230,211	280,095

Revised

BOROUGH OF AVONDALE
Post Office Box 247
Avondale, Pennsylvania 19311

610-268-8501

April 6, 1999

SSM
Mr. Darryl Jenkins, P.E.
345 North Wyomissing Blvd
Reading, Pa. 19610

Dear Mr. Jenkins,

Thank you for the opportunity to review the draft of the 537 Plan developed for the Borough of Avondale by SSM. Here are my comments.

The 537 Plan discusses the need to upgrade and expand the capacity of the existing sewage treatment plant owned by the Borough of Avondale to provide wastewater management for future growth and development for the Borough and New Garden Township.

During the planning process, I would hope that the Borough Council and its' consultants would consider upgrading the plant to include enough capacity to accept and treat septage that is generated in the surrounding areas. A "State of the Art," high tech sewage treatment plant that accepts and properly treats septage is greatly needed in southern Chester County. .

Back in the late 80's and early 1990s, the Southeastern Chester County Refuse Authority (SECCRA Landfill), located in London Grove Township, Chester County conducted a study to determine if it would be feasible, cost effective and profitable for SECCRA to design a treatment plant that could treat both leachate and septage. The studies included an estimate of the quantity of septage that was then generated in the southern most twenty four municipalities of Chester County. The study also included revenue projections to determine if the program would be cost effective and generate additional revenue for SECCRA while providing for a service that was needed to benefit the community.

BOROUGH OF AVONDALE
Post Office Box 247
Avondale, Pennsylvania 19311

610-268-8501

Based on the studies, the results clearly indicated that building such a plant would be the best thing for the area. SECCRA then attempted to gain approval from its member municipalities to change it's Charter to allow SECCRA to accept and treat septage at their leachate treatment plant. However, SECCRA was not successful in obtaining the required number of votes from there members to allow this to happen.

The Pennsylvania Department of Environmental Protection (DEP)and the Chester County Health Department (CCHD) are certainly promoting the proper handling of septage through their licensing and permitting programs that all septage haulers must abide by. Also, some of the municipalities in our area are adopting ordinances which state that septic systems must be pumped regularly at the expense of the homeowner. New Garden Township was one of the first to adopt an ordinance of this kind. If we can provide disposal service at a reasonable rate and centrally located to reduce hauling costs, the haulers should be able to keep their prices lower for the cleaning service to the homeowners with the on lot systems. Reasonable prices and good public education programs would go along way to get the homeowners to be responsible for the proper maintenance of their systems which would ultimately protect the ground water.

According to "An Owners Manual", published by the CCHD, sixty (60) percent of the population in Chester County are served by on lot systems. It is estimated that approximately 100,800 homes in Chester County are serviced by on lot systems.

Chester County is experiencing rapid growth in population and housing, but few new sewer treatment plants are being built which means that more on lot systems are being installed. One would assume that there would be Federal, State, and or County Grant money available to help finance a project of this type. I would hope that DEP and the county would bless such an undertaking.

BOROUGH OF AVONDALE
Post Office Box 247
Avondale, Pennsylvania 19311

610-268-8501

SSM
Avondale Borough, 537 Plan
4/6/99, pg 3 of 3

The Borough of Avondale may have the unique opportunity to provide a much needed service to the community and add revenue to their limited budget, well into the future. There is virtually no competition in the area at the present time. The only disposal sites that accept septage from this area on a regular basis are currently located in northern Chester County and New Castle County, Delaware. The transportation costs to haul the septage to a further destination certainly adds to the cost of cleaning septic tanks in our area.

We need to look beyond today and plan for the future. If you have questions or need more information, Please call me at (610) 268-0700 during the day or (610) 268-2047 during the evening. Thank you for your consideration of this project.

Sincerely,

Doris Howell

Honorable, Doris E. Howell
Mayor

London Grove Township

550 East Baltimore Pike, Suite 200
West Grove, Pa 19390
610/268-8524 FAX 610/268-8527

September 8, 1997

Mr. Robert McCue, President
Borough Council
Avondale Borough
P. O. Box 247
Avondale, PA 19311

Dear Mr. McCue:

The Township has received a copy of a letter from John Veneziale, PA D E P, to you dated June 18, 1997 re: Act 537 Plan-of-Study, Avondale Borough, Chester County.

London Grove Township continues to be committed to their Act 537 Plan, the basis of which is spray irrigation. Therefore, L.G.T. should not be considered for potential future flows to Avondale's wastewater treatment plant.

Sincerely,

Judith A. Shuler, Manager

cc: John Veneziale, PA D E P
Chester County Planning
Chester County Health Dept.
New Garden Township

AGENCY CONSISTENCY REVIEW

SSM

Certified Mail, Return Receipt

Letter of Transmittal

Spotts, Stevens and McCoy, Inc.
345 North Wyomissing Blvd., Reading PA 19610
Telephone: 610/376-6581 Fax: 610/376-6950

TO: Department of Conservation and Natural Resources
Bureau of Forestry (FAS)
PNDI Program
PO Box 8552
Harrisburg PA 17105-8552

DATE April 29, 1999 | W.O. NO. 5685-005
ATTENTION:
RE: Avondale Borough, Chester County
PNDI Search Request for Sewage Facilities Plan

WE ARE SENDING YOU: [x] Attached [ ] By separate mail via ____ the following items:

FILE COPY

[ ] Copy of Letter [ ] Prints [ ] Specifications
[ ] Change Order [x] As Noted [ ] Other ____

COPIES	DATE	NO.	DESCRIPTION
1			PNDI Search Request Form

THESE ARE TRANSMITTED as checked below:
[ ] For approval [ ] As requested [ ] Reviewed [ ] Returned for corrections
[x] For your use [ ] For review and comment [ ] Reviewed as noted [ ] Other ____

REMARKS

Please contact us should you have any questions. Thank you.

COPY TO ____

Signed Darryl A. Jenkins
Darryl A. Jenkins, P.E.

If enclosures are not as noted, kindly notify us at once.

REQUEST FOR PENNSYLVANIA NATURAL DIVERSITY INVENTORY (PNDI) DATA

4-29-99
Date

TO: Department of Conservation and Natural Resources
Bureau of Forestry (FAS)
PNDI Program
PO Box 8552
Harrisburg, PA 17105-8552

FROM: Spotts, Stevens, and McCoy, Inc.
P.O Box 6307
Reading PA 19610-0307
Attn: DARRYL JENKINS
(municipal planning consultant address)

FOR: Avondale Borough
P.O. Box 247
Avondale PA 19311
(municipality address)

Chester County

Please conduct a review of the Pennsylvania Natural Diversity Inventory (PNDI) information system for records of species of special concern reported from the above municipality. This information will be incorporated in initial planning assessments under the Pennsylvania Sewage Facilities Act and in specific alternative proposals. At this time, the planning process is addressing:

The planning process is addressing the expansion of the Borough of Avondale's existing wastewater treatment facility. The facility has a current capacity of 300,000 gpd, and expansion options would increase this capacity to 420,000 gpd. New treatment units would be added both within, and outside of the existing footprint of the facility

(current project details)

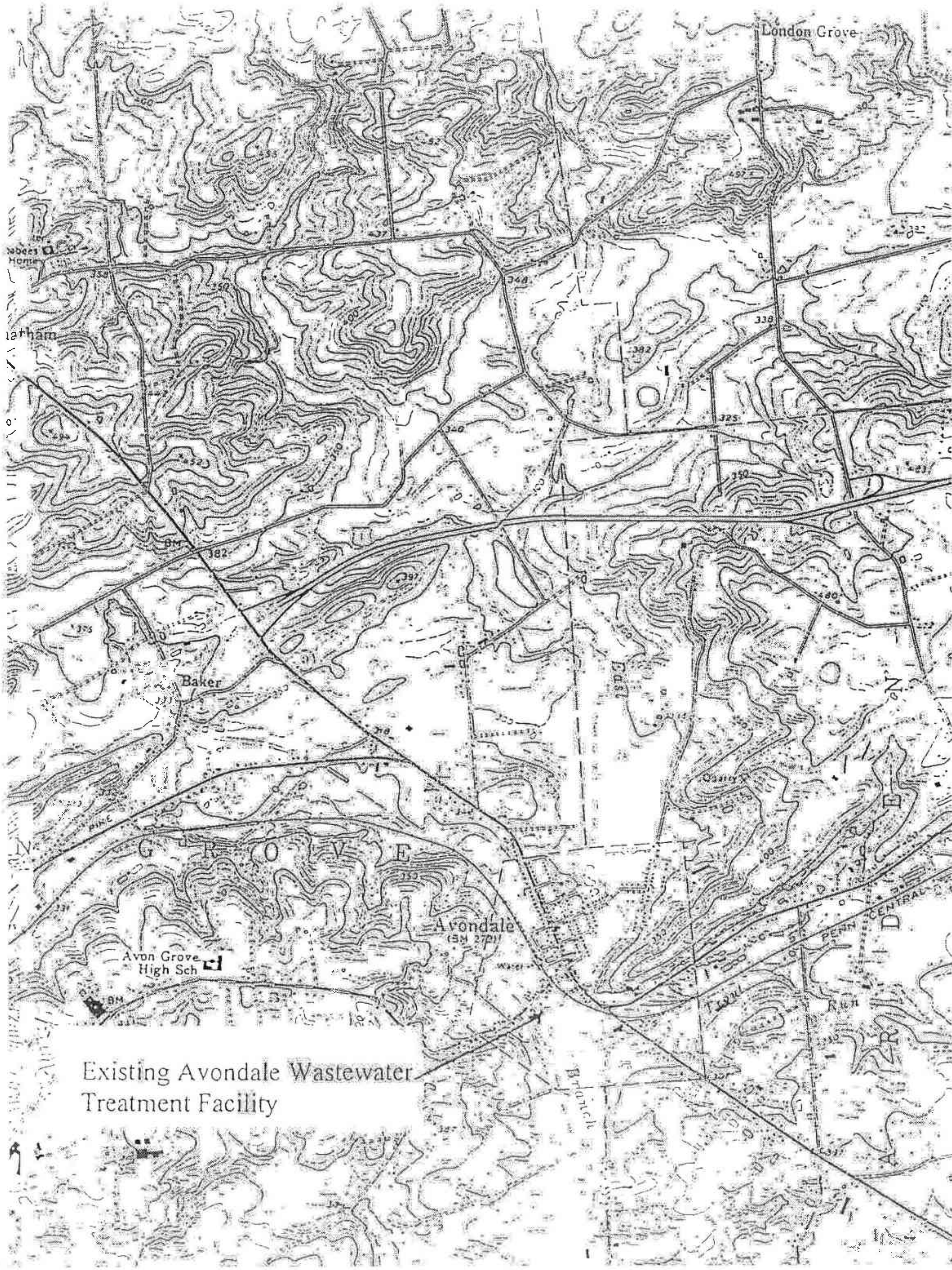
The location of the proposed project components are shown on the attached partial copy of the West Grove PA 7.5 minute U.S.G.S. topographic maps.

In its reply, DCNR will notify this municipality regarding plant and animal species of special concern listed by any state agency or tracked by PNDI and reported in the project vicinity. In addition, DCNR will identify the agencies having management authority and expertise to assist with evaluation and mitigation of potential impacts on these species.

If you have questions concerning this project please contact:

DARRYL JENKINS — Planning Consultant
610-376-6581 — Telephone Number

Municipal Official — Telephone Number


London Grove
Baker
GROVE
PIKE
Avondale
Avon Grove
High Sch
PENN CENTRAL
Run
Branch
Existing Avondale Wastewater
Treatment Facility

Spotts, Stevens & McCoy, Inc.

Z 175 635 342

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Department of Conservation & Natural Resources
Bureau of Forestry (FAS)
PNDI Program
P.O. Box 8552
Harrisburg PA 17105-8552

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PS Form 3800, April 1995

5695-005 DAS

SENDER:
- Complete items 1 and/or 2 for additional services.
- Complete items 3, 4a, and 4b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write *"Return Receipt Requested"* on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):
1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Department of Conservation & Natural Resources
Bureau of Forestry (FAS)
PNDI Program
P.O. Box 8552
Harrisburg PA 17105-8552

4a. Article Number: Z 175 635 342

4b. Service Type
☐ Registered ☑ Certified
☐ Express Mail ☐ Insured
☐ Return Receipt for Merchandise ☐ COD

7. Date of Delivery: MAY 03 1995

5. Received By: *(Print Name)*

8. Addressee's Address *(Only if requested and fee is paid)*

6. Signature: *(Addressee or Agent)*
X

PS Form 3811, December 1994 102595-97-B-0179 Domestic Return Receipt

Is your RETURN ADDRESS completed on the reverse side?

Thank you for using Return Receipt Service.

Letter of Transmittal

Spotts, Stevens and McCoy, Inc.
345 North Wyomissing Blvd., Reading PA 19610
Telephone: 610/376-6581 Fax: 610/376-6950

TO:
Chester County Health Department
601 Westtown Road, Suite 288
West Chester PA 19382

DATE 4/23/99 | W.O. NO. 5685-005
ATTENTION: Mr. Ralph DiFazio
RE: Act 537 Plan
Borough of Avondale

WE ARE SENDING YOU: [X] Attached [ ] By separate mail via _____ the following items:

[ ] Copy of Letter [ ] Prints [ ] Specifications
[ ] Change Order [ ] As Noted [X] Other Act 537 Plan

COPIES	DATE	NO.	DESCRIPTION
1			Act 537 Plan, Borough of Avondale

THESE ARE TRANSMITTED as checked below:
[ ] For approval [ ] As requested [ ] Reviewed [ ] Returned for corrections
[ ] For your use [ ] For review and comment [ ] Reviewed as noted [ ] Other _____

REMARKS

Attached is the Borough of Avondale's Act 537 Plan for your review as requested. Please contact us should you have any questions.

COPY TO _____

Signed Darryl A. Jenkins, P.E.

If enclosures are not as noted, kindly notify us at once.

INTRODUCTION

I. PREVIOUS WASTEWATER PLANNING

Avondale Borough has completed individual planning studies for past projects at its wastewater treatment facility, but an Act 537 Plan has never been completed. Following is a compilation of other relevant studies that have been completed.

A. Identify and briefly analyze all existing wastewater planning.

1. Has been previously undertaken under the Sewage Facilities Act (Act 537).

As indicated above, there have been several planning activities related to wastewater management in Avondale Borough. Not all of these were necessarily based on Act 537 planning, but, they all addressed wastewater management in and around Avondale Borough.

- The Chester County Water and Sewer Master Plan (1970)

  This 1970 document was compiled to provide a guide for the future of Chester County water and sewer systems. This County plan was also designated to serve as the Act 537 Plan for any municipality which elected this option. It has so served as Avondale Borough's Act 537 Plan since 1970. The plan used a very thorough analysis of many factors that affect planning on a countywide basis. Some of these factors included: population, economy, land uses, transportation and utilities. The plan also addressed the county's geology, soils (reviewed for limitations on on-lot systems), surface water, water pollution control facilities, and implementation and administration. Avondale Borough is mentioned as being the designated treatment facility for its own wastewater, as well as that from a portion of New Garden Township.

- New Garden Township's most recent Act 537 Plan also designates Avondale Borough as the facility for treatment of wastewater flows from the southwest portion of the Township.

2. **Has not been carried out according to an approved implementation schedule contained in the plans.**

This section does not apply since Avondale Borough has not previously completed an Act 537 Plan.

3. **Is anticipated or planned by applicable sewer authorities**

Avondale Borough has been under a self-imposed moratorium for sewer connections since 1990 because of recurring exceedances of the flow limit contained in the NPDES permit for the wastewater treatment facility. The facility is permitted for 300,000 gpd, but that limit has not been complied with on an annual average basis for a number of years. New Garden Township has also voluntarily imposed a ban on new connections within its Avondale service area. Therefore, no wastewater planning has been completed by either municipality with respect to allowing new sewer connections.

4. **Has been done through official plan revisions (planning modules) and addenda.**

Because of the existing moratorium on sewer connections, no planning modules are being accepted for processing by the Borough.

B. Identify and Briefly Summarize All Municipal and County Planning documents Adopted Pursuant to the Pennsylvania Municipalities Planning Code (Act 247)

OPEN SPACE, RECREATION AND ENVIRONMENTAL RESOURCES PLAN

This plan was adopted in 1993 and sets forth recommendations for providing for open space and recreation and preserving environmental resources within the Borough.

ZONING ORDINANCE

The Borough first adopted a zoning ordinance in 1963. Since that time the ordinance has been amended several times with the most recent change being adopted in 1987. The ordinance was extensively amended and revised in 1996 to incorporate the protection of environmentally sensitive areas within the Borough.

SUBDIVISION AND LAND DEVELOPMENT ORDINANCE

The Borough first adopted a subdivision and land development ordinance in 1976. Extensive amendments and revisions to this ordinance were adopted in 1996.

Comprehensive Plan

The Comprehensive Plan is a guideline for future development of land in the Borough, with provision for community facilities and a traffic circulation system. The Comprehensive Plan is comprised of a statement of Community Development Objectives, which are goals for future development within the Borough; a Land Use Plan; a Community Facilities Plan; a Circulation Plan; a plan for meeting the housing needs of present and future residents of the Borough; a statement of the interrelationships among the plan components; a discussion of short and long-range plan implementation strategies; and a statement indicating the relationship of existing and proposed development of the Borough to development and plans in

adjoining municipalities, to the objectives and plans for development in the county, and to regional trends. These components of the Comprehensive Plan are mandated by the Pennsylvania Municipalities Planning Code.

The Land Use Plan component of the Comprehensive Plan establishes general categories of future land use and, within residential categories, establishes ranges of densities and types of dwellings which are expected for those areas. Following adoption of the Comprehensive Plan, the policies established in a Comprehensive Plan are usually implemented through provisions of the Borough Zoning Ordinance and Subdivision and Land Development Ordinance and additional actions of the Borough Planning Commission and Borough Council. The Comprehensive Plan is intended to serve as a policy statement which guides the preparation of land use regulations and actions of Borough officials.

Prior to preparation of the elements of the Comprehensive Plan itself, certain background studies were made to provide a basis on which to make the decisions on land use, community facilities, and circulation. Studies have been done on regional setting, Borough history, natural features, population, housing and economic characteristics, community services and facilities, circulation, and existing land use.

Landscapes

Prepared by the Chester County Planning Commission, this 1996 policy document establishes objectives for the preservation of natural resources, and the avoidance of sprawl in Chester County municipalities.

1. **All land use plans and zoning maps which identify residential, commercial, industrial, agricultural, recreational, and open space areas.**

The existing land use and future land use elements of the Comprehensive Plan identify residential, commercial, industrial, agricultural, recreational, and open space areas. The Zoning Ordinance provides for each of these uses and closely mirrors the land use pattern.

2. **Zoning or Subdivision Regulations that establish lot sizes predicated on sewage disposal methods.**

A copy of the Borough Zoning Map is included in Appendix 1. Most of the Borough is zoned R-1, residence district. Single family detached dwellings are the primary permitted land use, on a lot of a minimum size of 8,400 square feet. Maximum building area is 30%.

Several blocks in the center of the Borough are zoned R-2. In the R-2 district, single family, two family and multiple family dwellings are permitted at a density of 3,000 square feet per family. Maximum building area is 40%.

Commercial and Industrial zoning are found in the areas of West State Street, First Avenue, the southern portion of Pennsylvania Avenue (Route 41) and Baltimore Pike.

Because of the extent of the Borough's sewage collection system, all new development must be connected to public sewers.

3. **All limitations and plans related to floodplain and storm water management and special protection (Chapter 93) areas.**

The zoning ordinance contains a provision that no construction or development shall take place with any identified floodplain area of the Borough.

The provision not permitting development within floodplains helps to preserve the corridors along White Clay Creek, Indian Run, and Trout Run. The hydric soils, wetlands, high yield aquifer, and linear features found within the floodplain will be afforded some protection. The ordinance also gives protection to the hydric soils, wetlands, high yield aquifer, and linear features outside the actual floodplains.

The portion of White Clay Creek within the Borough has Trout Run and Indian Run as tributaries, as well as a tributary with two tributaries, a tributary with one tributary, and two tributaries without tributaries.

White Clay Creek is designated for protection of cold water fishes (maintenance and propagation of the family Salmonidae and fish food organisms) and standard water uses by DER, and subject to DER standards for pH, dissolved oxygen, iron, temperature, dissolved solids, and bacteria. The U.S. Geological Survey of White Clay Creek indicated generally moderate biological conditions.

White Clay Creek is an interstate stream, because it drains to Delaware, and the Delaware River Basin Commission (DRBC) has established water quality criteria for dissolved oxygen, temperature, pH, phenols, threshold odor number, synthetic detergent, radioactivity, fecal coliform, total dissolved solids, turbidity, and effluent quality. The DRBC has indicated that the stream should be maintained in a safe and satisfactory condition for public and industrial water supplies after reasonable treatment; agricultural water supplies; maintenance and propagation of resident game fish and other aquatic life, and trout; wildlife; and recreation.

The Chester County Water Resources Inventory Study of the Clay and Elk Subbasin, indicates water demands on the White Clay Creek watershed should be more than adequately met by available water supply, based on analysis of reserve supplies.

II. PHYSICAL AND DEMOGRAPHIC ANALYSIS USING WRITTEN DESCRIPTION AND MAPPING

A. Identification of planning area, municipal boundaries, Sewer Authority/Management Agency service area boundaries.

The Borough is located in the south eastern portion of Chester County. The Borough is bordered on the east, north and south by New Garden Township and on the west, north and south by London Grove Township. Both Townships have experienced population growth over the past ten years and are expected to continue to grow. The population of London Grove grew from 3531 to 3922 (an 11.1% increase) from 1980 to 1990. New Garden experienced an increase of 13.4%, from 4790 to 5430.

The Borough is traversed by PA Route 41 which runs southeast and northwest. PA Route 41 is a major highway which runs from Delaware, where it connects with Interstate 95, to U.S. Route 30 at Gap. The former U.S. Route 1 enters the Borough from the east and combines with PA Route 41 through the Borough and then splits and continues toward West Grove Borough.

The Borough is approximately 4 miles from the Delaware state line, approximately 18 miles from Gap, approximately 35 miles from Philadelphia, approximately 33 miles from Lancaster, approximately 60 miles from Baltimore and approximately 15 miles from Wilmington, DE.

During future years it is expected that Avondale will experience only limited development pressure. During the 1960's the "new" U.S. Route 1 "bypass" was built. The bypass has directed traffic away from the Borough. There is currently a study underway to determine feasible alternatives for the relocation of PA Route 41 away from the Borough. If and when PA Route 41 is relocated a substantial amount of traffic may also be directed away from the Borough. The combination of the Route 1 bypass and Route 41 bypass would result in Avondale no longer being traversed by heavily traveled major highways.

B. Identification of physical characteristics

Avondale Borough is part of Chester County. The 762 square miles or 487,000 acres that make up Chester County fall wholly within the Piedmont Province of the Appalachian Highlands. The County is part of a land of gently undulating to steeply rolling country that stretches from the Hudson River to Georgia, sandwiched between the Atlantic Coastal Plain and the Blue Ridge. It is underlain primarily by deeply weathered, old, hard, complex crystalline rocks. The main rock structure and most ridges tend to follow a northeast-to-northwest pattern."

SOURCE: Chester County Open Space & Recreation Study, Chester County Planning Commission and Parks and Recreation Department, 1982.

The character of the Borough has been generally residential with limited commercial activity and two industries. It is likely that the commercial base may increase, the residential base will increase, and the industrial base will not change significantly.

Since 1940, based on statistical characteristics, the Borough has been considered to be suburban, with respect to established settlement pattern criteria. It is unlikely this will change in the future. In that regard, there are presently 1.1 dwelling units per acre of ground, 2.79 persons per household and 1908 persons per square mile.

C. **Soils-Analysis with description by soil type and soils mapping show areas suitable for in-ground on-lot systems, elevated sand mounds, individual residential spray irrigation systems, and areas unsuitable for soil dependent systems. Show Prime Agricultural Soils and any locally protected agricultural soils.**

The Land Resources Map is contained in Appendix 2 and indicates areas of steep slopes (slopes greater than 15%), as indicated by the Soil Survey, Chester and Delaware Counties, Pennsylvania, and prime agricultural soils (Capability Units I, II, and III), from Soil Survey, Chester and Delaware Counties, Pennsylvania.

Steep Slopes

There is one large area of steep slope within the Borough, found between Church Street, Route 41, State Road (Baltimore Pike), and the eastern Borough line. Land use essentially consists of several large lot residential properties. Several smaller areas of steep slope are located in the following areas of the Borough, including (1) western portion of the Borough, at the northern Borough boundary, (2) west of Indian Run near the historic farmstead, and (3) north of Miller Drive.

Areas which have slopes greater than 15% have severe limitations to development. In general, this land is too steep for residential subdivisions and cultivation. Development of steep slopes can result in hazardous road conditions, costly excavation, erosion and sedimentation and storm water runoff problems. These slopes are quite prone to erosion, and protection of them is particularly important for water resource protection when watercourses are nearby. (The White Clay Creek is nearby). Development should be limited, vegetative cover maintained to the greatest extent possible, and erosion controls instituted. Without absorptive vegetation, runoff can rapidly erode the slopes.

Prime Agricultural Soils

Prime agricultural soils are found throughout most of the Borough.

The capability classification of the United States Department of Agriculture is a grouping of soils to show, in a general way, the suitability for most kinds of farming. The classification is based upon limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. Soils are classified according to degree and kind of permanent limitation, without consideration of major and generally expensive land forming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

The soils included within the prime agricultural soils delineation are Class I, II, and III soils. Class I soils have few limitations that restrict their use. Class II soils have some limitations that reduce the choice of plants or require moderate conservation practices. Class III soils are those that have severe limitations that reduce the choice of plants or require special conservation practices, or both. There are five other capability classes, that are not designated prime agricultural soils.

The prime agricultural soils are soils which generally should be the best soils for farming and which should be retained for agricultural purposes when possible. Typically, the best farmland is also land conducive to building activities. While some of the prime agricultural soils within the Borough are still farmed, much of the soils have been developed. Agricultural preservation programs have usually established in Townships, and are rare in Boroughs.

The areas not designated as prime agricultural soils generally are comprised of slopes greater than 15%, are wet, or are severely eroded.

D. **Geologic Features - (1) Identification through analysis, (2) mapping and, (3) their relation to existing or potential nitrate-nitrogen pollution and drinking water sources. Include areas where existing nitrate-nitrogen levels are in excess of 5 mg/l.**

These features include the high-yield aquifer, Cockeysville Marble as identified in Chester County Geology Maps, and linear features (fractures), identified in

Groundwater Resources of Chester County, Pennsylvania.

Most of the Borough, and the entire central portion of the Borough, is Cockeysville Marble. Exclusions include areas in the far northern portion of the Borough, along the western boundary of the Borough, in the southeast corner of the Borough, and the wooded and steep sloped areas in the eastern portion of the Borough. The characteristics of Cockeysville Marble are given below:

COCKEYSVILLE MARBLE

Description - Typically a medium to coarse-grained, white to light blue-gray colored marble, often banded with flakes of golden brown phlogopite.

Bedding - Well bedded in thick beds.

Fracturing - Joints have a blocky pattern; well developed; moderately abundant; regular; moderately spaced; open and usually vertical.

Weathering - Moderately resistant; slightly weathered surface; shallow in depth; smooth, sandy-textured, large blocks result from long, continued weathering; overlying mantle is variable in thickness.

Topography - Low, rolling valleys; natural slopes are gentle and stable.

Drainage - Good surface and subsurface drainage.

Porosity - Joints and solution channels produce a secondary porosity of medium to high magnitude.

Groundwater - Yields of up to 1000 gallons per minute or more are obtainable.

Ease of Excavation - Blasting required; bedrock pinnacles may be encountered; moderate drilling rates with rotary equipment.

Cut-Slope Stability - Good cut-slope stability; able to stand in near-vertical cuts.

Foundation Stability - Good quality foundation for heavy structures; thorough sinkhole and bedrock pinnacle investigations should be made.

Construction Materials - Good source for road material, riprap, building stone, embankment facing and fill.

Source: Groundwater Resources of Chester County, Pennsylvania.

The Cockeysville Marble is important for two reasons. First, it can be a source of substantial groundwater of relatively good quality. As noted above, groundwater yields of up to 1,000 gal./min. or more are obtainable. Porosity is of medium to high magnitude. Second, there is high potential for groundwater pollution. Cockeysville Marble is calcium carbonate and is subject to solution by a weak carbonic acid through chemical interaction with air and water. The carbonic acid solution works to dissolve rock, forming underground solution channels and possibly sinkholes. Storage of water can occur in these solution channels, giving the potential for large water yields. However, pollutants may also move through the underground solution channels.

Because of the potential for pollution of the groundwater, the use of on-site sewage disposal within the Cockeysville formation should be discouraged and potentially hazardous materials should not be stored where they could enter the groundwater system. Fortunately, the Borough is served by a public sanitary sewer system.

Care must also be taken in the removal of groundwater, which could result in collapse of rock and formation of sinkholes. While portions of the area of Cockeysville Marble are used for agriculture or are in park land, much of the area has been developed.

Fractures are areas of high groundwater yield because storage can occur there. As

is the case with Cockeysville Marble, fractures are areas where groundwater is also more susceptible to pollution, as pollutants can travel through fractures at a greater speed and distance. Fractures are indicated in a north/south direction in the center of the Borough (at the northern tip of the Borough in the vicinity of the White Clay Creek); in a north/south direction in the south central portion of the Borough in the vicinity of Route 41 and Trout Run; and in an east/west direction across the central portion of the Borough in the vicinity of State Street, First Avenue, White Clay Creek, and Church Street.

E. Topography-Depict slopes that are suitable for conventional systems; slopes that are suitable for elevated sand mounds; slopes that are unsuitable for on-lot systems.

Not applicable. All new development within the Borough would be connected to the public sewer system.

F. Potable Water Supplies-Identification through mapping, description and analysis to include available public water supply capacity and aquifer yield for groundwater supplies.

The existing water system is an outgrowth of a private system installed in the early 1900s. At that time, water was pumped from the quarry in the southern portion of the Borough to an open masonry reservoir located on the hill southwest of the Borough in London Grove Township. The pumping station was located adjacent to the present sewage treatment plant site. Service was provided on a request basis and not all homes in Avondale were supplied by the system.

The system was purchased by the Borough in the late 1950s and improvements and extensions were made to the distribution system. At that time, the decision was made to change the source of supply and the first well, known as Well No. 1, was developed in 1960. In 1961, Well No. 2 was developed and added to the system.

Well No. 1 originally produced 170 gpm; however, its output has been reduced to

130 gpm to eliminate the periodic turbidity problem created at the higher pumping rates. Well No. 2 produces 170 gpm with no deterioration in water quality. The wells are manually operated and pumped on alternate days. Over the years the wells have proven to be very reliable, as evidenced by only a slight drop in static water level without a reduction in output during drought conditions.

The system is operated in compliance with the existing state and federal regulations relating to public water supplies.

The existing storage facility is a 420,000 gallon covered reservoir constructed in 1901 which "floats" on the system. That is, the wells pump directly into the distribution system with the excess water filling the reservoir. The reservoir is 70 feet square by 11.5 feet deep with a concrete bottom and brick walls.

As originally installed, the distribution system consisted of 3 and 4 inch pipe. Over the past 20 years, the Borough has installed 6-inch lines in various locations to improve the hydraulic capabilities of the system, as well as replaced the majority of the service taps to eliminate leaks. In addition, the water system has been extended to previously unserved portions of the Borough. The Borough has established the policy that service will not be provided beyond the Borough boundary. Presently, all Borough residents desiring water service have been connected to the system. A plan of the water system is contained in Appendix 3.

Current water consumption in the Borough averages about 130,000 gpd. The Borough's current supply sources are more than adequate to meet future supply requirements.

G. **Wetlands-Identify wetlands as defined in Title 25, Chapter 105 by description, analysis and mapping. Include National Wetlands Inventory mapping and potential wetland areas per USDA, SCS mapped hydric soils. Proposed collection, conveyance and treatment facilities and lines must be located and labeled, along with the identified wetlands, on the map.**

The Water Resources Map located in Appendix 4 indicates watershed boundaries, 100-year floodplains, wetlands, hydric soils, the high-yield aquifer within the Borough (Cockeysville Marble) and linear features (fractures). The high-yield aquifer and linear features constitute the important geologic and hydrologic features within the Borough. In addition, the stream corridors have been indicated and stream order classification given.

Drainage Basins

Drainage basins are indicated for Trout Run, Indian Run, and White Clay Creek (East Branch), the three streams within the Borough. The Chester County Open Space and Recreation Study classifies the White Clay Creek as a major stream within Chester County. Indian Run flows through the western portion of the Borough. Trout Run flows through the southeast portion of the Borough, and White Clay Creek through the central portion of the Borough, with the confluence east of Indian Run Road. The White Clay Creek flows southwardly into Delaware.

Floodplains

The 100-year floodplain from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map is indicated for each stream. The floodplains for Trout Run and Indian Run typically range from 100 to 200 ft. wide until the southern portion of the Borough, where the streams meet the White Clay Creek. The floodplain for the White Clay Creek ranges from 400 to 800 ft. and then narrows at the railroad tracks. South of the railroad tracks the width of the floodplain for the three streams ranges from 700 to 900 ft. in width.

Floodplains are areas adjacent to watercourses which are covered by water during times of flooding. A 100-year floodplain is the area which has a 1% chance of being flooded during any one year, and which is typically used for regulatory purposes. It is best if the floodplains are not developed, because development within the floodplains results in a danger to persons and property. If development occurs within the floodplain, this may constrict the area over which

flood waters may flow, resulting in increased damage upstream from backwater and increased flood damage downstream because of resultant increased flood velocities downstream. Outdoor storage of materials within floodplains is not desirable because of the possibility of the materials entering the stream when flooding of the banks occurs.

Care must be taken in disturbing areas along watercourses because increased sedimentation within the stream (increased depositing of soil within the stream) can occur. The runoff can erode stream banks and channels. If sedimentation is increased, filling of stream beds can occur, which could cause flood waters to cover a larger area, meandering of streams, and choking of life within the stream, detracting from the aesthetic value of the stream.

It is desirable to keep pervious surfaces on stream banks, as opposed to imperious surfaces such as paved areas. As surface runoff of water moves toward streams, water can be absorbed into the ground if the surface is pervious. Increased absorption can result in replenishment of groundwater and also in decreased flood peaks because less water reaches the stream from the surface of the land. Inadequate supply of groundwater can result in an inadequate flow of water to the stream during dry months. The inability to sustain stream flow can mean a greater concentration of pollutants at periods of low flow.

Agricultural activities practiced along streams should be practiced with care. Increased tillage and use of the soil can increase the sediment concentration and runoff reaching streams. Animal excretions can result in increased bacteriological concentration in runoff, pesticides can result in increased undesirable chemicals in runoff, and fertilizer and manure can increase nitrate concentrations in runoff.

As the Borough is served by sanitary sewer system, there does not have to be concern about on-site sewage disposal systems within the Borough. On-site sewage disposal systems should not be located within areas subject to flooding because of the danger of contamination of the stream and the groundwater because of the proximity of the stream and the presence of the high water table. There may not be an adequate distance between the on-site facility and surface water to

permit renovation of sewage effluent prior to its reaching the stream. In some instances, soils found in the floodplains are very porous and the movement of sewage effluent is too rapid to allow for the renovation of the effluent prior to reaching the groundwater table or the stream. In other situations, the soil near the surface may be saturated with water or become readily saturated with sewage effluent, resulting in effluent remaining near or rising to the surface of the land. When flooding occurs, sewage effluent could then contaminate the surface water. The efficiency of filter fields of septic tanks can be impaired or destroyed as a result of flooding.

Agriculture is the predominant land use along the floodplain of the Indian Run. The Borough sewage treatment plant site is located at the intersection of West State Street and Indian Run Road and undeveloped Borough land is located along the railroad in the northwestern portion of the Borough. An abandoned quarry owned by the Borough, several residential lots, and a commercial lot along Indian Run Road in the southwest portion of the Borough are also located within the floodplain.

Industrial, agricultural, commercial, and residential properties are located within the Trout Run floodplain in the southern portion of the Borough.

The floodplain of the White Clay Creek, in the central portion of the Borough, contains the Borough park, agricultural land, commercial land, and the Borough treatment plant.

Wetlands

The wetlands shown on the Water Resources Map are from the National Wetlands Inventory, prepared by the Office of Biological Services, U.S. Department of the Interior, Fish and Wildlife Service. The wetlands inventory was prepared by stereoscopic analysis of high altitude aerial photographs, with the wetlands identified on the photographs based on vegetation, visible hydrology, and geography. A detailed on the ground and historical analysis of any site may result in a revision of the wetland boundaries, and it is possible that small wetlands and those obscured by dense forest cover may not be identified.

Wetlands are indicated at three locations to the west of the Indian Run, between the White Clay Creek and New Street, along the bank of Trout Run, between Trout Run and Route 41, and in the vicinity of the confluence of White Clay Creek and Trout Run. The latter area is of substantial size. In general, the wetlands areas are currently in agricultural land use.

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, prevalence of vegetation typically adapted for life in saturated soil conditions. During on-site investigation, wetlands can sometimes be identified when they are saturated with permanent or semi-permanent standing water and contain common wetlands plants such as cattails and willows. If wetlands can not be identified by hydrophytes (plants adopted to life in saturated soil conditions), soils may be investigated to determine whether wetlands are present. Hydric soils mapping can be used to identify potential wetlands sites. Hydric soils are discussed below.

To try to put wetlands into less technical terms, often sites adjacent to streams, low lying land that remains wet for considerable periods of the growing season, land that can not be farmed because it is too wet or can only be farmed every few years, or low-lying land that can only be developed by filling are likely to be wetlands.

Wetlands can be areas rich in plant growth and animal habitat. They often serve as breeding places for many organisms. In addition to providing a home and a source of food for organisms, wetlands can protect water sources and can help keep water sources clean by acting as natural filters and removing pollutants such as bacteria and sediment from water. This occurs as plants growing in and around wetlands trap pollutants.

Wetlands store water which can replenish groundwater and surface water supplies.

In general, no developmental activity or placement of fill material may occur within wetlands without obtaining a DER permit.

Hydric Soils

Hydric soils are also indicated on the Water Resources Map. The hydric soils have been mapped from the Soil Survey, Chester and Delaware Counties, Pennsylvania and Hydric Soils of Pennsylvania by the U.S. Department of Agriculture Soil Conservation Service, and indicate areas of potential wetlands. Hydric soils are developed under conditions sufficiently wet to support the growth and regeneration of hydrophytic vegetation and are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions (an anaerobic situation is one in which molecular oxygen is absent) in the upper part. Criteria for identifying hydric soils include somewhat poorly drained soils that have water table less than 0.5 ft. from the surface for a significant period (usually a week or more) during the growing season; are poorly drained or very poorly drained and have either water table at less than 1.0 ft. from surface for a significant period during the growing season if permeability is equal to or greater than 6.0"/hr. in all areas within 20", or have water table at least 1.5 ft. from the surface for a significant period during the growing season if permeability is less than 6.0"/hr. in any layer within 20"; soils that are ponded for long duration (from 7 days to 1 month) or very long duration (greater than 1 month) during the growing season; or soils that are frequently flooded for long duration or very long duration during the growing season.

Two areas of hydric soil are indicated west of the Indian Run generally in the vicinity of the wetlands, however, extending over a greater area. These areas are currently used for agriculture.

A large area of hydric soil is located in the vicinity of Trout Run. Existing land uses include agricultural, industrial, commercial, and residential.

An area of hydric soil is located in the Borough park along the White Clay Creek between First Avenue and Church Street. A larger area of hydric soil is located east of the White Clay Creek in the northeast corner of the Borough. This area has been developed for residential purposes.

Future extensions to the existing sewage collection system would most likely be constructed by individual land developers who would be required to obtain any and all necessary permits for encroachment upon existing wetlands.

III. EXISTING SEWAGE FACILITIES IN PLANNING AREA

A. Identify, map, and describe municipal and nonmunicipal, individual, and community sewerage systems in the planning area.

1. Location, size, and ownership of treatment facilities, main intercepting lines, pumping stations, and force mains, including their size, capacity, point of discharge. Also include the name of the receiving stream, drainage basin, and the facilities.

The Borough of Avondale sanitary sewer system serving the Borough of Avondale and New Garden Township consists of approximately 7,000 ft. of 10" lines and approximately 2.75 miles of 8" lines. All lines are gravity lines which flow to the treatment plant located in the southwest area of the Borough. The plant is located in the Borough of Avondale and discharges to the Indian Run Creek.

The treatment plant was built in the late 1960s. Originally designed as an activated sludge plant using contact stabilization, it was later modified to be a straight activated sludge process. PA DEP approved a plant upgrade on May 5, 1993. This upgrade included the addition of flow equalization and aerated sludge holding tank. Also completed as part of the project was the conversion of the existing digesters to aeration tanks and modifications to the existing clarifiers. The plant has a permitted hydraulic capacity of 0.300 mgd. The permitted organic loading is 550 lbs/day. The Borough facilities operate under NPDES permit PA0025488.

Flows from New Garden Township are metered at two locations. One metering manhole is located on Route 41. The other meter is located along Trout Run.

A map depicting the Borough's sewage collection system is located in Appendix 5.

2. **A narrative and schematic diagram of the facilities basic treatment processes including the facility's NPDES permitted capacity, and the Clean Stream Law permit number.**

Avondale receives flow from Avondale and New Garden Township. Flow enters the plant at the wet well inside the control building. The wastewater is pumped from the wet well through a bar screen and a grit removal device. The flow is discharged to the aerated equalization tank. From the equalization tank it is pumped to a conventional activated sludge process.

The activated sludge process is a biological process used to remove the organic load from the wastewater. The activated sludge process is separated into two parallel treatment trains. Each train is broken into three cells. The first cell has diffused aeration, while the second and third cells have mechanical aerators. Flow leaves the aeration cells and enters the clarifiers.

Each train has its own square clarifier. The clarifiers are used to separate the inert and biological solids from the wastewater.

The forward flow exits the clarifiers and enters the Chlorine Contact Tanks (CCT). The flow is disinfected in the CCT. The final effluent is discharged to Indian Run Creek.

Bio-solids removed from the clarifiers are transferred to either the aerobic digester, gravity thickener, or returned to the head of the aeration tanks. The digester is used to destroy the volatile fraction of the bio-solids. The thickener is used to remove the excess water from the solids. Excess bio-solids are disposed off-site by a licensed hauler.

The effluent discharge requirements for the wastewater treatment facility are as follows:

Discharge Parameter	Limitation
Flow	Report Only
$CBOD_5$	25 mg/l
Total Suspended Solids	30 mg/l
Ammonia as Nitrogen	2.0 mg/l (5/1 through 10/31)
Ammonia as Nitrogen	6 mg/l (11/1 through 4/30)
Fecal Coliform	200 colonies/100 ml
Dissolved Oxygen	Min. 2 mg/l
pH	6-9 standard units
Total Residual Chlorine	0.75 mg/l until 6-30-99, 0.6 mg/l thereafter
Copper	0.045 mg/l
Zinc	0.40 mg/l
Lindane	0.00006 mg/l
4,4'-DDD	0.000001 mg/l
Diazionon	0.00091 mg/l
Malathion	0.0022 mg/l

A schematic diagram of the process is shown in Appendix 6.

3. **A description of problems with existing facilities, including existing or projected overload under Title 25, Chapter 94, or violations of the NPDES permit, Clean Streams Law permit, or other permits, rules, or regulations of the Department.**

a. Avondale Borough

As noted earlier, the Avondale wastewater treatment facility has exceeded its hydraulic loading of 0.3 mgd as authorized under its current NPDES permit. The average annual flows for the last 5 years (as reported in the 1997 Chapter 94 Report) are noted below.

Year	Average Flow	GPD Per Connected EDU
1993	0.346 mgd	416 gpd
1994	0.318 mgd	383 gpd
1995	0.282 mgd	339 gpd
1996	0.452 mgd	544 gpd
1997	0.373 mgd	449 gpd
1998	0.333 mgd	400 gpd

Despite the hydraulic flow limit exceedance, the wastewater treatment facility is still able to operate efficiently. The concentration limits for the required NPDES testing parameters are met most of the time during hydraulic overload events, but obviously, the mass loading limits are not. Aside from this problem, the treatment facility is in good operating order.

In January 1997, Avondale Borough, at the request of PA DEP, prepared a Capacity Study for the wastewater treatment facility. The purpose of this study was to define the capacity of the facility based on the capabilities of the individual treatment units. The study concluded that the treatment facility was subject to excess flow due to inflow and infiltration (I/I), and that this excess flow should be removed to improve performance. The study also recommended that the clarifiers and the chlorine contact tank would have to be upgraded to ultimately expand treatment capacity. A copy of the capacity study has previously been submitted to the Department, and is intended to serve as the official evaluation of the operation and performance efficiency of the Borough's wastewater treatment facility.

The Borough's sewage collection system is in good operating order, and is not hydraulically overloaded. There are no records indicating that surcharging or backups have ever occurred. The collection system is constructed of vitrified clay pipe, and consists of approximately 7,000 linear feet of 10" pipe, and 14,500 linear feet of 8" pipe. There are no pumping stations within the system.

In April 1997, Avondale Borough, at the request of PA DEP, completed a comprehensive I/I study of its entire collection system. Inflow and infiltration (I/I) is unwanted flow that enters a sewage collection system. Inflow is that rainfall that enters the collection system directly through downspouts, storm sewers, and sump pump connections. Inflow can also enter the system through broken vents, traps, and cleanout connections on laterals. Infiltration is that groundwater that enters the system through cracks and joints of the sewer system. I/I increases the hydraulic loading to a sewage facility and therefore has the potential to upset operations.

The purpose of the report was to determine the source of the I/I. The report used past findings and new investigations to locate the sources. The investigations included a statistical review, night-time inspections, plugging and weiring, smoke testing, and portable flow metering.

The I/I study concluded that the Borough's collection system was being subjected to nearly 180,000 gpd of I/I at the time. A portion of this I/I was emanating from the 10" interceptor lines that transport the New Garden Township flows to the wastewater treatment facility. A copy of the I/I study has been previously submitted to the Department, and is intended to serve as the official evaluation of the Borough's sewage collection system.

In light of the results of the I/I study, the Borough retained a contractor in April, 1998 to effect repairs upon the sewage collection system. The contractor's work was completed in October, 1998, and was extremely successful in reducing the amount of I/I within the collection system. It has been calculated that approximately 93,000 to 115,000 gpd of infiltration was eliminated through the repair of deteriorated pipe, leaking pipe joints, and leaking laterals.

In addition to the repairs made within the sewage collection system, the Borough also initiated an inspection program to identify homes which had connected sump pumps. To date, nearly 90% of the homes within the Borough have been inspected, and any sump pumps that were found have been disconnected from the sewage collection system.

The repair project has had a two-fold effect on the performance of the wastewater treatment facility. First, peak wet weather flows have been drastically attenuated. Prior to the project, peak flows as high as 1.0 mgd had been recorded at the plant, and average peak flows were in the neighborhood of 0.4 to 0.5 mgd during significant storm events. Peak flows are now below 0.4 mgd. The second effect has been that the monthly average flows have dropped below the NPDES permit limit of 0.3 mgd. The positive results of the repair work are readily apparent, and the Borough has made a commitment to continue with annual repair and maintenance projects.

b. New Garden Township

Representatives of Avondale Borough and New Garden Township met in May of 1998 with representatives of the Department of Environmental Protection (DEP) to discuss numerous issues related to the Avondale Waste Water Treatment Facility. One of the

outcomes of that meeting was a commitment by New Garden Township to conduct an analysis of Infiltration and Inflow (I & I) entering that portion of the New Garden Township collection system tied to the Avondale collection system. Some time earlier, an evaluation of I & I had been undertaken by Avondale which included a portion of the shared interceptors within Avondale that connect with the Route 41 Line and Railroad Line in New Garden. Those results were reported separately by Avondale.

During the period July 7 through July 23, 1998 numerous flow measurements were taken throughout the New Garden collection system. The results of the evaluation are contained in a report prepared by GTS Technologies, Inc. titled EVALUATION OF INFILTRATION/INFLOW (I & I) OCCURRENCE AND MAGNITUDE, EMANATING FROM NEW GARDEN TOWNSHIP, AND ITS EFFECT ON THE HYDRAULIC LOAD IN THE AVONDALE WWTF. A copy of the report is included as Appendix 12.

It is important to note the I & I evaluation was preformed prior to redirecting a portion of the New Garden flow from the Avondale facility to the East End facility. The overall system flows referenced in the report are now different as a result of the change, however, the conclusions regarding I & I remain valid when taken in the proper context.

The conclusion reached in the report is that approximately 12,000 gpd of infiltration could be attributable to the New Garden collection system which includes both the Railroad Line and the interceptor portion of the Route 41 Line. Since the Route 41 Line is a force main within New Garden, it is assumed that no infiltration exists in that section of the collection system. During the study period, the total flow from New Garden to Avondale was 120,250 gpd, therefore, I & I represents 10 % of the flow.

In another section of this Sewage Facilities Plan and in Appendix 17, data is presented which summarizes flow readings obtained since the diversion of flow in August. Based on those data, the current Railroad Line flow to Avondale is 22,753 gpd. The I & I report discussed above states that "infiltration is limited to the 10 inch Interceptor Sewer between Penn Green Road and the Meter Pit." which is the Railroad Line. If one assumes a linear relationship of infiltration to total flow in the Railroad Line, then the current infiltration is 2,273 gpd. If the relationship is not linear, a significant portion of the I & I could remain in the Railroad Line but the total should not exceed 12,000 gpd. If the total is 12,000 gpd that would equate to 52.7% of the flow which is unrealistic based on the per EDU flow discussed below. Therefore, the Railroad Line I & I is most likely more than 2,273 gpd but significantly less than 12,000 gpd.

Further, when the current flows from New Garden to Avondale are analyzed, one finds the average flow per EDU per day connected to the Railroad Line is 274 and the average flow per EDU per day connected to the Route 41 Line is 262. These values are within reasonable limits for the type and age of the system and the type and number of connections.

The conclusion reached is that New Garden is not contributing a significant amount of I & I to Avondale. In the interest of completeness, additional flow measurements should be taken to establish the amount of I & I remaining in the Railroad Line since the diversion

4. Details of scheduled or in progress upgrading or expansions of treatment facilities and the anticipated completion date of the improvements. Discuss any remaining reserve capacity and the policy concerning the allocation of reserve capacity. Also discuss the

compatibility of the rate of growth to existing and proposed wastewater treatment facilities.

There are currently no plans in effect for the upgrade or expansion of the Avondale facility because of the self-imposed moratorium on new sewer connections within the Borough. This Act 537 Plan Study, however, recommends that the treatment facility be expanded to 0.418 mgd to accommodate projected future sewage flows.

There is currently no reserve capacity at the facility because of the recent hydraulic overload problems, in addition to the self-imposed moratorium on new sewer connections.

Allocation of flow at the Avondale wastewater treatment facility is governed by a 1968 Agreement between Avondale Borough and New Garden Township. The agreement also defines the responsibilities of each of the respective municipalities with regard to operation, maintenance, monitoring, and cost-sharing for same. Following is a delineation of the flow allocation among the two municipalities.

- The Agreement defines an Equivalent Dwelling Unit, or EDU, at 350 gpd.

- New Garden Township currently has an allocation of 495 EDUs, or 173,250 gpd. This allocation represents 58% of the total treatment facility capacity.

- Avondale Borough currently has an allocation of 362 EDUs, or 126,750 gpd. This allocation represents 42% of the total treatment facility capacity.

From its current allocation of 495 EDUs, New Garden Township has 435 connected EDUs, which represent 88% of its available capacity. Avondale Borough has 394 connected EDUs, which represent 108% of its available capacity.

It should be noted that as of August 21, 1998, New Garden Township diverted a portion of its wastewater flow treated by the Avondale facility to the new New Garden Township Wastewater Treatment Facility (NGTWWTF). Based upon actual flow metering records, it has been determined that New Garden Township has reduced its flow to Avondale by approximately 77,000 gallons per day. This means that New Garden Township's average daily flow (in 1998) has gone from approximately 131,000 gpd to 54,000 gpd. New Garden Township has indicated that it intends to replace the diverted flow with additional connections from within the same service areas. Avondale has already begun to process planning modules for these replacement connections as they are submitted.

The direct result of this flow diversion has been the reduction of the average daily flows at the Avondale sewage treatment plant. As of November 1998, the total effluent flow at the plant was 6,274,000 gallons, or an average of 209,133 gpd. In the month prior to the diversion, July 1998, the total effluent flow was 10,059,000 gallons, or an average of 324,485 gpd.

Despite the fact that the recent average monthly sewer flows at the wastewater treatment facility have been below the permitted flow value of 0.3 mgd, neither the Borough nor New Garden Township has discussed lifting the moratorium on connections. The compatibility of future growth in both municipalities with this decision will be discussed in greater detail in Section IV of this study.

5. **A detailed description of operation and maintenance requirements of the municipality for on-lot systems and the status of past and present compliance with these requirements and any other requirements relating to sewage management programs.**

Avondale Borough does not have a sewage management plan in effect because of the small number of on-lot sewage disposal systems that are presently active within its municipal boundaries. There are currently 309 active sewer accounts within the Borough for its population of 1,031 residents. Borough records indicate that there are only 10 homes served by on-lot disposal systems, which means that 97% of all residences are served by public sewer. Neither the Borough nor the Chester County Health Department has any record of malfunctions associated with these systems, so it must be assumed that all of the on-lot systems are in proper operating order. It should be noted, however, that it is typically very difficult to identify a malfunctioning system unless a complaint is received from a neighboring property, or the owner of the malfunctioning system comes forward to the Borough, or the Chester County Health Department, to obtain a permit to repair the system.

At the present time, it is not anticipated that a formal wastewater management plan and education program will be required for those areas of the Borough that have on-lot sewage disposal systems. As the existing sewage collection system is extended within the designated sewer service and growth area, homes with on-lot systems will be connected where feasible. If, however, malfunctioning systems do become a problem within a defined area of the Borough, appropriate measures would be taken to rectify the problem. These might include the establishment of an "on-lot" sewage district where formal procedures for providing the continued operation of subsurface sewage disposal systems would be established. Provisions that might be included would be established frequencies for pumping of septic tanks; regulation of plumbing fixtures (i.e., installation of low-flow shower heads and faucets, etc.); and, promulgation of prescribed annual maintenance procedures for on-lot sewage disposal

systems. Needless to say, this alternative would have an extremely low cost, but proper administration of such a program would be a critical factor. In addition, the question of how to repair systems that have already failed would need to be addressed. The homeowners would be made aware that PENNVEST funding is available to repair on-lot systems at an interest rate of 1% for terms up to 15 years. In addition, the Borough could choose to negotiate with local financial institutions in an effort to secure private, low interest loans should such a need exist. This, however, it not a program that is currently warranted, so further discussion will not be necessary.

6. **Disposal areas, if other than stream discharge, and any applicable groundwater limitations.**

There are no such disposal areas within the Borough boundaries.

B. **Using DEP's manual titled "Sewage Disposal Needs Identification Guidance", identify, map, and describe areas that use individual and community on-lot sewage disposal and, unpermitted collection and disposal systems ("wildcat" sewers, borehole disposal, etc.) and retaining tank systems in the planning area including:**

1. **The types of systems in use.**

As previously noted, there are only 10 homes within the Borough limits that use on-lot disposal systems. These homes are basically scattered in the corners of the Borough boundaries where it was not feasible or cost-effective to install sewers when the system was originally constructed. The homes are located as noted below:

• Ellicott Avenue, south of PA Route 41	2 homes
• Church Avenue, north of PA Route 41	1 home
• Baltimore Pike, north of PA Route 41	3 homes

- Unnamed private street near Church Avenue — 3 homes
- West State Street, west of PA Route 41 — 1 home

There are no other unpermitted, or "wildcat" sewers within the Borough. No sewage holding tanks are in use.

2. **A sanitary survey complete with a description of documented and potential public health pollution, and operational problem (including malfunctioning systems) with the systems, including violations of local ordinances, the Sewage Facilities Act, the Clean Stream Law, or regulations promulgated thereunder.**

Not applicable. The completion of a sanitary survey was not a requirement in the approved Plan of Study for this Act 537 Plan.

3. **A comparison of the types of on-lot sewage systems installed in an area with the types of systems which are appropriate for the area according to soil, geologic conditions, topographic limitations sewage flows, and Title 25, Chapter 73 (relating to standards for sewage disposal facilities). (Reference - Title 25, §71.21.a.2.ii.C).**

None of the on-lot sewage disposal systems within the Borough is located within the defined hydric soils areas. However, much of the Borough is subject to a seasonal high groundwater table, which could potentially affect the operation of an on-lot sewage disposal system. Despite the good drainage characteristics of the prevailing Cockeysville Marble formation, a broad statement can be made that the soils within the Borough are generally unsuitable for on-lot systems. Moreover, all future lots to be developed within the Borough will be served by public sewers, so the installation of additional on-lot sewage disposal systems is really of no concern.

4. An individual water supply survey to identify possible contamination by malfunctioning on-lot sewage disposal systems consistent with the

PA DEP Sewage Disposal Needs Identification Guidance manual (Reference - Title 25, §71.21.a.2.ii.B).

An individual water supply survey was not a requirement of the approved Plan of Study for this Act 537 Plan. Borough records indicate that there are only five homes that are not served by public water because of their distance from existing water distribution mains. The Borough's water supply meets all applicable federal, state, and local requirements for drinking water.

C. **Identify wastewater sludge and septage generation, transport, and disposal methods. Include this information in the sewage facilities alternative analysis including:**

1. **Location of sources of wastewater sludge or septage (Septic tanks, holding tanks, wastewater treatment facilities). (Reference - Title 25, §71.71).**

The major sludge generating facility within Avondale Borough is the wastewater treatment plant. This sludge is taken to another wastewater treatment plant for treatment and disposal. The plant produces approximately 250,000 gallons per year of thickened sludge. Septage generated from the few remaining on-lot disposal systems is the responsibility of the respective homeowners.

The amount of septage generated within the Borough can be calculated based on the following assumptions:

- Septic tanks are pumped every three years
- The average septic tank capacity is 900 gallons
- Ten homes use on-lot disposal systems

Using these factors, the annual septage production for the Township is:

$$10 \text{ homes} \times \frac{\text{one 900 gallon tank}}{\text{home}} \times \frac{\text{1 Pump Out}}{\text{3 years}}$$

= 3,000 gallons of septage per year

2. **Present disposal methods, locations, capacities, and transportation methods. (Reference - Title 25, §71.71).**

Presently, sludge generated by the Borough's wastewater treatment facility is removed from the plant by a licensed sludge hauler. The hauler uses a properly sized tank truck for removal of the sludge and transport to the disposal facility.

Septage from the remaining on-lot disposal systems is removed by haulers selected by the respective homeowners.

IV. FUTURE GROWTH AND LAND DEVELOPMENT

A. Delineate and describe the following through map, text and analysis:

1. Areas with existing development or plotted subdivisions. Include the name, location, description, total number of EDUs in development, total number of EDU's currently developed, and the total number of EDUs remaining to be developed.

a. Avondale Borough

EQUIVALENT DWELLING UNITS

As noted in Section III of this report, the 1968 Agreement between Avondale Borough and New Garden Township set forth an Equivalent Dwelling Unit (EDU) value of 350 gpd. This value may be somewhat inflated when compared to the value of 275 gpd per EDU that is typically used in planning studies. For the years 1993 through 1998, the average flow per connected EDU was 422 gpd. It should be noted, however, that during 1996 and a portion of 1997, record amounts of rainfall were recorded in southeastern PA. When these years are excluded from the average EDU value calculation, a value of 385 gpd per EDU is obtained, which is still higher than the typical EDU planning value of 275 gpd. However, it must be taken into account that the Borough did not perform any I/I remediation work during those years, which would account for the higher flows. Given that the Borough has recently completed a major I/I project that was very successful, and that it has made a commitment to continue performing this work, it is reasonable to assume that flows will continue to drop, and thereby lower the average EDU value. In addition, nearly all of any new connections to the sewage collection system would be served by PVC pipe, which is vastly superior to the clay pipe that now comprises the Borough's collection system with regard to the prevention of I/I.

When all of these factors are considered, it is reasonable to use a value of 275 gpd per EDU for planning purposes as a conservative approach.

As a designated urban center, Avondale Borough has many existing land use patterns. Throughout the Borough there is generally a good balance of existing land use to serve the residential, commercial, social, and other needs of the community. The uses are predominantly residential and commercial. There is one major industry, several churches, the fire department, post office, municipal building, banks, etc. Most of the commercial enterprises can be found along Pennsylvania Avenue (Route 41). The majority of the structures in the Borough are very old. New construction has been limited to residential dwellings off of West State Street near the Borough limits (Avon Mohr). Development potential through the Borough is limited due to the existing structures and natural constraints associated with available open land. Significant growth is not likely to occur within the Borough. The exception may be construction of an apartment complex or some other high density low land use facility.

The total number of housing units in the Borough is 347. Of that number, 227 or 65.4%, are single unit detached; 17 or 4.9% are single unit attached; 34 or 9.8% are 2-4 units; 8 or 2.3% are 5-9 units; 51 or 14.7% are over 10 units; and 10 or 2.5% are mobile homes. There are 224, or 64.6%, owner occupied units; 115 or 33.1% renter occupied units; and 8 or 2.3% vacant units in the Borough. The average number of persons per occupied units is 2.79; per owner occupied unit is 2.8; and per rented unit is 2.63. The current population of the Borough is 1,031 people. There are no active land development projects within the Borough because of the moratorium on new sewer connections. The Borough has 394 connected EDUs from this current allocation of 363 EDUs. This leaves no EDUs for future connections within the existing

allocation based on the existing 1968 Agreement with New Garden Township.

b. New Garden Township

That portion of the Railroad Line along with a portion of the Route 41 Line which collects and directs flow from within New Garden to Avondale are shown in Appendix 16.

Connected to the Railroad Line are 92 residential units and 15 commercial units. The commercial units are designated as such based on the physical use of the space and not the strength of the waste. Data is presented in Appendix 17 which establishes the average daily flow from the Railroad Line as 22,753 gpd. Based on the above, the average daily flow for all connected units is 213 gpd. If one assumes an average daily flow per residential connection of 200 gpd then the average daily flow per commercial connection is 290 gpd. Both 200 gpd for residential connections and 290 gpd for commercial connections seems reasonable allowing for the type of commercial connections that are serviced.

The residential units connected to the Railroad Line are located primarily along a section of Newark Road, Pine Street and Reese Street in the southwest and west sections of Toughkenamon plus a few along Old Baltimore Pike. The commercial connections are, for the most part, facilities related to mushroom growing or processing. In addition, there is a truck transport company and a number of small retail or office type units connected.

Connected to the Route 41 Line are 49 residential units, 63 commercial units and 1 institutional unit. The commercial units are designated as such based on the physical use of the space and not the strength of the waste. The institutional unit is New Garden Elementary School. Data is presented in Appendix 17 which

establishes the average daily flow from the Route 41 Line as 29,604 gpd. Based on the above, the average daily flow for all connected units is 262 gpd. If one assumes an average daily flow per residential connection of 200 gpd and an actual flow of 2,673 gpd for the school then the average daily flow per commercial connection is 274 gpd. Both 200 gpd for residential connections and 274 gpd for commercial connections seems reasonable allowing for the type of commercial connections that are serviced.

The residential units connected to the Route 41 Line are located, for the most part, along Route 41 from just east of Penn Green Road to the Township/Boro boundary. The commercial connections are scattered along Route 41 from the former Hewlett Packard facility to Penn Green Road. A major section of the former Hewlett-Packard building has been demolished which results in those previous active connections now being considered reserved capacity. The remaining portion of the building and some ground has been sold to a light manufacturing company that is currently contributing about 8,167 gpd to the Route 41 Line. Other commercial connections are mushroom industry related plus a few retail establishments. In addition, New Garden Elementary School is connected as mentioned above.

The analyses above does not include a factor for I & I since New Garden believes that contribution to be insignificant as stated previously in this report.

2. Land use designations established under the Pennsylvania Municipalities Planning Code, including residential, commercial and industrial areas. Include a comparison of proposed land use as allowed by zoning and existing sewage facilities planning.

a. Avondale Borough

- Zoning Ordinance

A copy of the Borough Zoning Map is included in Appendix 1 of this report. Following are the base districts for the Borough:

R-1	Residential District
R-2	Residential District
FD	Flexible Use District
TC	Town Center District
C	General Commercial District
I	Industrial District

In addition to the base district provisions, certain land areas are subject to additional provisions for the purposes of environmental protection. These are:

- Carbonate Overlay District
- Flood Hazard Overlay District
- Wetland Protection Overlay District
- Steep Slope Overlay District
- Woodland Overlay District

The majority of the Borough is zoned R-1 and R-2. The maximum lot coverage is 35% in the R-1 district and 50% in the R-2 District. The zoning ordinance contains a general provision that prohibits development within any identified floodplain.

The environmental protection standards contained within the zoning ordinance are designed to:

- Conserve the natural resources of the Borough

- Fulfill the goals of the Borough Open Space, Recreation and Environmental Resource Plan, and the goals of the Borough Comprehensive Plan

- Establish performance standards which apply to uses which may disturb sensitive natural resources, including, but not limited to, floodplain, steep slope, woodland, wetland, and high-yield aquifer areas

- Implement the provisions of the PA Municipalities Planning Code, Section 605(2)

Existing land use patterns have a great influence on the Future Land Use Plan, but also affect circulation within the Borough and demand for community facilities and services. An existing land use map is included in Appendix 7.

The categories which have been mapped include One Family Residential. This has not been broken down into densities, so this may include land with several dwelling units per acre or land in large parcels but used for residential purposes. Residential with accessory apartments is also shown. This would typically be a dwelling which was designed as a single family dwelling which now may have a few apartments within the building. Multiple Family Residential is a building which is devoted to apartment usage. Residential and business in combination are those buildings which serve as a residence but also have a commercial operation within the building. Commercial land is land used solely for commercial purposes. Industrial land is that land used solely for industrial purposes. Agricultural land is used for farming purposes, and may contain a farmhouse. Public and quasi public uses

include Borough land and those owned by civic and religious groups and other government organizations. Open land is land which is not developed and not used for agricultural purposes.

One Family Residential

The most predominant land uses within the Borough are One Family Residential and Agricultural. The greatest concentrations of one family homes are found in the central portion of the Borough, in the northeast corner of the Borough east of Church Street, and in the southwest corner of the Borough in the vicinity of Miller Drive. The remaining area east of Church Street and the area between Route 41 and the railroad are designated One Family Residential, however contain only several dwelling units and do contain potential for further development.

Agriculture

Agricultural Land uses are generally found along the watercourses within the Borough, including the White Clay Creek, Indian Run, and Trout Run. They are also found south of Avondale/New London Road and east of Ellicott Avenue. Those areas along the watercourses have severe limitations for building because of flooding and the presence of other water related resources. Because of slopes, the agricultural lands along the London Grove Township boundary and south of Avondale/New London Road also have limitations to development. The area east of Ellicott Avenue has more potential for development.

Industrial

There are two major industrial uses within the Borough, Edlon Industries along West State Street and the railroad

tracks and West Chester Manufacturing along Route 41 and Ellicott Avenue. A quarry is operated along Old Baltimore Pike.

Commercial

Commercial land uses are concentrated along Route 41 between Second Avenue and Ellicott Avenue and along Old Baltimore Pike. Additional commercial uses are scattered along the southern portion of Route 41, West State Street, the northern portion of Pennsylvania Avenue, and the eastcentral portion of the Borough. Commercial uses range from those serving the day to day needs of the Borough residents, such as the banks, sandwich shop, candy store, greenhouse, and hardware store in the central portion of town and the uses found at the WaWa-Dominos center at Old Baltimore Pike and Church Street, to those uses serving needs of highway travelers such as the vehicle service stations along Old Baltimore Pike and Route 41 south of West State Street.

Multiple Family Residential

The largest apartment complex within the Borough is found south of First Avenue. In addition, buildings which have been converted for apartment usage are found along Route 41 and Old Baltimore Pike.

Residence and Business in Combination

These uses are found along Pennsylvania Avenue in the vicinity of 2nd and 3rd Avenues.

Residential with Accessory Apartments

These uses are also found along Pennsylvania Avenue, where single family residences may have a few accessory apartments.

Pennsylvania Avenue is still a very attractive street from the northern Borough boundary to 2nd Avenue because of the trees along the street and the attractive homes, initially built as single family detached dwellings. Over time, there has been conversion from use solely as singly family dwellings to commercial uses, residential with accessory apartments, residential and business in combination, and multiple family residential. A concern of the Borough will be to maintain the attractive character of Pennsylvania Avenue.

Public and Quasi Public

The Public and quasi public land uses include the Borough Hall, the sewage treatment plant and quarry along Indian Run Road, the additional Borough land and recycling center along Pomeroy Avenue, the Borough park, the five churches within the Borough, the Grange, and firehouse.

Open Land

A relatively small area of open land is indicated between Trout Run and the Octoraro Railroad in the southeastern portion of the Borough.

PLANNING IMPLICATIONS OF EXISTING LAND USE

Throughout the Borough there is generally a good balance of existing land use to serve the residential, commercial, social and other needs of the community. The uses are predominantly residential and commercial. There is one major industry and one smaller industry, several churches, the fire department, post office, municipal building, banks and other commercial establishments. Most of the commercial enterprises can be found along Pennsylvania Avenue (Route 41). The majority of the structures in the Borough are very old. New construction has been limited to residential dwellings off of West State Street near the Borough limits (Avon Mohr). Development potential throughout the Borough is limited due to the existing structures and natural constraints associated with available open land. Significant growth is not likely to occur within the Borough. The exception may be construction of an apartment complex or some other high density low land use facility.

At the present time, it is unknown what types of land development projects will be proposed for the remaining parcels of open land within the half mile square area that makes up the Borough. The term "unknown" has been utilized here because the Borough has not received any land development proposals (including sketch plans) for any properties within its borders since the sewer connection moratorium was instituted. None of these inquiries have advanced to sketch plan stage, and therefore, it is difficult for the Borough to project with any great accuracy how specific parcels of developed, undeveloped, or potentially redevelopable land will be utilized. Since the moratorium on sewer connections was implemented, the Borough has received numerous inquiries for mostly residential uses, and there have also been requests for commercial and light

industrial uses as well. It does not appear that any of the proposed land uses would contradict the existing zoning requirements.

b. New Garden Township

The zoning districts in New Garden that are or could be in the future served by either the Railroad Line or the Route 41 Line include portions of the R-1 District (Residential District), H/C District (Highway/Commercial District), C/I District (Commercial/Industrial District), the C/I-2 District (Commercial/Industrial Limited District) and the U/D District (Unified Development District). A copy of the New Garden Zoning Map is included as Appendix 18.

R-1 District (Residential District)

Provide for residential development at a density that maintains a rural, open character and continues to rely upon on-site facilities. Allow opportunities for flexibility in design through the use of lot averaging and clustering provisions. Provide for adequate housing opportunities by allowing a variety of housing choices. Encourage the preservation of agricultural land and open space through clustering and other design options.

H/C District (Highway/Commercial District)

Provide opportunities for the development of convenient, well planned office and retail centers within the Township. Ensure compatibility with existing and future development

C/I District (Commercial/Industrial District)

Designate an area within the Township for modern, well-planned commercial and industrial uses. Promote land use compatibility with existing commercial and industrial development.

Accommodate future commercial and industrial uses in an area suitable for such development.

C/I-2 District (Commercial/Industrial Limited District)

Encourage uses that are compatible with existing commercial and industrial uses and the general character of the district. Promote a unified approach to development in order to better coordinate uses in the district. Ensure the safety and well being of the community through the proper regulation of commercial and industrial activities.

U/D District (Unified Development District)

Provide for unified land planning which maintains the efficiency of the circulation system and limits the number of direct access points to arterial roads within the Township. Establish access management for the Limestone Road and PA Route 41 corridors. Conserve environmental resources which are sensitive to development. Encourage the retention of permanent open space within a master plan for development. Provide an opportunity for campus-type development which requires a tract size larger than what typically serves individual uses.

Published population projections and housing construction projections are not available for the limited segment of the Township which is the focus of this plan. The data that is available is for New Garden as a whole.

PLANNING IMPLICATIONS OF EXISTING LAND USE

The area surrounding the Railroad Line is primarily the western section of Toughkenamon and the Old Baltimore Pike corridor west of Toughkenamon. The majority of Toughkenamon and the area south of Toughkenamon along Newark Road is or will be in the future served by the East End Facility and not by Avondale.

The result is that relatively small sections of R-1 zoned property and H/C zoned property are possible candidates to be served by public sewers extending from the Railroad Line.

Within this potential development area are numerous natural features constraints that limit development. In addition, the parcels of land are relatively small, just a few acres, except for one large tract which is held in a trust. Consequently, the projected new sewage flow from this area over the next five and ten years is minimal. Based on zoning, natural features, lot size, environmental constraints and other development limitations, the projected new sewage flow from this area of New Garden is approximately 19,798 gpd.

The area surrounding the Route 41 Line is oriented toward commercial growth since Route 41 is a major transportation corridor running through the Township. Residential development has and will continue to be oriented outside the commercial corridor and be serviced by individual on-lot systems or in the future possibly by community systems or a new municipal system. The New Garden Township building and park are located along Route 41 and occupy a significant amount of land thereby eliminating it from development. There is also a church located along Route 41 that owns a large tract of land on which a small school might be built in ten years or so. The former Hewlett-Packard site is one remaining area that holds significant development potential and for which sewage capacity is already reserved. There is also a large tract that is under agreement of sale to the Kennett Consolidated School District that is to be developed in two or three phases over a period of years. Based on zoning, natural features, lot size, environmental constraints and other development limitations, the projected new sewage flow from this area of New Garden is approximately 101,095 gpd.

3. **Future growth areas with population and EDU projections for these areas using historical, current and future population figures and projections of the municipality. Discuss and evaluate discrepancies between local, county, state and federal projections as they relate to sewage facilities.**

a. **Avondale Borough Projections**

As noted earlier, Avondale Borough has a current population of 1,031 persons, based on 1997 Borough records. Population projections for the Borough, as compiled by the Chester County Planning Commission, are presented below:

Year	Population
1990	954
1991	980
1992	1,010
1993	1,030
1994	1,070
1995	1,090
1996	1,120
2000	1,150

The projections compiled by the Chester County Planning Commission are probably too optimistic with regard to the Borough's near-term population. It is unlikely that the Borough will gain 119 people in one year to meet the project for 2000, especially without the addition of more housing units. In light of this, it appears that a more reasonable population project would be:

Year	Population
1999	1,040
2000	1,050
2005	1,150
2010	1,200
2020	1,240

The above projections take into account available land for development, as well as the projected revitalization of vacant property within the Borough. The Borough should be able to adequately manage and accommodate this level of growth without suffering significant consequences. This is in contrast to areas where the population has exploded and the municipality was unable to avoid the serious adverse consequences. Moreover, the Borough's population has already been as high as 1,127 (in 1970), which shows that existing infrastructure can meet the needs of the projected population.

EDU Projections

It was previously noted that the Borough has ceased to accept reservations for sewage capacity at the wastewater treatment facility since the implementation of the connection ban. It should also be noted that the Borough does not presently hold any sewer reservation fees for the purchase of future available capacity. However, it has maintained an "unofficial" list of property owners that would like to purchase capacity when it becomes available. The Borough's position is that this list is probably a more accurate tool for projecting residential future sewage flows than the standard

method of assuming a number of EDUs per acre based on the allowed use per the current zoning. It is unclear how existing commercial and light industrial parcels will be developed, as well as what potential sewage capacity may be warranted. Therefore, it will be assumed that 2.5 EDUs per acre will be required. Proceeding with this methodology, following are the Borough's EDU projections for future connections:

- Existing Allocation Summary

Total Allocation at Treatment Facility	362 EDUs
Total Connected EDUs as of 10-31-98	394 EDUs
Available EDUs from Existing Allocation	0 EDUs

- Projected Future Allocation Needs

Part 1 – Calculate Capacity Required for New Connections within Avondale Borough

The projected number of new connections for the Borough has been calculated as follows:

Residential	102 EDUs
Commercial	11 EDUs
Light Industrial	8 EDUs
Total	121 EDUs

The flow value for future EDUs to be connected to the STP is 275 gpd. Therefore, the flow to be generated by these future connections is:

121 EDUs x 275 gpd per EDU = 33,275 gallons

Part 2 – Calculate New Capacity Required to Replace the Portion of New Garden Township's Capacity that is being Utilized by Avondale Borough

Background information:

1. Existing New Garden Township (NGT) Capacity Allocation = 173,250 gpd

2. Existing Avondale Capacity = 126,750 gpd

3. Avondale has been, and still is using capacity at the treatment plant beyond its current allocation of 127,050 gpd. Within the proposed expansion of the plant, it will be necessary to "make NGT whole," that is to provide enough capacity to ensure that NGT is fully able to utilize its allocation of 172,950 gpd. To accomplish this, it will be necessary to analyze the Borough's flow since the completion of the I/I project to determine how much beyond its allocation its present flows are.

Replacement Flow Calculations

Month	Total Flow from Avondale Borough	Average Daily Flow	Average Amount Above Flow* Allocation of 127,050 gpd
Jun 98	6,671,820 gals.	222,394 gpd	95,344 gpd
July 98	6,285,480 gals.	202,757 gpd	75,707 gpd
Aug 98	5,583,040 gals.	180,098 gpd	53,048 gpd
Sept 98	4,919,530 gals.	163,984 gpd	36,934 gpd
Oct 98	5,272,130 gals.	170,069 gpd	43,019 gpd
Nov 98	4,856,570 gals.	161,886 gpd	34,836 gpd
		Total	338,888
		Average (Total/6)	56,481 gpd

*The average amount above the flow allocation is the average daily flow minus 126,750 gals.

The fourth column of the above chart indicates that Avondale has used between 34,836 gpd and 95,344 gpd of NGTs capacity since June of 1998 when the I/I repairs were completed. The average of these capacity exceedances is 56,481 gpd.

It must be assumed that the capacity exceedance consists of additional I/I that has yet to be removed. If it is assumed that 30% of this amount can be removed (30% is the typical I/I capture rate that is sustainable), then a replacement flow allocation of approximately 40,000 gallons (70% of 56,481) must be incorporated into the expansion for NGT.

Therefore, the NGT allocation replacement component within the proposed plant expansion is

40,000 gpd. Note that the replacement component can be further reduced if more I/I than anticipated is removed from the collection system.

The connection of these proposed EDUs is solely dependent on the expansion of the wastewater treatment facility. It is anticipated that the bulk of the proposed EDUs would connect within 5-7 years of the completion of a project to expand treatment capacity. This would mirror the population increases that are projected for the Borough as a result of revitalization projects, and the development of remaining open land.

b. New Garden Township

The areas within New Garden that are being served by the Railroad Line and the Route 41 Line were described in a previous section of this plan. A summary description of future growth areas and potential connections was also provided.

It is very important to establish the analytical foundation upon which past, present and future flows are being evaluated. In this section an analysis of future capacity needs will be presented based on a number of factors which will be explained.

Historical Data:

Route 41 Line Average Daily Flow

1994	25,831 gpd	
1995	33,396 gpd	
1996	35,425 gpd	
1997	30,724 gpd	
1998	31,010 gpd	1/1/98 through 8/21/98; see Appendix 17

The mean value for the years shown above is 31,277 gpd with a standard deviation of 3,596 gpd. Since a moratorium has been in place since well before 1994 and only a very few connections have been removed and replaced by others, coupled with the fact the Route 41 Line is a force main, suggests the variations shown above are of little significance both practically and statistically.

Railroad Line Average Daily Flow

1994	97,752 gpd	
1995	81,886 gpd	
1996	157,217 gpd	
1997	104,993 gpd	
1998	99,793 gpd	1/1/98 through 8/21/98; see Appendix 17

The mean value for the years shown above is 108,328 gpd with a standard deviation of 28,658 gpd. Obviously, during 1996 something of significance occurred which remains somewhat of a mystery. Because of the abnormal flow observed in 1996, efforts were made to address what appeared to be excessive I & I problems. During 1996 a total of 11 manholes were reconstructed, 4 manholes were reset and 10 manholes were raised. In 1998, 9 additional manholes were raised. The data suggests these efforts paid a dividend in that the 1997 flow was significantly reduced.

If one were to disregard the 1996 flows, the mean value for the remaining years is 96,106 gpd with a standard deviation of 9,958 gpd. If these results are compared to all years including 1996 as stated above, it appears that a significant amount of I & I was eliminated from the system as a result of the work done in 1996. Further, since a moratorium has been in place since well before 1994 and only a very few connections have been removed and replaced by others (certainly none of significant flow) would suggest the per connection flow has remained relatively constant as well.

Present Data:

Route 41 Line

1998 29,604 gpd From 8/21/98 to 12/25/98; see Appendix 17

Since no changes of significance have occurred with respect to the Route 41 Line customer base, the present flow is not significantly different than earlier flows.

Railroad Line

1998 22,753 gpd From 8/21/98 to 12/25/98; see Appendix 17

The present flow reflects the result of having shifted flow from Avondale to the East End facility.

The data in Appendix 17 clearly establish that 77,040 gpd of flow on average has been removed from Avondale and is now being treated at the East End facility. Data will continue to be collected and analyzed in order to closely monitor flows as replacement connections are made.

It is important to note that Avondale and New Garden have established an understanding that new connections are to be made to the system on a replacement flow basis equal to the 77,040 gpd which was removed from the Avondale system until such time as additional capacity is made available.

Again, looking at the data contained in Appendix 17, one finds the total gallons per day processed at the Avondale facility was 389,618 for the 233 day period before flow was diverted to the East End and it has been 218,627 for the 126 day period since flow was diverted.

Similarly, the total gallons per day processed at the Avondale facility from New Garden was 130,803 for the 233 day period before flow was diverted to the East End and it has been 52,357 for the 126 day period since flow was diverted.

Further, the total gallons per day processed at the Avondale facility from Avondale was 258,815 for the 233 day period before flow was diverted to the East End and it has been 166,270 for the 126 day period since flow was diverted. Since the flow diversion does not have an impact on the flow originating in Avondale, the data suggests that 92,545 gpd has been eliminated from the system as a result of the I & I remediation efforts undertaken by Avondale coupled with the presumed low water table throughout the area.

Finally, again referring to Appendix 17, New Garden is currently using only 24 % of its purchased and owned capacity in the Avondale facility while Avondale is using 131.2 % of its purchased and owned capacity. This point becomes particularly significant when projecting future capacity needs for New Garden.

Future Projections:

Capacity purchased and owned by New Garden in the Avondale facility	173,250 gpd
Current Railroad Line use	22,753 gpd
Current Route 41 Line use	29,604 gpd
Available for use before allocations	120,893 gpd

Capacity purchased and reserved for the Hewlett-Packard property (60x350)	21,000 gpd
Capacity projected for the new school (1600x25)	40,000 gpd
Capacity for projects on the waiting list (143x350)	50,050 gpd
Available for use after allocations (28x350)	9,843 gpd

The 350 shown above represents 350 gpd per EDU which is contained in the Agreement between Avondale and New Garden. The 25 shown above represents 25 gpd per pupil. Both values are significantly higher than figures currently used for estimating purposes.

- If one adjusts the values above to reflect currently used estimates then the following results are derived.

Available for use before allocations	120,893 gpd
Capacity purchased and reserved for the Hewlett-Packard property (60x250)	15,000 gpd
Capacity projected for the new school (1600x15)	24,000 gpd
Capacity for projects on the waiting list (143x250)	35,750 gpd
Available for use after allocations (185x250)	46,143 gpd

- If one adjusts the values above to reflect the average New Garden flows discussed in another section of this plan then the following results are derived.

Available for use before allocations	120,893 gpd

Capacity purchased and reserved for the Hewlett-Packard property (60x300)	18,000 gpd
Capacity projected for the new school (1600x15)	24,000 gpd
Capacity for projects on the waiting list (143x300)	42,900 gpd
Available for use after allocations (120x300)	35,993 gpd

- If one adjusts the values above to reflect average flows used by Avondale as discussed in another section of this plan then the following results are derived.

Available for use before allocations	120,893 gpd
Capacity purchased and reserved for the Hewlett-Packard property (60x275)	16,500 gpd
Capacity projected for the new school (1600x15)	24,000 gpd
Capacity for projects on the waiting list (143x275)	39,325 gpd
Available for use after allocations (149x275)	41,068 gpd

Based on the calculations above, the remaining capacity available for unidentified uses (after allocations) ranges from 9,843 gpd to 35,993 gpd to 41,068 gpd to 46,143 gpd.

For purposes of this section of the plan, a value of 300 gpd, which is typical of other New Garden flow being processed by Avondale, has been selected. The result, therefore, is that 35,993 gpd or 120 EDU's remain for allocation to as yet unidentified uses. This capacity is in addition to what is available and identified for specific uses.

Based on the analysis above, there are certain issues which become very clear.

1. Avondale must provide enough new capacity to meet its growth projections **plus the equivalent of what it is currently using of the New Garden purchased and owned capacity (40,000 gpd).**

2. New Garden currently owns enough capacity to provide for certain identified future uses to include projects on the waiting list.

3. Does New Garden need new capacity above the 173,250 gpd that it already owns and is partially using keeping mind that most projects on the waiting list have not given a positive response to New Garden's recent inquiry about their respective willingness to step up and purchase the capacity that is now available?

The members of the Board of Supervisors and Sewer Authority do not feel there is a compelling need now to request new capacity above the current 173,250 gpd purchased and owned by New Garden. Keeping in mind, however, that Avondale must undertake an expansion for its own needs, the Board of Supervisors and Sewer Authority are willing to discuss purchasing new capacity in the range of 45,000 gpd if such capacity can be purchased at a reasonable price.

c. Summary of Projections

Avondale Borough will require 121 EDUs, or 33,275 gpd of additional treatment capacity to meet its future needs based on anticipated development activity. In addition, 40,000 gallons, or 145 EDUs, must be provided as replacement flow for New Garden Township. New Garden Township has indicated that it will purchase 45,000 gpd or 164 EDUs. A final tabulation of flow projections is noted below:

Existing Facility Capacity	300,000 gpd (857 EDUs)
Existing Avondale Borough Allocation	126,750 gpd (363 EDUs)
Existing New Garden Township Allocation	173,250 gpd (494 EDUs)
TOTAL	300,000 gpd (857 EDUs)
Projected Avondale Borough Additional Allocation	33,275 gpd (121 EDUs)
New Garden Township Replacement Allocation	40,000 gpd (124 EDUs)
Projected New Garden Township Additional Allocation	45,000 gpd (164 EDUs)
TOTAL ADDITIONAL ALLOCATION	118,275 gpd (408 EDUs)
New Wastewater Treatment Facility Capacity	418,275 gpd

In order to meet the projected need for new sewer connections, the wastewater treatment facility will have to be expanded to treat an average annual flow of 418,275 gpd. Options for meeting this requirement are outlined in Section V of this study. For the purposes of completing a preliminary design for this Act 537 Plan Study, the hydraulic capacity for the expanded facility will be assumed at 420,000 gpd.

4. **Zoning and/or subdivision regulations; local county or regional comprehensive plans; and existing plans of a Commonwealth agency relating to the development, use, and protection of land and water resources with special attention to:**

Public ground/surface water supplies
Recreational water use
Groundwater recharge areas
Industrial water use
Wetlands

The protection of land and water resources is controlled in Avondale Borough through the Zoning and Subdivision ordinances. These ordinances are in general agreement of the goals set forward in the

"Chester County Comprehensive Plan, as well as Landscapes, the County's Comprehensive Plan Policy Element.

The Chester County Comprehensive Plan sets down one objective for general land use as:

"Direct new development to areas adjacent to existing development, with adequate sewer, water and transportation capacities"

Other pertinent goals are:

- To develop a coordinated land use pattern which provides a variety of uses, recognizes land capacity and respect natural features
- To protect conserve and preserve the open spaces, drainageways, floodplains and other natural resources of the region
- To preserve agricultural areas for the agricultural use and maintain its importance in the local and regional economy
- To provide residential and nonresidential growth in appropriate areas so as to avoid the problems of random development
- To maintain and improve a healthful residential environment with adequate recreational , commercial and industrial supporting areas

Areas that stand out for protection are the areas adjoining the watercourses within the Borough, White Clay Creek, Indian Run, and Trout Run. In addition to containing 100-year floodplains, hydric soils, wetlands, the high yield aquifer, and linear features, these areas have a high probability for the presence of prehistoric archaeological sites and prime agricultural soils.

Another area of major concern is the area north of Old Baltimore Pike and east of Church Street, which contains the only significant wooded area within the Borough and is also the only extensive area of steep slope within the Borough.

Areas of the Borough which do not contain a combination of sensitive environmental areas include the small areas of steep slope along the western Borough line and north of Old Baltimore Pike and the historic sites, scenic vistas, and scenic Pennsylvania Avenue corridor identified on the Scenic, Historic and Cultural Resources Map. Pennsylvania Avenue from the northern Borough line to West State Street is of particular importance to the Borough, being lined by attractive mature trees and attractive buildings. Eight historic sites have been identified along this portion of Pennsylvania Avenue.

Remaining areas of prime agricultural soils will not be considered as a resource to be protected because the Borough has very limited developable land outside the stream corridors, is served by public sewer and water, and has a nucleus of community facilities and existing development. This is reflected in the designation for most of the Borough in the Land Use Plan for Chester County as Activity Area.

The Protected Municipal Lands Map in Appendix 8 indicates land that is permanently protected from encroachments which could effect environmentally sensitive areas. Within the Borough these include the Borough-owned tracts, including the Borough park along the White Clay Creek, the Borough sewage treatment plant site along the Indian Run, the Borough property across the Indian Run Road from the sewage treatment plant site, and the Borough Hall and Borough property along Pomeroy Avenue and the railroad tracks. There are no conservation easements, Agricultural Security Areas, nor registered historic districts within the Borough. The Borough park and properties along Indian Run Road do afford some protection to the White Clay Creek and Indian Run stream corridors.

In summary, the areas containing the most sensitive environmental areas within the Borough are the stream corridors and the wooded steep slope in the eastern portion of the Borough, and these are the areas the Borough will most concerned with trying to protect from disturbance. Another area of major concern is Pennsylvania Avenue from the northern Borough line to West State Street because of the trees, historic buildings, and other attractive buildings along the road. Also of concern are the small areas of steep slope along the western Borough boundary and the scenic vistas and additional historic sites identified within the Borough. All of these resources are protected through the Zoning and Subdivision and Land Development Ordinances.

Needs Assessment

Water Resources Protection

On the Water Resources Map found in Appendix 4, 100-year floodplains, hydric soils, wetlands, the high yield aquifer, and linear features have been identified. These resources are all found within the corridors of the White Clay Creek, Indian Run and Trout Run. The areas of high yield aquifer cover a large portion of the Borough, and are also found outside the stream corridors. The high yield aquifer (Cockeysville Marble) is an area of potential water supply, but also an area in which the groundwater is particularly vulnerable to pollution.

A major goal of the Borough is to protect the quantity and quality of surface and groundwater within the Borough by protecting the water resources within the Borough.

Floodplains are an important resource because they serve as areas where groundwater and surface water supplies can be recharged by the absorption of water. Protecting floodplains from development can decrease flood peaks and storm water runoff and protect stream banks and channels. Persons and property within floodplains are subject to potential harm from flooding.

Wetlands serve as buffer areas for streams, breeding places for organisms, sources of food for organisms, and animal habitats. In addition, they serve to replenish and to protect groundwater and surface water supplies by absorbing water. The hydric soils are areas that have not been identified as wetlands, but are potential wetlands. The linear features (fractures) are areas of potential water supply and areas where the groundwater is particularly susceptible to pollution.

In order to protect the quantity and quality of surface and groundwater, the Borough will try to preserve the water resources contributing to ground and surface water supplies and quality. Because the hydric soils, wetlands, floodplains, fractures, and portions of the high yield aquifer are found along the watercourses, if the stream corridors are preserved from development the Borough's goal can in large be accomplished. Ways of protecting the stream corridors are through designation of the corridors for preservation and the establishment of buffers along the streams through preservation of hydric soils, wetlands, and floodplains.

The high yield aquifer (Cockeysville Marble) is an area where groundwater resources can be polluted. Portions of the formation can be preserved via preservation of the stream corridors within the Borough. If development would occur in portions of the Cockeysville Marble outside the stream corridors, safeguards to prevent pollution of the groundwater have been established. This includes requiring developer recognition and study of the carbonate areas and having certain protective procedures and standards applicable to the area.

Land Resources Protection

A major objective of the Borough is to protect important soils and topographic features. This goal has been accomplished by preserving the steep slopes within the Borough.

Development of slopes greater than 15% can result in erosion and sedimentation and storm water runoff problems. Vegetation on the slopes should be maintained to minimize erosion. Conservation of steep slopes which are wooded can also provide highly visible greenways which maintain a perceived open space character. The one large area of steep slope within the Borough, which also happens to be wooded, is found between Old Baltimore Pike and Church Street.

Biotic Resources Protection

A major objective of the Borough is to protect biotic resources within the Borough, specifically the significant wooded area between Old Baltimore Pike and Church Street. By protecting wooded areas, a scenic resource can be preserved. Woodlands also function as wildlife habitats and, particularly on steep slopes, means of preserving soils and preventing erosion. Woodlands can hold rainfall in the soil and thus help maintain groundwater reserves.

Scenic, Historic, and Cultural Resources Protection

A major objective of the Borough is to preserve scenic, historic and cultural resources, including areas of high probability for the presence of prehistoric archaeological sites, scenic vistas, the scenic Pennsylvania Avenue, and historic sites.

Areas of high probability for the presence of prehistoric archaeological sites are generally found in the stream corridors in the Borough. The scenic vistas are found at the northern end of Pennsylvania Avenue, at

Indian Run on West State Street looking towards the farmstead in the western portion of the Borough, looking out from the high point in the vicinity of Cook Court and Miller Drive, looking toward the White Clay Creek from Church Street in the northeast portion of the Borough, and looking out to the west from Ellicott Avenue in the southern portion of the Borough. Historic sites are found scattered throughout the Borough, but are concentrated in the area extending from New Street to the area of the railroad tracks and from West State Street and First Avenue to the northern Borough boundary. The archaeological, scenic and historic resources are important to the understanding of the history and heritage of the Borough, to the preservation of unique features which made the Borough special to residents of the Borough, and to providing for pleasing experiences for Borough residents.

Evaluation of Needs

Land Use Plan, Chester County

In the Future Land Use 2010 Plan contained within the Land Use Plan, Chester County, Pennsylvania, adopted by Chester County in 1988, White Clay Creek and Indian Run were designated Stream Valley Greenways, which are areas following major streams and their larger tributaries, and include adjacent land along the watercourse. Designation as Stream Valley Greenways is consistent with preserving the sensitive environmental resources along the creeks. The stated policy for the Greenways was to restrict development along streams to protect those vulnerable natural resources, preserve open space and provide for a continuous stream valley system. The Trout Run was not designated Stream Valley Greenway.

The northeast corner of the Borough was designated Employment Center. Employment Centers are areas with a high concentration of businesses such as an industrial or office park, and contain only limited support retail uses and few or no residential uses. This Employment Center area is a small portion of an employment center extending through London Grove

and New Garden Townships. Existing land use in this portion of the Borough is generally one family residential, with two churches, and contains some areas of high probability for the presence of prehistoric archaeological sites, floodplain, hydric soil and high yield aquifer.

The portion of the Borough west of Indian Run-White Clay Creek is designated Development Reserve. The County describes these areas as areas which are largely undeveloped at the present time, but are anticipated to evolve to the Suburban Development areas in the future. These are the most appropriate areas for concentrated residential development that cannot be accommodated in the Suburban Development areas. The stated policy was to expand future residential development into the development reserve areas and to expand future residential development into those areas as additional land is needed to accommodate development. In accomplishing the expansion, the strategies indicated include, among others:

- encourage historic preservation to protect historic sites as part of development activity

- protect stream headwater areas, where not yet developed, from intensive development to preserve surface water quantity and quality

- acquire and develop community parks in the areas identified in the County Open Space and Recreation Study

- preserve natural areas, such as woodlands, floodplains and wetlands for the many environmental benefits they provide.

A portion of the Development Reserve Area in the southwest corner of the Borough has been developed. The remainder of the Development Reserve Area is used for agricultural purposes. The historic farmstead north of West State Street, which includes an area of steep slope and is one of the

scenic areas of the Borough, is included within the Development Reserve Area.

The remainder of the Borough, and the majority of the Borough, is designated Activity Area, Local Center. The Activity Areas are multi-purpose centers characterized by concentrations of commercial activity, employment areas, institutional uses, and residential uses, including a variety of housing types. These areas have high volumes of traffic. They are the most dense, more urban areas of the County. Avondale is designated Local Center, as opposed to a Regional Center.

Much of the Activity Center area, except for the agricultural land west of White Clay Creek and north of Third Avenue, the agricultural land in the southern portion of the Borough, and portions of the wooded slope in the eastern portion of the Borough, are already developed. Resources within the Activity Area include the wooded slope in the eastern portion of the Borough, scenic and historic Pennsylvania Avenue, a number of historic resources, a scenic vista in the southern portion of the Borough, the Trout Run stream corridor, and areas of the high yield aquifer.

Previously, we identified the stream corridors within the Borough as environmentally sensitive areas and indicated a goal of the Borough will be to protect the quantity and quality of surface and groundwater. The County plan is consistent with this with regard to the White Clay Creek and Indian Run stream corridors, given the designation of Stream Valley Greenways for White Clay Creek and Indian Run.

The Trout Run corridor, which is also of concern to the Borough, has not been designated Stream Valley Greenway, most likely because the Trout Run does not have a long length.

The wooded slope in the eastern portion of the Borough is also of concern to the Borough. Protection of this area has not been indicated in the County report, which designates the area as Activity Area.

The high yield aquifer, Cockeysville Marble, is also of concern to the Borough. Portions of the aquifer are located in the White Clay Creek and Indian Run stream corridors. The remaining portions of the aquifer are designated Activity Area, Employment Center, and Development Reserve.

Pennsylvania Avenue and most of the historic resources within the Borough are designated Activity Area.

The scenic farmstead and areas of steep slope within the western portion of the Borough are designated Development Reserve, which indicates that they are anticipated for eventual development.

5. **Sewage planning to provide adequate wastewater treatment for the municipality. This planning must be related to both the five and ten year future planning periods and be based on growth impacts on existing and proposed wastewater collection treatment facilities.**

As noted earlier in this section, it will be necessary to expand the Borough's wastewater treatment facility to a capacity of 0.418 mgd to accommodate future growth within the Borough and New Garden Township. This Act 537 Plan addresses all relative sewage planning as related to both the five and ten year future planning periods for the respective municipalities.

V. IDENTIFY ALTERNATIVES TO PROVIDE NEW OR IMPROVED WASTE-WATER DISPOSAL FACILITIES

The Borough of Avondale faces challenges regarding sewage disposal. The specific issues include the following:

1. The WWTP is rated for 0.300 mgd. Over the past five years the WWTP has seen average monthly and average annual flows greater than 0.300 mgd. This has resulted in effluent violations of their NPDES permit for parameters to include flow and Total Suspended Solids (TSS). Please note that the violations are based on the mass limit. The effluent concentrations are typically within the permit requirements.

2. Although the Borough is significantly built out, there is the potential for 161 new connections. It is anticipated that 75% of possible connections will actually hook-up. Based on these projections, it is estimated that 121 new connections will be made in the Borough. Assuming 275 gpd/EDU, the additional calculated flow from the new connections will be 33,275 gpd.

   New Garden Township is anticipating an increase in flow discharged to the Avondale WWTP. The projected increase is 45,000 gpd. In addition, the Borough of Avondale has been utilizing a portion of New Garden Township's capacity. This capacity will have to be returned to New Garden Township. The returned capacity will be approximately 40,000 gpd.

   The additional flow to the plant is calculated to be:

121 New Connections	=	33,275 gpd
Flow from New Garden Township	=	45,000 gpd
Returned Capacity	=	40,000 gpd
		118,275 gpd

   Therefore, the WWTP will need capacity to treat:

Existing Flow	-	300,000 gpd
Additional Projected Flow	-	118,275 gpd
		418,275 gpd

3. Some of the treatment units limit the capacity of the plant. Included in Appendix 9 is a capacity report outlining the specific shortfalls of each piece of equipment. The report recommends modifications to specific treatment units to increase the capacity of the WWTP.

   Please note that the calculations done in the "Capacity Report" were done to verify capabilities under existing conditions. The calculations done in this document are for facilities required to handle future conditions. In order to meet these conditions, conservative numbers for loading values were used. These numbers differ from those in the "Capacity Report".

4. Included in Appendix 10 is a copy of the Toxics Reduction Evaluation. The evaluation documented the presence of Diazinon in the influent of the WWTP. However, since the data was collected in 1993-1995, the influent characteristics have changed. Over the last two years, Diazinon has not been detected in the influent or the effluent of the facility. Modifications to the WWTP for the purposes of handling Diazinon are not being considered at this time.

Action is required to resolve these items. New wastewater disposal methods appear to be the most logical solution.

A. Conventional Collection, Conveyance, Treatment, and Discharge Alternatives

1. The potential for regional wastewater treatment.

   The Avondale WWTP currently serves as the regional WWTP for the Borough of Avondale and portions of New Garden Township. This plan maintains the WWTP current status as regional wastewater facility. There

is no economic or operational reason to create a new facility or alter any of the existing relationships.

2. The potential for extension of existing municipal or nonmunicipal sewage facilities to areas in need of new or improved sewage facilities.

The Borough contains isolated "patches" of undeveloped land within its borders that could eventually be developed within the constraints of the existing Zoning and Subdivision and Land Development Ordinances. Other undeveloped lands will remain in that condition due to restrictions based on floodplain or steep slope proximity. Aside from these small areas, the Borough is essentially "built out", notwithstanding the redevelopment of vacant properties within the various zoning districts.

The purpose of this plan is to increase the WWTP capacity. This will afford new connections for undeveloped and redeveloped properties, in addition to providing a buffer against inflow and infiltration in the future. In addition, the increased capacity will allow New Garden Township to offer service to those residents of New Garden that need it.

The increased flow due to the extensions in the Borough of Avondale and New Garden Township is estimated to be 118,275 gpd.

3. The potential for the continued use of existing municipal sewage facilities through one or more of the following:

a. Repair

The existing WWTP equipment is in satisfactory working condition. The problems facing the WWTP lie in the capacity of the individual units. The "Capacity Report" in Appendix 9 outlines those units that need to be upgraded.

b. Upgrading

The average flow seen at the WWTP is now below 0.300 mgd.

The past average flow was significantly higher. A large portion of the hydraulic load at the plant was I/I. Appendix 11 contains an I/I report that illustrates the load due to I/I and recommends methods to relieve the I/I. Over the last year the Borough has taken several actions to reduce the I/I. Due to these actions the recent flows have been reduced. In addition, New Garden Township has removed approximately 77,000 gpd of flow from the Avondale WWTP by sending it to another regional facility. The reduction of I/I and the diversion of flow by New Garden has lowered the average flow to below 0.300 mgd.

Even though the flows are now averaging below the permitted capacity of 0.300 mgd, several of the process units still need to be upgraded. Based on current PA DEP standards ("Domestic Wastewater Facilities Manual", DER #1357-8/91) the listed process units (see Appendix 9) do not have the capacity to treat 0.300 mgd or the projected flow of 0.418 mgd.

Process units at the WWTP will have to be upgraded. The Capacity Report in Appendix 9 outlines the limits of each unit. The following is a list of those units that need to be upgraded:

Clarifiers
Aeration Tanks
Chlorine Contact Tank

The capacity of all of the units was measured against PA DEP requirements using peaking factors applied to the hydraulic and organic loading. These peaking factors were created using historical data from the WWTP. These peaking factors will be used in this planning document. For a full explanation of the peaking factors see Appendix 9.

As shown in the "Capacity Report", there are other process units that do not meet the PaDEP requirements. However, this is based

on a desktop evaluation and does not consider any operational data. Many of the process units have performed beyond the criteria listed in the PaDEP manual for sewage facilities design. These units include:

Aerobic Digester
RAS Pumps
Raw Sewage Pumps

No upgrades are planned for these units for the following reasons:

Aerobic Digester - Although the digestion facilities do not meet the PaDEP criteria, they are sufficient for the needs of the WWTP. No sludge is completely stabilized on site. Sludge is stored in the digesters, then hauled to a sludge handling facility. There is sufficient storage at the WWTP to handle sludge generated from a flow of 0.418 mgd.

This practice has been incorporated into the operations contract of the WWTP. The current operations contract is in the second year of a 10 year term. Therefore, no digestion capacity is needed at the WWTP for at least the next eight (8) years.

RAS and Raw Sewage Pumps - The RAS and raw sewage pumps have demonstrated their ability to handle flow conditions well beyond their design points. Before any large scale modifications are done to the pumps, they will be tested. The tests performed will include a flow and horsepower verification. This will enable Avondale to determine if new pumps or impellers are required. There is no operational or economic reason to modify the pumps at this time.

In order to raise the WWTP capacity to an annual average of 0.418 mgd, the clarifiers and the aeration tanks will need to be upgraded.

There are two alternatives to accomplish this. The following is a description of each alternative.

ALTERNATIVES TO INCREASE CAPACITY

The aeration tanks, the clarifiers and the CCT have to be modified to increase the WWTP capacity to 0.418 mgd. As shown in appendix 9, each one of these units is lacking capacity as compared to PA DEP requirements. The following is a list of the most limiting parameter for each unit based on the most relevant criteria.

UNIT	PA DEP Requirement	Equivalent Annual Average Flow Capacity
Aeration Tanks	Maximum CBOD loading of 20 lbs. per 1,000 cu. ft.	0.239 mgd
Clarifiers	Solids loading rate not to exceed 40 lbs./day/sf based on Average Flow	0.265 mgd
CCT	Maintain a 30 minute retention time at the Maximum Monthly Average Flow	0.249 mgd

As previously stated these are the relevant criteria limiting the capacity of the WWTP. These do not include some more limiting criteria as shown in appendix 9. The following list the other criteria shown in appendix 9 and the reasons they were not used to size the necessary modifications.

AERATION TANKS

The following information was taken from Table 2 in Appendix 9:

PA DEP Requirement	Equivalent Annual Average Flow	Reason(s) this criteria was not used to size modifications
Maintain hydraulic retention time of 12 hours at Maximum Monthly Average Flow	0.210 mgd	Many extended aeration facilities meet discharge criteria with less than a 12 hour hydraulic retention time at Maximum Monthly Average Flow. The current Avondale WWTP has met organic (CBOD and Ammonia) discharge criteria with less than a 12 hour hydraulic retention time. This criteria does not account for flow equalization. The Avondale WWTP has an 80,000 gallon equalization tank that allows it to function at higher flows.

CLARIFIERS

The following information was taken from Table 2 in Appendix 9:

PA DEP Requirement	Equivalent Annual Average Flow	Reason(s) this criteria was not used to size modifications
Solids loading rate not to exceed 50 lbs./day/sf based on Peak Hourly Flow	0.083 mgd	This criterion does not account for the positive affects attributable to equalization. The Avondale WWTP has an 80,000-gallon equalization tank. This dampens the importance of Peak Hourly Flow.
Surface overflow rate not to exceed 1,200 gpd/sf based on Peak Hourly Flow	0.133 mgd	This criterion does not account for the positive affects attributable to equalization. The Avondale WWTP has an 80,000-gallon equalization tank. This dampens the importance of Peak Hourly Flow.

CCT

The following information was taken from Table 2 in Appendix 9:

PA DEP Requirement	Equivalent Annual Average Flow	Reason(s) this criteria was not used to size modifications
Maintain a 15 minute retention time at Peak Hourly Flow	0.195 mgd	This criterion does not account for the positive affects attributable to equalization. The Avondale WWTP has an 80,000-gallon equalization tank. This dampens the importance of Peak Hourly Flow.

MODIFICATION SIZING

To increase the capacity of the WWTP to 0.418 mgd modifications are needed. Specifically the aeration tanks, clarifiers and CCT must be expanded. The following calculations size the modifications:

AERATION TANK MODIFICATIONS

The aeration tanks at the Avondale WWTP are limited by the influent CBOD loading. As shown previously, the PA DEP requirements limit the maximum CBOD loading to 20 lbs. per 1,000 cu. ft. of aeration tank. Assuming an influent CBOD concentration of 220 mg/l and an influent flow of 0.418 mgd the CBOD loading to the aeration tanks is:

220 mg/l * 0.418 mgd * 8.34 = 767 lbs CBOD/day

This would require an aeration volume of:

767 lbs CBOD/day ÷ 20 lbs CBOD/day/ 1,000 cu. ft. = 38,350 cu. ft.

The existing aeration tanks have a volume of approximately 22,000 cu. ft. The net required volume is:

38,350 cu. ft. - 22,000 cu. ft. = 16,350 cu. ft.

This is the additional aeration volume needed to increase the WWTP capacity to 0.418 mgd.

CLARIFIER MODIFICATIONS

The clarifiers at the Avondale WWTP are limited by a solids loading rate of 40 lbs/day/sf. Assuming a MLSS concentration of 3,500 mg/l the following calculations are used to size the clarifier surface area requirement:

Influent Flow: 0.418 mgd

Return Sludge Flow: 0.418 mgd

MLSS Concentration: 3,500 mg/l

Surface Loading Calculation

(0.418 mgd + 0.418 mgd) * 3,500 mg/l * 8.34 = 24,403 lbs. per day

Surface Area Requirement

24,403 lbs. per day ÷ 40 lbs/day/sf = 610 sf

The existing clarifiers have a combined surface area of 442 sf. Therefore, the net required surface area is:

610 sf - 442 sf = 168 sf

This is the required surface area needed to increase the WWTP capacity to 0.418 mgd.

CHLORINE CONTACT TANKS

The CCT are limited by their volume. The CCT must be able to provide 30 minutes retention time at Maximum Monthly Average Flow. The following calculation illustrates the required volume:

418,000gpd ÷1,440 min./day * 1.57 (Maximum Monthly Peaking Factor)* 30 min. = 13,672 gal.

The existing CCT has a volume of 8,140 gallons. The net required CCT volume is:

13,672 gal. - 8,140 gal. = 5,532 gallons

This is the required CCT volume needed to increase the WWTP capacity to 0.418 mgd.

CONVENTIONAL TREATMENT OPTIONS

There are two conventional treatment options to increase the capacity of the WWTP to 0.418 mgd.

The following is a discussion on both alternatives.

ALTERNATIVE 1-Addition of Above Ground Steel Package Plants

Under this alternative two (2) above ground steel package plant would be added to the treatment process. The capacity of each plant would be 0.060 mgd, for a total increase of 0.120 mgd. The units specified for this alternative would be large enough to meet and surpass the requirements previously calculated.

The package plants would be installed with aeration tanks, clarifiers, equalization tanks, CCTs and all of the necessary piping and accessories. The units would be constructed of bolted steel placed on a concrete foundation. The space requirement for each package plant is approximately 50' x 24' x 12' high. For planning purposes DAVCO package plants have been selected.

ALTERNATIVE 2-Addition of Above Ground Concrete Aeration Tanks with Circular Clarifiers and an extension of the CCT

Under this alternative two (2) above ground concrete aeration tanks would be added to the treatment process. Each aeration tanks would be equipped with two (2) surface aerators to transfer oxygen. Each tanks would be 30' x 20' x 14 high.

This alternative would also add two 15 foot diameter circular clarifiers. Each clarifier would be equipped with a sludge collector mechanism, bridging, RAS pumps and WAS pumps. These clarifiers would be run in parallel.

In addition to the aeration tanks and the clarifiers the CCT would be expanded under this alternative. The sides of the CCT would be extended approximately 4 feet. This would increase the volume of the CCT to approximately 13,500 gallons.

Please note that under both alternatives residual chlorine equipment and controls would be added to the CCT. This is being done to ensure that the residual chlorine concentrations meet the discharge criteria.

c. Reduction of hydraulic or organic loading to existing facilities.

The WWTP currently has no problems handling the organic loading from Avondale and New Garden. However, as mentioned previously, the WWTP processes a significant amount of I/I.

Several steps have been undertaken to minimize the I/I. The Borough contracted an I/I study which is included as part of this planning document in Appendix 11. The study located the sources of I/I and recommended actions to take to remediate the I/I.

Based on the I/I study the Borough contracted repairs on the collection system to seal it from I/I. The repairs were completed in the spring and summer of 1998. These actions have shown a significant decrease in the amount of I/I appearing at the WWTP.

In addition, the Borough has set up a program to repair more of the collection system on an annual basis. They have budgeted capital to do this. These general efforts should alleviate most of the problems at the WWTP due to I/I.

d. Improved operations and maintenance.

In 1996 the Borough turned over the operations of the WWTP to Miller Environmental Inc.. Miller Environmental is a professional operations company. Since they have operated the plant, operations, maintenance and effluent quality has significantly improved.

e. Other applicable actions that will resolve or abate the identified problems.

The major problems associated with the plant pertain to capacity. The actions listed previously are the most applicable actions that will resolve this problem.

B. **The use of individual sewage disposal systems including individual residential spray irrigation systems.**

Spray irrigation is a two step process used to treat sewage. Wastewater is collected and transported to a primary treatment system. The influent to the system is processed to remove organic content and insert solids. In addition the wastewater is disinfected prior to discharge. Typically the systems used for primary treatment are identical to those used in conventional wastewater treatment.

After the sewage is treated, it is pumped to a spray network. The treated effluent is sprayed over a field or forested area for absorption into the soil. The effluent receives additional treatment as it percolates through the soil and enters the groundwater.

Two types of spray irrigation systems could be considered for use within the Borough. One would be a comprehensive system that would spray all of the Borough's treated sewage. The second would be small individual systems that would be built to service newly developed land where feasible, while existing sewage flows would continue to be treated and discharged at the existing sewage treatment facility. Within an urban area such as the Borough, it would be extremely difficult to provide the necessary isolation distances to operate individual spray irrigation systems. The use of such treatment systems would also depend heavily upon the type of development that would occur on a vacant parcel, as this would dictate the amount of land that could be reserved for spraying, in addition to the installation of the treatment facilities. Since most of the remaining undeveloped land is zoned as residential, it is unlikely that any potential developer would sacrifice saleable land for use as a spray field. However, the Borough may consider such alternatives for implementation providing that issues such as safety; operation and maintenance; and, reliability are properly addressed by the land developer. There are no portions of the Borough that have been designated as mandatory spray irrigation areas within this plan.

The remaining spray irrigation alternative is to spray a portion, or all of the Borough's effluent. This alternative is not being considered for the following reasoans:

1. **Land Requirements** - Spray irrigation is a land intensive method of disposing of sewage. Assuming a wastewater flow of 120,000 gpd (10 year projection based on new EDUs from Avondale and New Garden) and an absorption rate of 1.0 inches/week/acre (typical value used for the soils types found in southern Chester county), the necessary land for disposal would total 30 acres. There is no area in the Borough that could contain all of the acreage required. This is especially pertinent when regional sewage treatment facilities exist.

2. **Cost** - Spray irrigation systems have increased in number over the last decade. Data has been collected on their cost of construction. The data shows that they are more expensive than conventional systems with the same capacity. General estimates show their construction cost in the order of $13 per gpd of capacity. Therefore for a 120,000 gpd system the construction cost would be $1.6 million.

   It is estimated that the land needed for the facility would total 35 acres including absorption area and facilities area. Typical fair market value for agricultural land in the area is approximately $9,000 per acre. The land acquisition costs would be $315,000.

   The estimated total cost for spray irrigation would be $1.9 million or $15.80 per gpd. This does not include the cost to add a new collection system or modify the existing. These prices are not consistent with the cost of about $10 per gpd to modify the existing facilities.

3. **Operations** - Spray irrigation systems cannot apply treated effluent to absorption areas over the entire year. Specifically during colder months, when the ground freezes, alternative disposal methods are required. The wastewater must then either be retained or sent to another facility for disposal. If a retention tank is used, it must be large enough to hold several days or even weeks worth of sewage. A tank this large would further increase the construction and land acquisition costs. If the sewage is sent to another facility, operations cost would increase.

For these reasons spray irrigation is not considered a viable alternative.

C. **The use of small flow sewage treatment facilities or package treatment facilities to serve individual homes or cluster of homes.**

This alternative requires the construction of several small treatment plants to service a flow of 0.120 mgd. It is estimated that two such facilities would need to be constructed to service the Borough of Avondale and New Garden Township. This alternative is not being considered for the following reasons:

1. **Operations and Maintenance** - These treatment facilities would require constant operations and maintenance. The Borough currently does not have the staff necessary to do this. There are no plans to increase the staff to levels necessary to do this in the future.

2. **Land Use** - This alternative would require the Borough to acquire multiple lots to construct these facilities. This is not an efficient use of land considering existing facilities exist. This is not compatible with the regional planning for the area.

3. **Existing Facilities** - There are existing facilities in the Borough that can service areas that need sewage disposal.

D. The use of community land disposal alternatives

This alternative is similar to the previous alternative. Treatment facilities are constructed to service larger numbers of EDUs. The treated sewage is discharged to either a larger drain field or larger sand mounds. This alternative would require the construction of multiple units to accommodate the entire Township. This Alternative is not being considered for the following reasons:

1. **Operations and Maintenance** - These treatment facilities would require constant operations and maintenance. The Borough currently does not have the staff necessary to do this. There are no plans to increase the staff to levels necessary to do this in the future.

2. **Land Use** - This alternative would require the Borough to acquire multiple lots to construct these facilities. This is not an efficient use of land considering wastewater facilities exist. This is not compatible with the regional planning for the area.

3. **Existing Facilities** - There are existing facilities in the Borough that can service areas that need sewage disposal.

For these reasons this alternative is not being considered at this time.

E. The use of retaining tank alternatives on a temporary or permanent basis.

Retaining tanks are installed subsurface to hold sewage. On a regular interval pumper trucks empty the tanks. This alternative would require the Township to install multiple tanks for large collection or single tanks to service individual users. This alternative is not being considered for the following reasons:

1. **Operating Costs** - It is estimated that Avondale and New Garden will generate 120,000 gpd of wastewater. The typical disposal and transportation costs for septage and wastewater is $0.05 per gallon. This would calculate to be an operating cost of $6,000 per day or approximately $2.2 million per year.

2. **Existing Facilities** – There are existing facilities in the Borough that can service areas that need sewage disposal.

3. **Management** – This alternative would require the Borough to add staff to manage proper disposal and insure the proper maintenance of the system. The Borough does not have staff nor is it planning to increase staff to manage a retaining tank alternative.

F. Sewage management programs to assure the future operation and maintenance of existing and proposed sewage facilities.

The Borough of Avondale does not have an existing sewage management plan. As noted earlier, there are only 10 homes within the Borough that are served by on-lot systems.

The need for a joint municipal sewage management program for both Avondale and New Garden is not required. With the expansion of the WWTP the Borough of Avondale will be nearly 100 percent sewered. New Garden has an independent sewer ordinance. Both municipalities retain jurisdiction over their residents and commercial interests. Both municipalities have no desire to share those jurisdictions.

G. **Nonstructural Comprehensive Planning Alternatives that can be undertaken to assist in meeting existing and future sewage disposal needs including:**

1. **Modification of existing comprehensive plans.**

The Borough of Avondale completed its comprehensive plan in 1993. The plan supports the Chester County Comprehensive Plan. Based on the Avondale Comprehensive Plan land use designations and ordinances have been modified. Specifically, the prime agricultural land in the Borough has been reclassified as residential.

Under the Chester County Comprehensive Plan the Borough is considered a suburban area. The Chester County Comprehensive Plan directs these areas to be revitalized. In order to comply with this revitalization directive Avondale has changed the prime agricultural land designation to residential. This change will allow for organized development within the borders of the Borough.

The Borough has recently made changes to their sewer ordinances. They have changed those ordinances dealing with industrial wastewater. These changes limit the quality of the wastewater industry discharges to the WWTP. Under the ordinance Industry must discharge wastewater with the same characteristics of domestic sewage.

This ordinance was created to deal with the Diazinon. Diazinon is a pesticide used by local mushroom growers. As the TRE (see Appendix 10) shows, the WWTP has been challenged to meet effluent requirements pertaining to Diazinon. Since the industrial wastewater ordinance was created Diazinon has not been seen in either the influent or effluent in any appreciable quantity.

H. A nonaction alternative which includes discussion of both short-term and long-term impacts on:

1. Water Quality/Public Health

The short-term impact of the no-action alternative on water quality/public health would be essentially the same as the current condition. That is, no new connections would be allowed to the sewage treatment plant.

The long-term impact would be that development within the Borough would be stifled.

2. **Growth potential (residential, commercial, industrial)**

The Borough of Avondale is predominantly built-out, but there remains properties for redevelopment. There remains a significant amount of homes that require sewage services. Also, with the reclassification of agricultural lands to residential, more growth can be expected. A no-action alternative would limit this growth.

3. **Community Economic conditions**

It is important to the Borough's economic condition to maintain a balance of residential, commercial, and industrial development. The no-action alternative could likely severely restrict such development.

4. **Recreational Opportunities**

There is no evident short-term or long-term impact on recreational opportunities by the no-action alternative.

5. **Drinking water sources**

It is reasonable to assume that the continued use of the remaining on-lot systems would negatively affect drinking water sources. Although the majority of the Borough is serviced by public water, the source of this water is local wells. On-lot systems may negatively affect this public water system.

6. Other environmental concerns

A no-action alternative will have little or no impact on other environmental concerns.

VI. EVALUATION OF ALTERNATIVES

A. Technically feasible alternatives identified in Section V of this checklist must be evaluated for consistency with respect to the following:

1. Applicable plans developed and approved under Sections 4 and 5 of the Clean Stream Law or Section 208 of the Clean Water Act.

The Avondale Borough wastewater treatment facility is the designated treatment facility for the identified service area within this Act 537 Plan Study. The decision to upgrade and expand the facility to accommodate additional growth within the service areas is consistent with the policy objectives of the Chester County Planning Commission as identified in the Chester County Comprehensive Plan. The proposed action also is consistent with the Department's policy regarding the minimization of the number of treatment facilities which discharge effluent directly to surface waters.

2. Municipal Wasteload Management Plans Developed Under PA Code, Title 25, Chapter 94.

Chapter 94 of the Rules and Regulations for the PA Department of Environmental Protection (DEP) concerns municipal wasteload management. As stated in the second section of the Chapter, its purpose is "..to require the owners and operators of sewage facilities to manage wasteloads discharged to the sewerage facilities in order to accomplish the following objectives: (1) prevent the occurrence of overload sewerage facilities; (2) limit additional extensions and connections to an overloaded sewer system or a sewer system tributary to an overloaded plant."

The expansion of the wastewater treatment facility will bring the Borough back into compliance with the Chapter 94 requirements, as the expansion will eliminate the hydraulic overload that has been experienced. The expansion will also allow the acceptance of current and future connections, while maintaining compliance with the NPDES permit conditions.

3. Plans Developed Under Title II of the Clean Water Act or Titles II and VI of the Water Quality Act of 1987

There is no Title II Clean Water Act or Titles II or VI Water Quality Act of 1987 plans that address Avondale Borough. the countywide 1970 plan (see Section I.A.1.) indicates very generally that Avondale Borough should be the regional treatment facility for its own sewage flows, as well as those from the New Garden Township service area.

4. Comprehensive Plans Developed Under the Pennsylvania Municipalities Planning Code.

Act 247, the Pennsylvania Municipalities Planning Code, is the state legislation which defines the authority of most Pennsylvania municipalities in the area of local planning and development regulation. The Planning code specifically empowers municipalities to create, adopt, and implement four different planning tools: the Comprehensive Plan; the Official Map; the Subdivision and Land Development Ordinance; and the Zoning Ordinance.

The Comprehensive Plan is not, strictly speaking, an ordinance. Instead, this document is a reference serving two functions. First, it is a collection of data on the existing status of land sues, facilities and services, the transportation network, population, local economy, municipal finances, and natural features. Second, it is a policy statement by the Borough expressing its goals in the areas of land development, facilities and services, and the transportation network.

Avondale Borough completed its first Comprehensive Plan in 1993, and is currently in the process of updating selected portions of the document. Following is a brief summary of the goals and objectives of the Comprehensive Plan as they relate to future land use:

A major goal of the Future Land Use Plan is to preserve the environmental resources of the Borough. To accomplish this, the corridors of the White Clay Creek, Indian Run, and Trout Run have been designated stream

corridor protection. These areas should be left in open space in order to preserve the water resources found in these corridors.

The major wooded area within the Borough has been designated Woodland Protection-Low Coverage Clustered Residential, to permit only limited development and clearance of the wooded area. This area is particularly vulnerable because of the steep slopes. The other areas of identified steep slopes within the Borough, found in the western portion of the Borough, have been designated Steep Slope Protection-Low Coverage Clustered Residential. Only limited development and grading of these areas would be permitted. In both the Woodland Protection and Steep Slope Protection areas development which occurs should be clustered on the areas of least slope to leave the remaining areas undeveloped.

The Borough is basically a residential community, and the Borough wishes to maintain the character of the existing residential neighborhoods. Generally consisting of single family detached areas at medium density, development within and adjoining these existing neighborhoods would also be single family detached development at medium densities. There is limited land available for residential expansion. A planned development residential area has been designated in the southeast corner of the Borough where a mixture of single family, two family, and multiple family development could occur.

Pennsylvania Avenue is a very scenic corridor because of the trees lining the road and the attractive properties, generally single family residential in appearance, along the road. The appearance of Pennsylvania Avenue will be encouraged by encouraging single family residential use except south of 2nd Avenue, where conversion to commercial use would be permitted provided the appearance of the structures were not significantly altered. Such commercial development would fit in with the existing neighborhood oriented commercial development which is found along Pennsylvania Avenue and West State Street in the center of town.

Potential for additional commercial development in the center of town is limited because of the lack of vacant land, circulation conditions such as

narrow streets, and difficulties in providing for off-street parking.

It is expected that in the future most new commercial development will occur along Old Baltimore Pike, where larger parcels will be available and sufficient off-street parking could be provided.

Expansion of existing industrial areas is limited by surrounding land use and the presence of stream corridors. Provision has been made for office development, limited industrial uses, and planned commercial uses in the southern portion of the Borough between Ellicott Avenue and Route 41. Given the corridor problems of Route 41, it will be necessary that any future development which would occur along Route 41 have limited and planned access to the road.

Another pertinent aspect of comprehensive planning within the Borough can be found in the Chester County Planning Commission policy element, "Landscapes". Following are relative goals and objectives form this document that support the expansion of the Avondale wastewater treatment facility, and in turn, the revitalization of the Borough.

Policy Number	Description
1.1.6	Maintain and upgrade existing sewer and water facilities to address problems, and support revi-talization and development activities
1.1.9	Protect and restore urban historic and natural resources
1.2.2	Direct additional development to areas with infra-structure capacity
1.2.1	Encourage infill development among existing developments based on infrastructure capacity and environ-mental constraints
6.1.2	Maintain or expand existing sewer and water facili-ties to support development in urban and suburban landscapes
6.1.3	Restrict the extension of sewer and water facilities in rural and natural landscapes

These policy elements are consistent with the Borough's objective to expand its wastewater treatment facility to allow additional development on appropriate parcels of land within its borders. The Chester county Planning Commission also encourages the land application of treated wastewater whenever feasible, but lack of available land and cost make this option prohibitive.

It should be noted that these policy elements are also supported by the Borough's zoning and subdivision/land development ordinances.

It is also important to ensure that the proposed development within New Garden Township that will generate flows to the treatment plant are consistent with these policies. The northeastern portion of the Borough is bordered by land in New Garden Township zoned R-1 Residential. The basic permitted uses are single family detached dwellings on one acre lots and agriculture. In the vicinity of Old Baltimore Pike, land within New Garden Township is zoned H/C Highway Commercial, where offices, retail stores, banks and shopping centers are permitted by right and restaurants, hotels and motels and recreational uses by special exception. Land south of the railroad tracks to Route 41 is zoned R-1 Residential. Land from Route 41 to Ellicott Avenue is zoned C/I-2, Commercial/Industrial Limited. Research and laboratory uses, offices, assembly, fabrication and manufacturing uses, warehousing, and non retail commercial activities are permitted. Therefore, the development of these areas is consistent with the regional planning vision for the area.

5. Antidegradation requirements as contained in PA Code, Title 25, Chapter 93, 95, and 102.

The protection of Pennsylvania's surface waters is regulated through the antidegradation requirements, as contained in Pennsylvania Code Title 25, Chapters 93, 95, and 102. These will be complied with through proper permitting and approvals. An amended or new NPDES permit will likely be required to implement the expansion at the Avondale facility, and the permitting process will act as a check on water quality standards (Chapters 93 and 95). There is no anticipated change in the location of the discharge point for the facility. The existing discharge point for the Avondale facility is to Indian Run, which is a tributary to White Clay Creek. It is classified for protection of cold water fishes and standard water uses under Chapter 93. Expansion of the Avondale facility will maintain consistency with these designated uses.

Construction of the addition to the treatment facilities will have a temporary impact at the facility site. A soil erosion and sedimentation control plan will be submitted to the Chester County Conservation District

in accordance with Chapter 102.

6. State Water Plans Developed Under The Water Resources Planning Act.

The State Water Plan was developed by the Department of Environmental Protection to be a comprehensive management tool for guiding the conservation, development, and administration of water resources and the lands which affect those resources. The Plan is made up of nineteen subbasin reports covering the entire state. Avondale Borough lies completely within Subbasin 3: Lower Delaware River. The summary introduction of the Subbasin report includes a statement which, although in reference to the subbasin as a whole, is also true of Avondale Borough.

"Subbasin 3..water resources have played an important part in its development, and continued prosperity will depend upon how well the region can harmonize its needs with the water resources available. The basin originally became a center of population, trade, and manufacturing because water was available for consumption, transportation, and power. The basin's water resources are currently heavily used and several area sources are developed to their maximum limits. Therefore, conservation must be an integral part of any solution to the future water needs of the subbasin."

7. Pennsylvania Prime Agricultural Land Policy Contained In Title 4 of the Pennsylvania Code, Chapter 7, Subchapter W.

This land policy orders and directs the prevention of the irreversible conversion of prime agricultural land to uses that result in its loss as an environmental or essential food production resource. The land policy specifies the definition of prime agricultural land as "prime", "unique", or "of state or local importance".

As previously noted, much of what is now developed land within the Borough would be considered prime agricultural land. However, because of the Borough's designation as an urban center, remaining farmland has

been zoned mainly for residential use through development reserve. It is logical, and consistent with the goals of the Chester County Planning Commission to encourage development adjacent to existing urban areas to mitigate sprawl. Therefore, remaining areas of prime agricultural soils will not be considered as a resource to be protected because of the limited developable land outside of the stream corridors, the availability of public sewer and water, and the Borough's existing nucleus of community facilities and existing development.

8. Countywide Storm Water Plans Approved By the Department Under the Storm Water Management Act.

The Storm Water Management Act requires each county in Pennsylvania to prepare and adopt a storm water management plan for each watershed in the County. These plans must assess projected land development patterns in the watershed and the potential impact of that development upon the quantity, velocity, and quality of runoff. Projected development in the flood hazard areas must also be analyzed. This plan must be considered during the development of sewage treatment facility plans, for the ability to provide sewerage will have an effect upon the development potential of a given area. The Borough's zoning ordinance and its subdivision and land development ordinance would generally support the goals of such a plan, but at the present time, Chester County does not have an adopted plan in place.

9. Wetland Protection Under PA Code, Title 25, Chapter 105.

Wetlands are described as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, and bogs. In addition to the prevalence of hydric flora, the presence of hydric soils and evidence of hydrology at the surface (i.e., wet or spongy conditions) are additional criteria considered for wetland designation. Wetlands include, but are not necessarily limited to, swamps, marshes, and bogs. Wetland preservation has been identified as a way to

provide for natural flood control, flow stabilization of streams and rivers, improved water quality, and aquifer recharge.

Wetland types are defined according to the ecological system which they support. Five broad categories has been established: marine (ocean system), riverine (river system), lacautrine (lake system), palustrine (marsh system), and estuarine (estuary system - dependent upon the variations in salinity which characterize the waters at the limen of fresh- and salt-water).

The wetlands within the Borough are protected from development through the zoning and land development ordinances. Within the site of the existing sewage treatment facility, there are no identified wetlands that would prohibit the expansion of the facility.

10. **Protection of Rare, Endangered, or Threatened Plant and Animal Species as Identified by the PA Natural Diversity Index (PNDI)**

In recent years, there have been both state and federal laws and regulations implemented to protect the habitat of rare, endangered, and threatened species. These laws and regulations require municipalities to assess the impact of a proposed sewage facilities planning alternative may have on a protected species. The Department of Conservation and Natural Resources, Bureau of Forestry, maintains the "Pennsylvania Natural Diversity Inventory" (PNDI). This database contains site specific information about the Commonwealth's rare, endangered, or threatened species. Municipalities or their consultants may access this system when evaluating various sites for sewage facilities.

A request for a PNDI search was filed, and a response received (refer to Appendix 15). The response indicated that PNDI has no record of occurrences of rare, threatened, or endangered species within the area and, therefore, does not anticipate any impact on such species.

11. Historical and Archeological Resource Protection under P.C.S. Title 37, Section 507, relating to cooperation by Public Officials with the

Pennsylvania Historical and Museum Commission.

This 1978 Act requires municipalities to cooperate fully with the Pennsylvania Historical and Museum Commission in the preservation, protection, and investigation of archaeological resources. Municipalities are required to notify the Commission when a specific site is under consideration and request the Commission to render a determination of the impact on archaeological or historical resources that could occur if the sewage facilities are constructed on that site.

B. Provide for the Resolution of Any Inconsistencies in Any of the Points Identified in Section VI.A. of this checklist.

There are no inconsistencies in any of the points identified in Section VI.A.

C. Evaluate alternatives identified in Section V of this checklist with respect to applicable water quality standards, effluent limitations, or other technical, legislative, or legal requirements (Reference - Title 25, §71.21.a.5.iii).

All of the alternatives selected in Section V discharge sewage to an existing facility. This facility discharges treated wastewater under an NPDES permit. All of the alternatives were selected to meet the current NPDES permit requirements.

D. Provide cost estimates using present worth analysis for construction, financing, on-going administration, operation and maintenance and user fees for alternatives identified in Section V of this checklist. Estimates shall be limited to areas identified in the plan as needing improved sewage facilities within five (5) years from the date of this of plan submission.

Section V reviewed several alternatives to provide enhanced sewage facilities in the Borough of Avondale. Each alternative outlined one or two methods of increasing the capacity of each process unit. These alternatives form the basis of two options to increase the capacity of the WWTP. Option One increases the capacity of the WWTP by adding two 0.060 mgd above-ground steel package plants. Option two increases the capacity of the WWTP by adding the following:

two (2) above-ground concrete aeration tanks
two (2) circular clarifiers
and extending the existing CCT

The reasons that these alternatives were selected are detailed in Section V.

Tables 1 and 2 estimate the construction costs for each alternative. The drawings in Appendices 13 and 14 show the layout of each option. Each estimate was completed using current construction cost information and prices supplied by vendors. These estimates are preliminary. Their accuracy is ± 27 percent. The accuracy of these estimates can only be improved through detailed engineering. Detailed engineering will not be completed until this plan is adopted. The estimated project and construction costs for Option 1 were approximately $1.01 million. The estimated project and construction costs for Option 2 were approximately $1.14 million.

Table 5 shows the present worth analysis. The present worth analysis was done to compare both options on an economic basis. To complete the present worth analysis operating costs for both options had to be calculated (see Tables 3 and 4). These calculations were done based on power usage, sludge disposal, and maintenance. No costs were applied to personnel. The Borough currently has an operations contract with Miller Environmental Inc. Pricing for operations will be done after this plan is executed.

The present worth calculation was done using 5 and 10-year terms. The interest rate used was 8 percent. The 10 year present worth for Option 1 is approximately $1.42 million. The 10 year present worth for Option 2 is $1.47 million (see Table 5).

From the two options, Option 2 was selected. Option 2 was selected for the following reasons:

1. **Plan's Objectives** - Option 2 meets the plan's objectives. This option provides additional capacity at the WWTP and therefore sewage to the areas that need sewage facilities. This option provides for growth and protects land resources by doing so.

2. **Meets Regional and Comprehensive Planning Objectives** - This alternative meets the objectives set down in previous planning. One of the main objectives of the County Comprehensive Plan is to revitalize urban areas. This option allows for growth in the Borough. Development on the remaining land in the Borough is a form of revitalization and therefore compatible with the County Comprehensive Plan.

   The County Comprehensive Plan and the Avondale Comprehensive plan set down goals for orderly and managed growth in the area. Option 1 allows for orderly and managed growth in the area.

3. **Management** - This option relies heavily on existing facilities and institutions. By doing so little to no modifications are needed to existing relationships, billing structure or operating agreements. This Option is readily instituted and managed.

4. **Economics** - Although Option 2 was shown to have a lower present worth for 5 and 10 years, it is difficult to rely on these numbers. Both alternatives are roughly the same. Considering the level of engineering detail that is still needed, these numbers are conceptual and order-of-magnitude. Without further engineering, no greater accuracy can be

expected. Therefore for the purposes of this planning document, these numbers are considered equal.

5. **Operations and Maintenance** - Option 2 is a more desirable system based on operations and maintenance. Option One includes steel tanks. Option Two includes concrete tanks. Concrete tanks typically have a longer life span and do not require regular painting.

Option 2 uses surface aeration. Option 1 uses diffused air. Diffusers require yearly cleaning and replacement of some of the diffusers. In addition, if the steel tanks need to be cleaned there is no way of putting heavy equipment (Bobcat) into the tank without crushing the diffusers. This means that all cleaning would be done using a bucket and a shovel. Surface aerators have no diffusers and can be cleaned much easier.

Option 2 uses circular clarifiers. Option 1 uses rectangular clarifiers. Circular clarifiers have a better performance record, especially during periods of high flows.

For all of these reasons, Option 2 is the recommended and selected alternative.

E. **Provide an analysis of the funding methods available to finance each of the proposed alternatives evaluated in Section V of this checklist. Also provide documentation to demonstrate which alternative and financing scheme combination is the most cost-effective; and a contingency financial plan to be used if the preferred method of financing cannot be implemented. The funding analysis shall be limited to areas identified in the plan as needing improved sewage facilities within five years from the date of the plan submission.**

Ultimately, the cost to the users of the project is determined both by operating and maintenance costs and by the methods in which the project costs are financed. Wastewater projects are traditionally funded by some combination of "Local Share" funds, federal/state grant programs, and "Long-term Financing".

1. Sources of "Local Share Funds"

"Local share funds" refers to funds that generally come from within the municipality, as opposed to funds that come from a governmental program, or from a public bond issue. Sources for local funds are varied, and a combination of one or more may be used, depending on the specifics of the project. A general description of "local share" sources is presented below.

Connection Fee: Fee based on the cost of the lateral from the main sewer to the property line.

Tapping Fee: Fee based on the capacity of the system being used. A separate fee may be used for collection systems and treatment systems.

Municipal Contribution: Funds contributed to a project by the local municipality and/or the municipal authority.

Developer Contribution: Funds contributed to a project by a private land developer(s), for construction of the facilities, which initially benefit his land development.

Assessments: Fees charged to a property owner based on the footage of sewer facilities that adjoin his/her property.

2. Governmental Programs

Several state and federal programs are sometimes applicable to fund all or a portion of sewage facilities projects. Program applicability depends on qualifying criteria, project cost, program resources, and competition. Brief descriptions of applicable governmental programs are presented below.

PENNVEST: The Pennsylvania Infrastructure Investment Authority operates a revolving loan program for funding of sewage facilities. The PENNVEST program obtains funds from capital budget appropriations, borrowed funds (PENNVEST bond issue), and federal funding. Twenty year loans are offered at subsidized interest rates which are determined by the unemployment rate in the county in which the sewage project is located. Very limited grants are available for special situations, to reduce user fees to an affordable rate. Applicants compete on a statewide basis based on a ranking system of six or more criteria. The program is competitive, and funding is limited. Design and permitting of the proposed facilities is normally required before an application can be submitted.

Department of Community and Economic Development (DCED): The Small Communities Program is administered through DCED to provide financial assistance through the Federal Community Development Block Grant Program (CDBG). Eligibility is limited to nonentitlement, urban counties, with low-moderate income levels. Funds are competitive. In Chester County, recent practice has been to allocate up to $100,000 per project per year, plus up to an additional $10,000 if a sewerage project is involved.

Department of Commerce: The Department of Commerce administers several programs that may be applied to funding of sewage facilities.

- Community Facilities Program: This program may provide grants to municipalities with populations of less than 12,000, and sewage project costs of $2 million or less. Grants are limited to $50,000 or 50 percent of the total project cost, whichever is less.

- Business Infrastructure Development Program (BID): This program offers grants and loans to municipalities in an attempt to encourage private industrial investment. The maximum loan or grant is $1.5 million, or 10 percent of the annual program

appropriation, whichever is less. Interest rates vary between 3 and 9 percent based on the area's unemployment.

- Site Development Grant Program: Grant funds are offered by this program to sponsor the development of industrial sites. Sewage facilities which are part of the industrial sites are eligible for funding. Grants are limited to $50,000.

- Economic Development Partnership Fund: The goal of this program is to provide loans and grants for the prevention of blight in distressed areas. Interest rates vary between 3 and 9 percent, depending on the unemployment rate on the area. Business must hire one full-time employee for every $15,000 borrowed.

- Industrial Communities Site Program: The goal of this program is to bring blighted industrial land into productive use, and create competitive industrial sites. Grants are limited to $1.5 million, or 50 percent of the total project cost, whichever is less.

3. Commercial Sources

Generally, there have typically been two types of commercial financing for sewerage projects. These are general obligation bonds and revenue bonds.

General obligation (GO) bonds are issued by a municipality and are a direct debt, or obligation of the municipality. In this case the municipality would be Borough of Avondale. Until 1972, there were strict limits on how much money could be borrowed by a municipality through GO bonds, and they were rarely used to finance projects such as sewer systems since, typically, only a portion of a municipality, especially a township, would benefit from the project. In 1972, the Local Government Unit Debt Act allowed municipalities to finance additional (beyond their normal limits) if the project was financially self-liquidating; that is, the project produced enough revenue to pay the principal and interest of the associated bonds. Even with this ability, many municipalities have retained, or created new authorities, to finance or to finance and operate water and/or sewer systems.

Municipal authorities, and some municipalities, typically finance projects with revenue bonds. As noted above, the source of revenue for a project is "self-financing" from the uses of the project.

A revenue bond issue. This has been the traditional method for long-term financing of municipal sewage in Pennsylvania. It provides long-term fixed rates, with a 20 to 25 year term. A bond underwriter, financial advisors, and bond counsel are required to implement a revenue bond issue.

A variation of an authority revenue bond issue is to borrow from a "Bond Pool". These are funds that are available from bonds issued by other authorities in the state, with proceeds available to re-lend to qualified borrowers. Fixed and variable rates are available, short-term and long-term borrowing may be considered. Financial advisors and bond counsel are required.

An additional potential funding source that has enjoyed success in recent year is the "Tax Exempt Bank Loan". Local financial institutions; i.e., banks, may be interested in providing loans for project development,

interim financing, or long-term financing. Fixed interest rates may be limited to some short-term period; e.g., less than three years, or may be applicable to the life of the project. Financial advisors, including bond counsel, are required.

Legislation and policies of both the federal and Pennsylvania governments with respect to financing for sewerage projects have been subject to on-going changes and realignment of organization. The net effect of these changes has been to shift a higher percentage of costs to the users, even though there is a continuing public demand for pollution abatement.

As a result, participation in the governmental programs is somewhat questionable. Application, qualification, and adequate funding must be available for a municipality to plan a project with confidence, using one of the governmental funding programs. Debt service for a 20 to 25 year revenue bond issue is currently generally competitive with the debt service offered under the PENNVEST program.

For planning purposes, use of the revenue bond issue financing method typically produces a conservative estimate of user costs. Future grant awards or loans from any of the above governmental programs, would reduce user costs, making the proposed project even more attractive.

Therefore, at this stage in the planning project, the Revenue Bond issue method of financing will be applied to the project costs. Market interest rates are at record low levels, and the Revenue Bond issue method is readily implementable.

NOTE: Although Revenue Bonds are the basis for user costs in this report, the initial project financing plan will be to first consider PENNVEST financing and then Revenue Bonds.

4. Other Sources - Operating Funds

Commonwealth of Pennsylvania Act 339, Annual 2 Percent Grant

Since 1938, the Commonwealth has provided annual operating subsidies, amounting to two percent of most local project costs, for sewerage construction. Sewage treatment plants are eligible for this annual subsidy, as well as major interceptors, pumping stations and force mains under certain conditions. Although the annual subsidy is provided through state legislation, there are regular attempts to reduce or eliminate this subsidy. The two percent subsidy is applicable only to the local share (e.g., principal amount of a bond issue) of eligible costs. Any costs financed by federal or state funds are not eligible for this subsidy. The key point here being that any project, or portion thereof, financed by Pennvest is not eligible for the two percent subsidy.

F. Analyze the need for immediate or phased implementation of each alternative proposed in Section V of this document.

The WWTP has had a history of exceeding the effluent criteria over the last 5 years. Increased hydraulic loading due to I/I has caused a majority of these exceedances. Although several steps have been taken to eliminate the I/I, the average hydraulic load still remains close to 0.300 mgd. The WWTP needs to be upgraded with respect to capacity.

The current bond and loan market is seeing the lowest rates in nearly 30 years. If money is going to be borrowed, it would appear that now is the time to do it.

Construction projects work on an economy of scale. The unit prices for large projects are typically lower than those of smaller projects. If construction at the WWTP is going to be undertaken, it is better to complete it all at one time.

For these reasons a phased approach is not recommended for the upgrade of the WWTP.

G. Evaluate administrative organizations and legal authority necessary for Plan implementation.

The Borough of Avondale has an existing Borough Council and an Authority. These institutions have administered the needs of the WWTP, negotiated agreements with other municipalities, borrowed money for projects and maintained the billing for sewer services provided. This will not change with the implementation of this Plan. They have the legal Authority to perform these tasks.

VII. INSTITUTIONAL EVALUATION

A. Provide an analysis of all existing wastewater treatment authorities, their past actions, and present performance including:

The daily operation and maintenance of the Avondale Borough wastewater treatment facility, as well as the wastewater collection system, is currently the responsibility of Avondale Borough Council. In 1966, Borough council formed an Authority for the purpose of financing and constructing a sewage collection system and wastewater treatment facility to serve the Borough, as well as a portion of New Garden Township. The relationship between the Council and the Authority is a "lease back", by which the Authority owns and leases the sewer system to the Borough. In 1997, the Borough placed the Authority on "inactive" status, with the reservation to activate it when necessary. The responses in this section are directed to both Avondale Borough Council and the Authority and their ability to implement the proposed project, as it is unknown whether the Authority would be utilized.

1. Financial and Debt Status

The Borough currently has no debt and, therefore, no debt service. The Borough is the guarantor of a loan to the Sewer Authority for improvements to the treatment facility that were undertaken in 1993. That contingent obligation was $400,000, and is classified as lease rental debt. The current debt service for this obligation is $60,736 per year until 2003.

2. **Available staff and administrative resources.**

Staffing for Avondale Borough presently consists of a part-time secretary, a part-time treasurer, and one part-time employee in the streets department. The water and sewer systems are operated on a full-time basis by a private contractor, Miller Environmental, Inc. The Borough recently signed a 10-year contract with Miller Environmental Inc. for continuation of these services. Their duties include daily operation and maintenance of facilities; recordkeeping and reporting; and provision of recommendations for improvements as needed.

3. **Existing legal authority to:**

a. **Implement wastewater planning recommendations.**

b. **Implement systemwide operation and maintenance activities.**

c. **Set user fees and take purchasing actions.**

d. **Take enforcement actions against adopted ordinance violators.**

e. **Negotiate agreements with other parties.**

f. **Raise capital for construction and operation and maintenance of facilities.**

The legal authority to implement and provide the above requirements is vested with Avondale Borough and the Avondale Borough Authority through the following ordinances, agreements, and acts:

i) The Authority is organized under the provisions of the Pennsylvania Municipalities Authority Act of 1945 (see Ordinance Chapter). The act provides for the incorporation as bodies corporate and politic of "Authorities" for municipalities, counties, and townships; prescribes the rights, powers, and duties of such Authorities; authorizes such Authorities to acquire, construct, improve, maintain, and operate projects, and to borrow money and issue bonds therefor; provides for the payment of such bonds and prescribes the rights of the holders thereof; confers the right of eminent domain on such Authorities; authorizes such Authorities to enter into contracts with and to accept grants from the Federal Government or any agency thereof; confers exclusive jurisdiction on certain court overrates; provides for health center projects; and provides for the financing of projects through loans by the Authorities.

ii) Avondale Borough has the ability to implement wastewater planning recommendations under the provisions of the Pennsylvania Sewage Facilities Act (Act 537) enacted by the Pennsylvania Legislature in 1966.

B. Provide an analysis and description of the various institutional alternatives necessary to implement the proposed technical alternatives, including:

1. **Need for new authorities.**

The Avondale Borough Authority is incorporated pursuant to an Ordinance of Avondale Borough, and is existing under and approved by virtue of the Pennsylvania Municipalities Authorities Act of 1945, approved May 2, 1945, P.L. 382, as amended and supplemented.

Neither the Borough nor New Garden Township has discussed the formation of a joint municipal authority for this project. The Borough Authority has a 30-year history of successfully managing the operation of

its sewage collection and wastewater treatment systems. Moreover, the 1968 Agreement between the two municipalities defines procedures for cost-sharing on capital projects, and it is anticipated that these procedures will be used to implement the proposed project to expand the capacity of the wastewater treatment facilities. The success of this arrangement is illustrated by the construction of the original collection and treatment facilities, as well as the most recent upgrade project in 1993 which involved the installation of a flow equalization tank.

2. **Functions of existing and proposed organizations (sewer authorities, etc.)**

The Avondale Borough Authority owns and maintains the sewage collection system and the wastewater treatment facility.

The Municipal Authorities Act of 1945 prescribes the rights, powers, and duties of such Authorities heretofore or hereafter incorporated; authorizing such Authorities to acquire, construct, improve, maintain and operate projects, and to borrow money and issue bonds, and prescribing the rights of the holders thereof; conferring the right of eminent domain on such Authorities; authorizing such Authorities to enter into contracts with and to accept grants from the Federal Government or any agency thereof; conferring exclusive jurisdiction on certain courts overrates; providing for health center projects; and providing for financing of projects through loans by the Authorities.

3. **Cost of administration, implementability, and the capability of the authority to react to future needs.**

The cost of providing administration to the proposed alternative will be reflected within the Borough's proposed budget. No new institutional requirements are necessary to implement the proposed alternative in regard to cost of administration. The capability of the Authority to react to future needs is provided by the Municipalities Authorities Act of 1945.

Avondale Borough and Avondale Borough Authority have long, successful, established histories and have all the institutional requirements in place to be able to react to future needs.

C. **Describe all necessary administrative and legal activities to be completed and adopted to ensure the implementation of the recommended alternative, including:**

1. **Incorporation of authorities or agencies.**

None is required.

2. **Development of all required ordinances, regulations, standards, and intermunicipal agreements.**

Ordinances and Resolutions:

Both Avondale Borough and New Garden Township already have existing ordinances and resolutions in place that cover: setting rates and charges for the sewer system; providing for collection and placing of liens; regulating the discharge of sanitary sewage and industrial wastes; and requirements for connections to the sewer system.

Standards:

Both municipalities have long ago adopted standard specifications relating to the construction of installation of sewage collection systems. These standards are consistent with those prescribed in the Department's Domestic Wastewater Facilities Manual.

Intermunicipal Agreements:

As noted earlier, operation of the sewage treatment facility is governed by

the 1968 Agreement between Avondale Borough and New Garden Township.

3. **Description of activities to provide rights-of-way, easements, and land transfers.**

The expansion of the sewage treatment facilities will not require the acquisition of rights-of-way, easements, or land transfers. The treatment facility is surrounded by Borough-owned property, so expanding beyond the current footprint will not be a problem.

Individual developers will be required to obtain necessary easements and rights-of-way as needed for future extensions to the sewage collection system. The Borough would not accept dedication of any sewer line without documentation of required easements.

4. **Adoption of other municipal sewage facilities plans.**

New Garden Township has passed a resolution adopting the Borough's Act 537 Plan as it relates to the expansion of the wastewater treatment facility to a capacity of 0.418 mgd.

5. **Any other legal documents.**

None required.

6. **Dates or time frames for Items 1 to 5 above on the project's implementation schedule.**

See implementation schedule in Schedule A at the beginning of this document.

D. **Identify the chosen institutional alternative for implementing the chosen wastewater disposal alternative. Provide justification for choosing the specific alternative.**

The chosen institutional alternative for implementing the selected wastewater treatment alternative is to maintain the existing institutional arrangements in place. As previously stated, the Borough has organized an Authority under the provisions of the Pennsylvania Municipalities Authority Act of 1945. The Authority presently owns and maintains the wastewater collection and treatment facilities and will do likewise in the future. The Borough and Authority have enacted ordinances to require connections, to set rates, and to accommodate other necessary administrative functions for the sewer system. The existing institutional arrangements have been functioning for many years with respect to the sewer system and are capable of implementing the chosen sewage alternative. Furthermore, the Borough and the Authority currently have adequate staff and administrative resources to implement the chosen alternatives.

VIII. JUSTIFICATION FOR SELECTED TECHNICAL AND INSTITUTIONAL ALTERNATIVES

A. Identify the technical wastewater disposal alternative which best meets the wastewater treatment needs of each study area of the municipality. Justify the choice by providing documentation which shows that it is the best alternative based on:

1. **Existing wastewater disposal needs.**

   The existing wastewater needs of Avondale Borough and New Garden Township are documented in Section III of this study. The expansion of the existing facility to a capacity of 0.418 mgd is necessary to meet these needs. The selected method to expand the facility is designated as Option 2, which involves the expansion of the existing plant facilities. This expansion will mitigate existing problems with hydraulic overloads.

2. **Future wastewater disposal needs.**

   Future growth and land development in Avondale Borough and New Garden Township is documented in Section IV of this study. The expansion of the facility to 0.418 mgd will be adequate to cover the projected build-out of the Borough during the next 10 years, as well as accommodate continuing growth in New Garden Township. It is unlikely that another expansion of the treatment facility will be required in the future based on current growth projections.

3. Operation and maintenance considerations

The selected alternative (Option 1) does have a slightly higher operation and maintenance cost than Option 2, but this is offset by its lesser capital cost. Both the 5-year and 10-year present worth analyses indicate that Option 1 is the most cost-effective.

4. Cost-Effectiveness

The selected alternative is the most cost-effective as proven by the five and ten year present worth analyses.

5. Available management and administrative systems

Avondale Borough has sufficient administrative and management systems in place to successfully implement the selected alternative. As noted earlier, the Borough has recently signed a long-term contract with Miller Environmental, Inc. for the operation of the existing wastewater treatment facility and the water distribution system. The Borough also has in place all necessary systems for administration, including billing and collections.

6. Available financing methods

The following is a list of funding methods which are available to Avondale Borough for the cost of the proposed future sewage facilities:

a. Municipal bond issue or conventional loan
b. PENNVEST low-interest loan
c. Tapping fees

These types of funding are discussed in the following sections.

A. Municipal Bond Issue or Conventional Loan

Depending on the amount of money which is needed, the Authority could pursue a municipal bond issue or a conventional loan. In general, a municipal bond issue is used when a large sum of money (approximately $2,000,000 or more) is required. A conventional loan is used when less money is required.

There are several types of municipal bonds. Some bonds are taxable and some are tax-exempt. However, the general classification of municipal bonds usually refers to tax-exempt bonds. The following three types of municipal bonds are generally used in financing public works:

1. General Obligation Bonds are tax-free bonds that are secured by the pledge of the full faith, credit, and taxing power of the issuing agency. This type of bond is backed by all of the taxes on real estate and personal property within the jurisdiction of the issuing agency. It involves minimum risk to the investor and, therefore, requires a lower rate of interest than other types of bonds.

2. Dedicated Tax Bonds are payable only from the proceeds from a special tax and are not guaranteed by the full faith, credit, and taxing power of the issuing agency. Examples of special dedicated taxes are the special assessments against a property which is adjacent to and the principal beneficiary of the improvement, and gasoline taxes used to finance highway construction.

3. Revenue Bonds are payable from revenues derived from the use of the improvement such as tolls, sewer bills, or rents paid by the users of the improvement and do not otherwise represent an obligation of the issuing agency.

Revenue bonds are not ordinarily subject to statutory or constitutional debt limitations. They are often issued by commissions, authorities, and other public agencies created for the specific purpose of financing, constructing, and operating essential public projects.

Typically, municipal and revenue bonds are sold to an investment banking firm who then resells the bonds to individual investors.

The advantage of municipal bonds to the investor is their tax-free status. A bond discount (a percentage of the total bond issue) serves as the investment banker's commission.

Before bonds are sold, they may be rated on the basis of risk to the investor by a rating agency such a Standard and Poor's and Moody's. The higher the rating, the lower the risk to the investor and, consequently, the lower the interest rate that must be paid on the bond.

The legal instrument which sets forth the rules which must be observed by the issuing agency is the Trust Indenture. The Trust Indenture is prepared by the Bond counsel and must be printed along with the bonds.

A Trustee is required to administer the bond issue and ensure the terms of the Trust Indenture are observed. These requirements result in an Annual Trustee fee.

Current interest rates on a 20-year term (repayment period) are about 7.0 percent. The longer the term, the lower the annual debt service (repayment) and the higher the total amount of interest that must be paid.

Investment bankers indicate that it does not pay to extend the term beyond 25 years because the interest rate increases disproportionately.

The following are the advantages of municipal bond issue funding:

1. This program affords long-term fixed rate financing

2. Tax-exempt municipal bonds are in high demand.

3. There is a local investment opportunity.

4. Municipal credit is established.

5. Avondale Borough retains flexibility for future borrowing.

6. The financing approval period is shorter than with PENNVEST.

The following are disadvantages of municipal bond issue funding:

1. Market interest rates are higher than maximum PENNVEST interest rates.

2. Municipal guarantee is usually required.

3. A Reserve Fund is generally required.

4. There are trustee fees, Bond Counsel fees, and costs for preparing a Trust Indenture.

5. Issuance costs are higher than with the PENNVEST program.

B. PENNVEST

PENNVEST was formed by the Commonwealth of Pennsylvania, and its legislative intent was to recognize that the health of millions of citizens of the Commonwealth is at risk due to substandard and deteriorated water and wastewater systems.

Some areas of the Commonwealth have to limit their economic and population growth due to their water supply and sewerage systems being outmoded and overloaded.

The economic revitalization of the Commonwealth if being stifled by a lack of clean water and adequate wastewater facilities.

It recognizes that financing of water and sewage projects is not currently available at affordable rates and, therefore, formed the PENNVEST Authority to assist in financing projects which protect health and promote economic development in Pennsylvania.

The PENNVEST Authority may receive money from sources including the following:

1. State funds appropriated to PENNVEST
2. Federal funds appropriated to or granted to PENNVEST
3. Proceeds from the sale of bonds

PENNVEST Authority establishes a Water Pollution Control Revolving Fund which is administered in accordance with the Water Quality Act of 1987.

PENNVEST's Board may also establish nonrevolving funds and accounts. Repayments of loan principal together with interest are deposited with PENNVEST in revolving funds or nonrevolving funds from which PENNVEST repays its indebtedness.

Criteria for obtaining assistance are established as follows:

1. Whether the project will improve health, safety, welfare, or economic well-being of the people.

2. Whether the project will lead to an effective or complete solution to the problems of the system and bring it into compliance with state and federal regulations.

3. The cost-effectiveness of the proposed project in comparison with other alternatives including other financial and physical alternatives.

4. The consistency of the project with state and regional resource management and economic development plans.

5. Whether the applicant has demonstrated its ability to operate and maintain the project in a proper manner.

6. Whether the project encourages consolidation of water and wastewater systems where consolidation enables customers to be most effectively served.

7. The availability of other sources of funds at reasonable rates to finance all or portions of the project.

Grants shall be made only when PENNVEST determines that the financial condition of the recipient is such that repayment of a loan is unlikely and that the recipient will not be able to proceed with the project without a grant.

Loans may be made by PENNVEST according to terms PENNVEST deems appropriate including current market interest rates and the economic distress of the area the project serves. The minimum rate of interest paid will be one percent.

Loans will be granted to entities who agree to have their system operators participate in continuing education courses developed by PA DEP.

PENNVEST may make funding available to finance those activities undertaken prior to application for construction financing (e.g., feasibility analyses, engineering design, etc.) All definitions, provisions, restrictions, procedures, and authorizations that are enumerated in the Act and in these regulations apply in the same manner to advance funding assistance as they do to construction financing assistance.

If or when it is determined that Avondale Borough intends to pursue a PENNVEST loan for feasibility analyses, design or construction, steps should be taken immediately to place the project on the PENNVEST list through your representatives in State government. Even so, application for PENNVEST funding to cover construction costs cannot be made until final design is complete.

There is a PENNVEST application which must be completed in order to initiate the loan process. The application has been designed so that it is easy to complete and review.

The application will be reviewed simultaneously by administrative, technical, financial, and legal staff in several offices in order to speedily process the application.

The information provided in this application will be the basis of funding decisions by the PENNVEST Authority. A look at the advantages and disadvantages of PENNVEST funding is helpful in determining its applicability to this project.

The following are the advantages of PENNVEST funding:

1. If Avondale Borough qualifies, the interest rates available even in the highest bracket are less than market value for a Municipal Bond Issue.

2. The program management is greatly influenced by PA DEP, and PA DEP is the same agency which approves Avondale's Act 537 Plan.

3. The issuance costs are relatively low compared to issuance costs of a Municipal Bond issue.

4. There is no negative arbitrage associated with this program. PENNVEST interest rates are so low that, in almost all cases, interest is earned during construction.

The following are the disadvantages of PENNVEST funding:

1. The program was conceived to assist communities with higher than average unemployment rates and lower than average family incomes so this proposed service area might not fit well into the eligibility criteria.

2. The program is in its infancy so many issues are unresolved.

3. The application process may be lengthy due to there being only two PENNVEST Board meetings each year and an increasing backlog of applications to be processed.

4. There is much competition for the low interest funding.

5. There are virtually no grants available and grants would only be made to disadvantaged communities.

6. Municipal guarantee is required.

7. Future borrowing may be limited by required loan documents.

8. PA DEP may not approve design for financing and, after great delay, the financing process must be restarted through a second alternative method of financing.

C. Tapping Fees

Another funding method is the collection of tapping fees.

Act 203 requires prospective users of sewage facilities to pay for the portion of the existing and proposed sewage facilities which they will use.

A project can be funded in the following ways:

1. Solely by the sale of EDUs.

2. By a combination of advanced tapping fees and bond issue/PENNVEST loan/conventional loan. The portion of the cost which would be financed would be reimbursed by the sale of future EDUs.

3. Solely by a bond issue/PENNVEST loan and then the Authority would be reimbursed by tapping fees.

The major advantage to collecting tapping fees is that there is less risk to Avondale Borough. The advantage to financing a project is that the new facilities would promote growth and landowners would connect to the system, while they might not otherwise.

7. **Environmental soundness and compliance with natural resources planning and preservation programs.**

The chosen alternative complies with natural resources planning and preservation programs as illustrated in Section VI of this document. The installation of the proposed collection system will adhere to all federal, state and local regulations. The necessary permits will be obtained as needed.

B. **Designate and describe the capital financing plan chosen to implement the selected alternative. Designate and describe the chosen back-up financing plan.**

For planning and estimating purposes Revenue Bonds were used in this document. However, there is no commitment by the Borough to use Revenue Bonds.

The issues surrounding financing methods are complex. Rates and terms must be evaluated in comparison to the Borough's needs. Schedule "A" at the beginning of this document, shows a time allotment for the review of financing methods. At the end of this time period Avondale Borough will select a method of financing. This time period runs concurrently with the PA DEP review period. Avondale Borough will be using the services of a financial consultant to determine the most suitable financing method.

It should also be noted that Avondale and New Garden Township will share the cost to implement the selected option based on their proportionate shares of the additional treatment plant capacity. From the 118,275 gpd of additional capacity that is to be added, Avondale is responsible for 73,275 gpd, and New Garden Township is allotted 45,000 gpd. The relative percentages are 62.5% for Avondale, and 37.5% for New Garden Township. Based on an estimated project cost of $1.14 million dollars, the municipal cost sharing amounts would be:

Avondale Borough	$ 712,500
New Garden Township	$ 427,500
TOTAL	$1,140,000

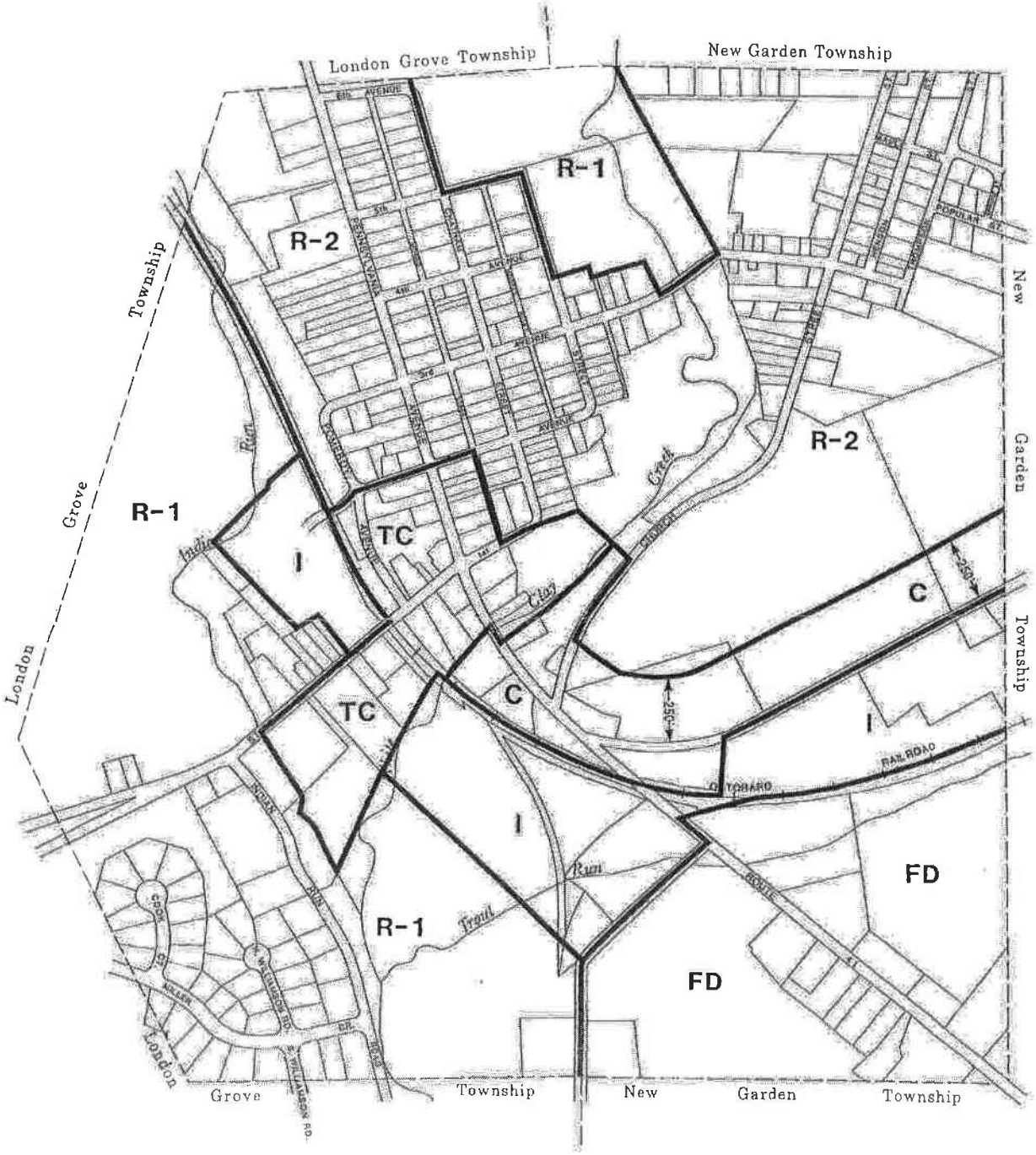
As a back-up financing plan, the Borough would most likely use a combination of upfront tapping fees, in conjunction with conventional financing.

APPENDIX 1

ZONING MAP

AVONDALE BOROUGH

Chester County, Pennsylvania



ZONING MAP

- **R-1** Residential District
- **R-2** Residential District
- **FD** Flexible Use District
- **TC** Town Center District
- **C** General Commercial District
- **I** Industrial District

0 200 400 600 800

Scale in Feet

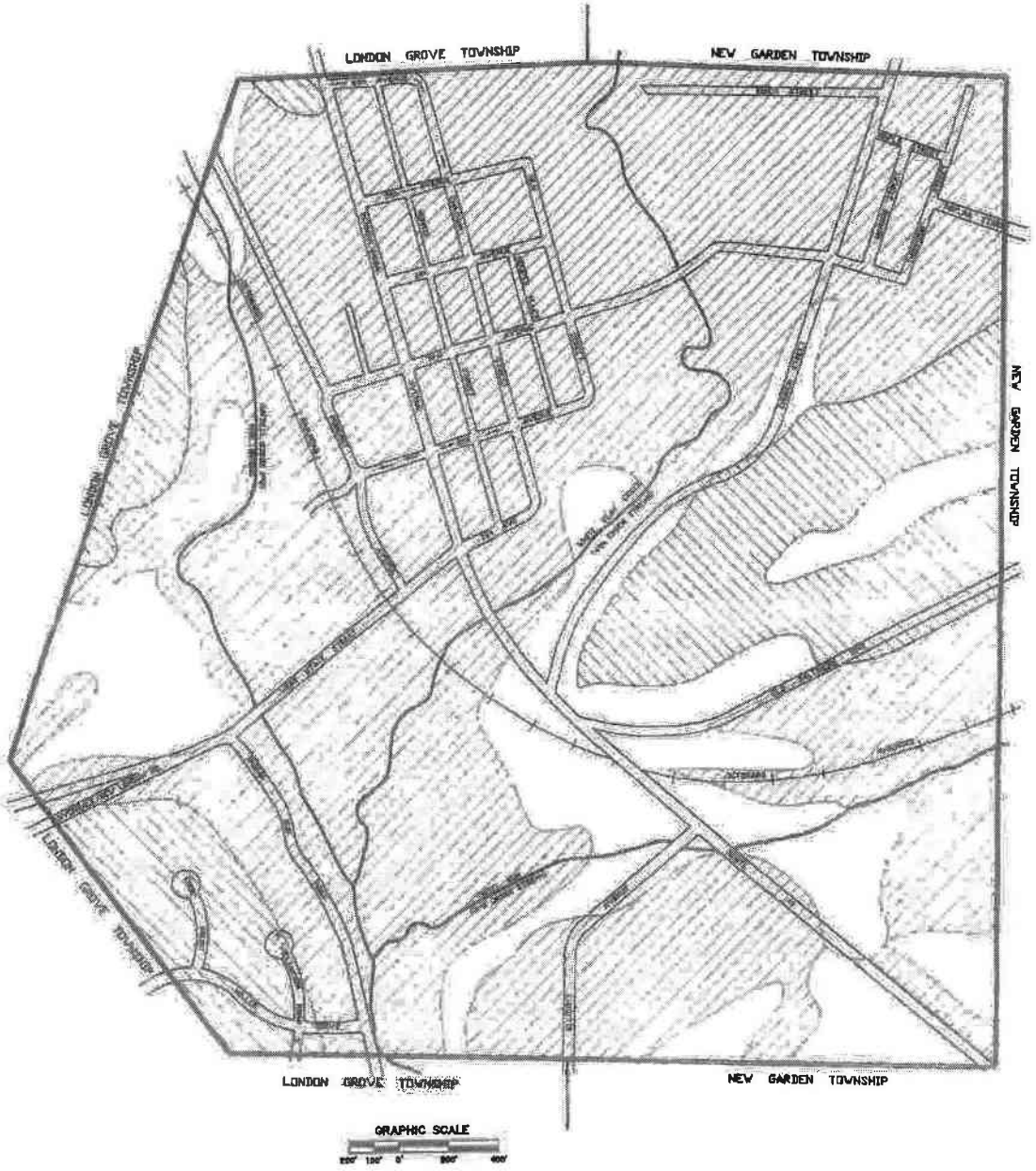
BASE MAP UPDATED 1995
MAP PREPARED BY CHESTER COUNTY PLANNING COMMISSION, 1996

APPENDIX 2

LAND RESOURCES MAP

LAND RESOURCES MAP

AVONDALE BOROUGH
CHESTER COUNTY, PENNSYLVANIA

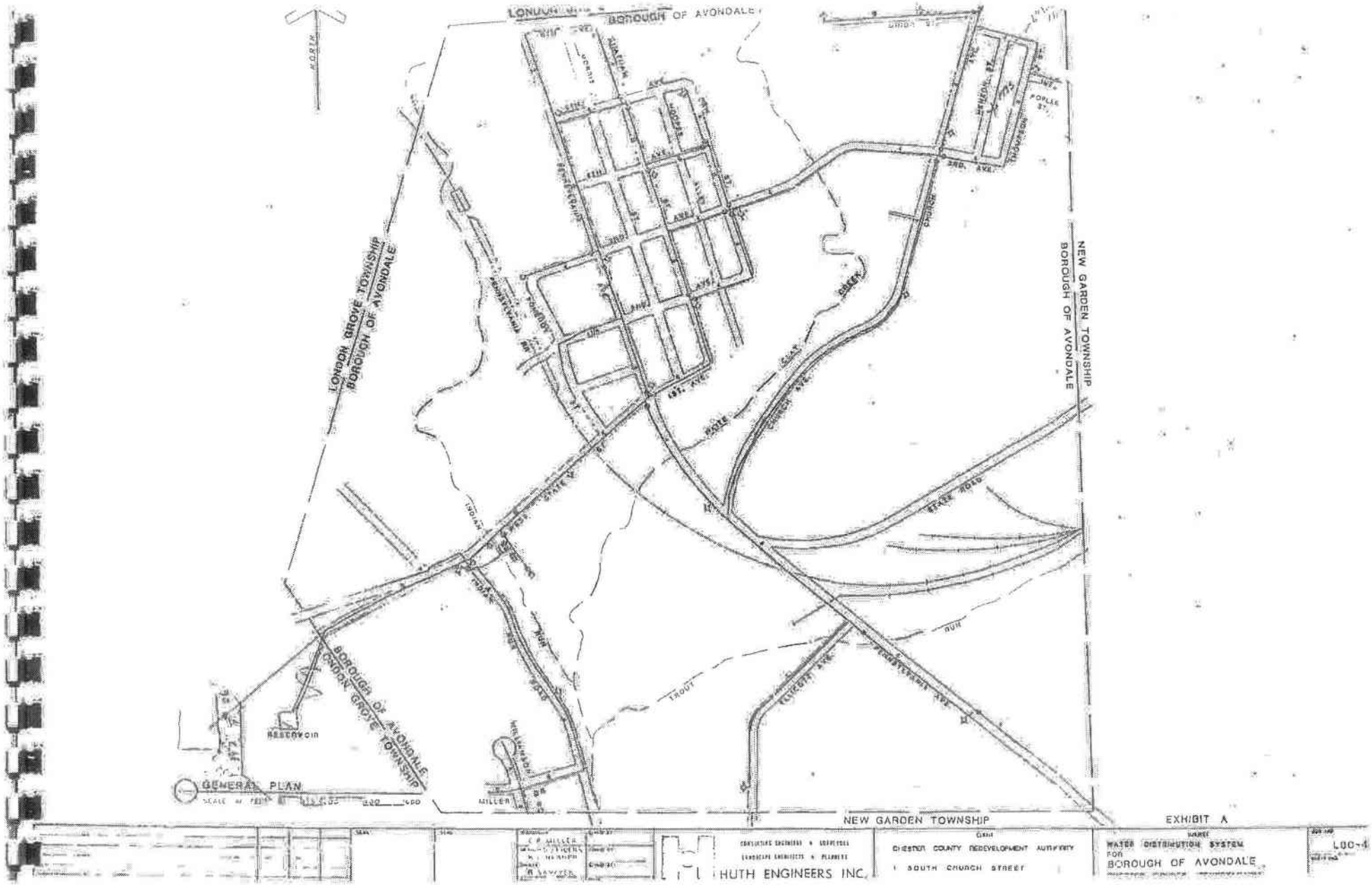


PRIME AGRICULTURAL SOILS (CAPABILITY UNITS I, II, AND III, FROM SOIL SURVEY CHESTER AND DELAWARE COUNTIES, PENNSYLVANIA)

STEEP SLOPES (SLOPES 15% AND GREATER, FROM SOIL SURVEY CHESTER AND DELAWARE COUNTIES, PENNSYLVANIA)

APPENDIX 3

WATER SYSTEM MAP


NORTH
BOROUGH OF AVONDALE
LONDON GROVE TOWNSHIP
BOROUGH OF AVONDALE
NEW GARDEN TOWNSHIP
BOROUGH OF AVONDALE
BOROUGH OF AVONDALE
LONDON GROVE TOWNSHIP
NEW GARDEN TOWNSHIP
RESERVOIR
MILLER
GENERAL PLAN
EXHIBIT A
HUTH ENGINEERS INC.
CHESTER COUNTY REDEVELOPMENT AUTHORITY
1 SOUTH CHURCH STREET
WATER DISTRIBUTION SYSTEM
FOR
BOROUGH OF AVONDALE

APPENDIX 4

WATER RESOURCES MAP

WATER RESOURCES MAP

AVONDALE BOROUGH

CHESTER COUNTY, PENNSYLVANIA

100 YEAR FLOODPLAIN (FROM FEMA FLOOD INSURANCE RATE MAP)

HYDRIC SOILS (FROM SOIL SURVEY CHESTER AND DELAWARE COUNTIES, PENNSYLVANIA AND HYDRIC SOILS OF PENNSYLVANIA BY USDA SOIL CONSERVATION SERVICE)

WETLANDS (FROM NATIONAL WETLANDS INVENTORY)

HIGH YIELD AQUIFER (COCKEYSVILLE MARBLE FROM CHESTER COUNTY GEOLOGY MAPS)

SUBMINOR DRAINAGE BASINS (FROM NATURAL ENVIRONMENT AND PLANNING)
(ALL WITHIN EAST BRANCH MINOR BASIN
TO WHITE SUB-MAJOR BASIN TO CLAY MAJOR BASIN)

LINEAR FEATURES (FRACTURES) (FROM GROUND WATER RESOURCES OF CHESTER COUNTY, PENNSYLVANIA)

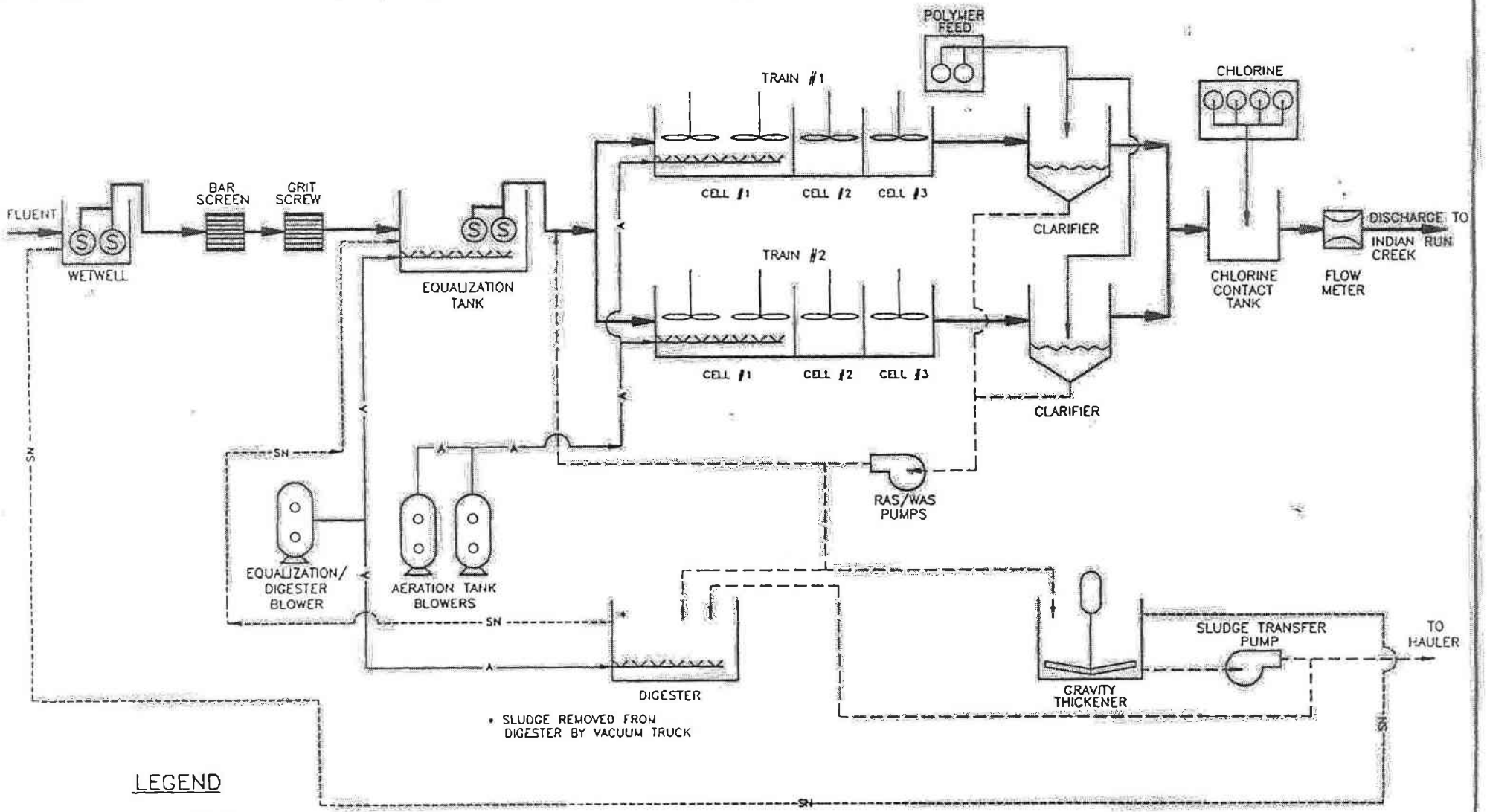
APPENDIX 5

SEWAGE COLLECTION SYSTEM MAP

AVONDALE BOROUGH
LONDON GROVE TOWNSHIP
NEW GARDEN TOWNSHIP
LEGEND
AVONDALE BOROUGH
NEW GARDEN TOWNSHIP
SSM
5685-004
D-100-0

APPENDIX 6

PROCESS FLOW DIAGRAM



PROCESS FLOW DIAGRAM

AVONDALE WASTEWATER TREATMENT PLANT					
FIGURE 1	AWA	CMH	—	—	1/14/97
	MADE	CHECK	APPROVALS		DATE
	NONE	5804-000-A-001			

SSM
SPOTTS, STEVENS and McCOY, INC.
ENGINEERS • PLANNERS • SCIENTISTS
P.O. BOX 6307
READING, PENNSYLVANIA

S:\5800\000\WK2359.DWG

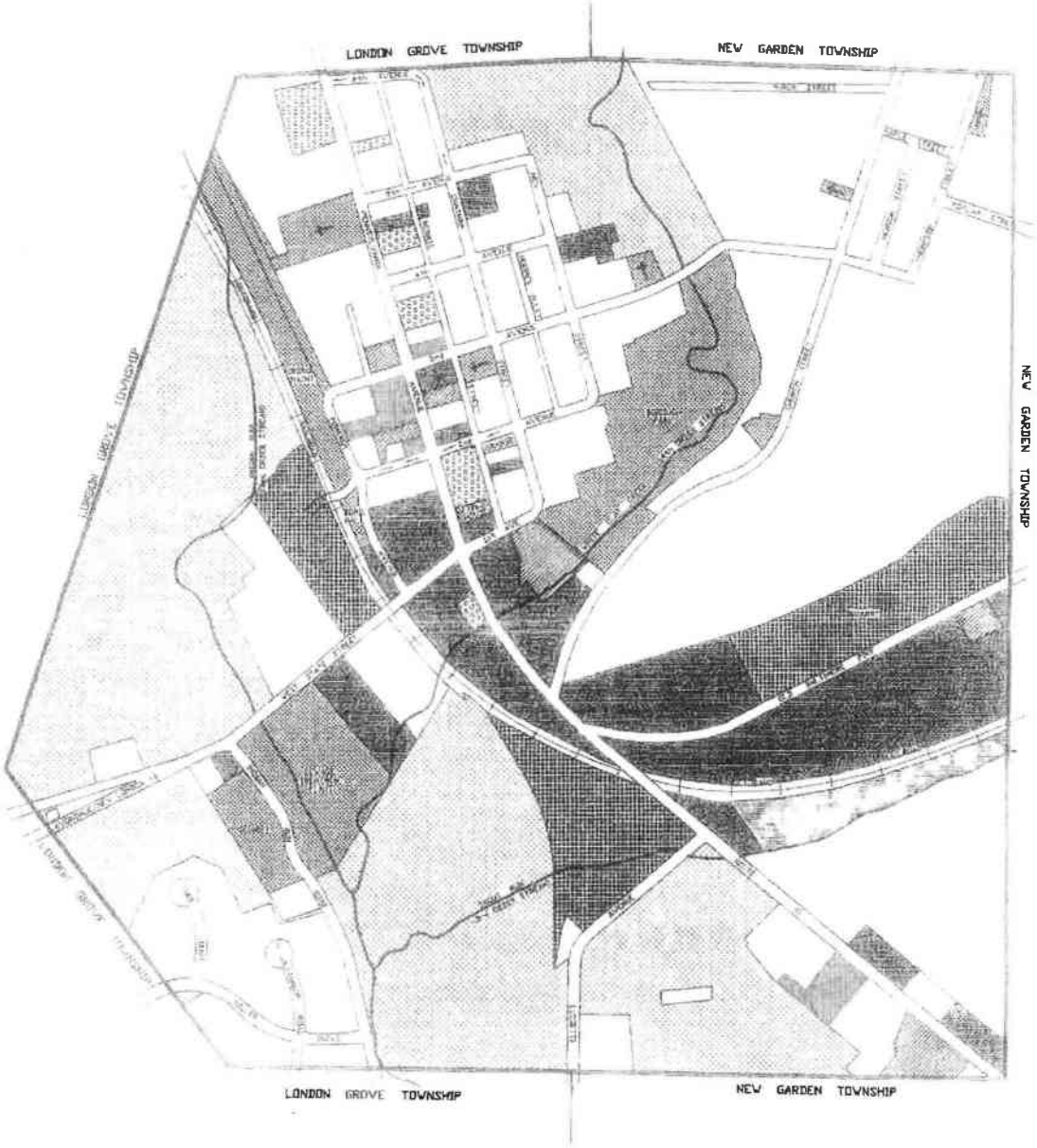
APPENDIX 7

EXISTING LAND USE MAP

EXISTING LAND USE MAP

AVONDALE BOROUGH

CHESTER COUNTY, PENNSYLVANIA



- ONE FAMILY RESIDENTIAL
- RESIDENTIAL WITH ACCESSORY APARTMENTS
- MULTIPLE FAMILY RESIDENTIAL
- RESIDENTIAL AND BUSINESS IN COMBINATION
- COMMERCIAL
- INDUSTRIAL
- AGRICULTURE
- PUBLIC AND QUASI PUBLIC
- OPEN LAND

GRAPHIC SCALE

200' 100' 0' 200' 400'

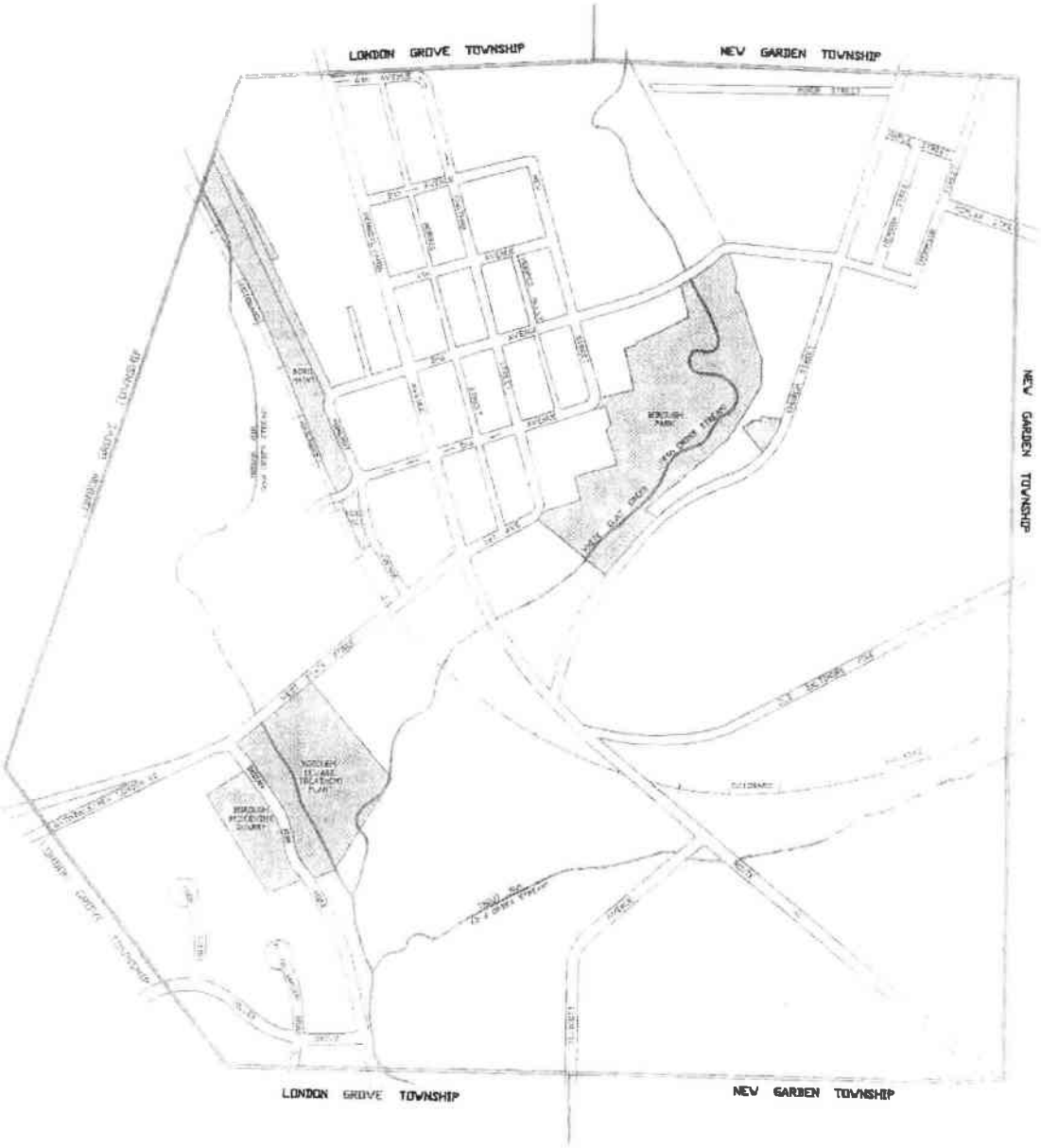
APPENDIX 8

PROTECTED MUNICIPAL LANDS MAP

PROTECTED MUNICIPAL LANDS MAP

AVONDALE BOROUGH

CHESTER COUNTY, PENNSYLVANIA



- PROTECTED MUNICIPAL LANDS

GRAPHIC SCALE

APPENDIX 9

CAPACITY STUDY FOR THE BOROUGH OF AVONDALE WASTEWATER TREATMENT PLANT

CAPACITY STUDY

BOROUGH OF AVONDALE
AVONDALE WASTEWATER TREATMENT PLANT

PREPARED FOR:
MILLER ENVIRONMENTAL, INC.

JANUARY 1997

5804-001

BOROUGH OF AVONDALE
AVONDALE WASTEWATER TREATMENT PLANT
CAPACITY STUDY

PREPARED FOR
MILLER ENVIRONMENTAL, INC.
902 COLONIAL DRIVE
BIRDSBORO, PENNSYLVANIA 19508

JANUARY 1997

5804-001

BOROUGH OF AVONDALE
AVONDALE WASTEWATER TREATMENT PLANT
CAPACITY STUDY

TABLE OF CONTENTS

1.0 Introduction

The purpose of this report was to define the capacity of the Avondale Wastewater Treatment Plant (WWTP). The capacity of the entire plant is based on the capabilities of the individual units. This reports reviews the capacities of the individual units.

The capacity of each unit was calculated based on the criteria of the Pennsylvania Department of Environmental Protection (PA DEP) and typical design requirements. The PA DEP criteria used were from "Domestic Wastewater Facilities Manual", DER #1357-8/91. Any typical design requirements used were documented in the report.

This report defines the capacity of each unit in terms of flow. However, some units derive their capacity from organic loading, solids loading or some other criteria. In these cases the criteria used was converted to hydraulic units using reasonable and documented assumptions. For example, many of the requirements for the aeration tanks are expressed in pounds of Biochemical Oxygen Demand (BOD) per day. To convert pounds of BOD to hydraulic terms the average BOD concentration (see Table 1) was used to back calculate flow. Flow in this report is expressed in terms of million gallons per day (mgd).

This report shows the units in the process that limit the overall capacity. All of the calculated flows were converted to Annual Average Flow (see Table 2) using peaking factors described in Section 2.0. By expressing all of the capacities in terms of Annual Average Flow the units were ranked from least to most. Ranking shows the weaker units compared to the overall capacity.

This report uses actual data taken from Discharge Monitoring Reports (DMRs), Chapter 94 reports and sampling data. The information used was collected from 1994 through 1996. The actual data includes BOD loading, Hydraulic loading and past performance. By using actual data a more accurate representation of the WWTP capabilities can be demonstrated.

1.1 Process Flow Scheme

Figure 1 shows a simplified process flow scheme.

The Avondale WWTP is located in the Borough of Avondale. The plant receives flow from Avondale and New Garden Township. Flow enters the plant at the wetwell inside the control building. The wastewater is pumped from the wetwell through a bar screen and a grit removal device. The flow is discharged to the aerated equalization tank. From the equalization tank it is pumped to a conventional activated sludge process.

The activated sludge process is a biological process used to remove the organic load from the wastewater. The activated sludge process is separated into two parallel treatment trains. Each train is broken into three cells. Each cell is equipped with a mechanical aerator and a diffused air system. Flow leaves the aeration cells and enters the clarifiers.

Each train has its own square clarifier. The clarifiers are used to separate the inert and biological solids from the wastewater.

The forward flow exits the clarifiers and enters the Chlorine Contact Tanks (CCT). The flow is disinfected in the CCT. The final effluent is discharged to Indian Run Creek.

Bio-solids removed from the clarifiers are transferred to either the aerobic digester, gravity thickener or returned to the head of the aeration tanks. The digester is used to destroy the volatile fraction of the bio-solids. The thickener is used to remove the excess water form the solids. Excess bio-solids are disposed off-site by a licensed hauler.

1.2 Past Performance

Table 1 shows organic and hydraulic data from the WWTP. The WWTP has been processing BOD and Ammonia without any significant problem. As shown on the summary table the average effluent concentrations are well below the permitted levels.

The WWTP has been having recent problems (1995 through 1996) with the parameters of Flow and Diazinon. The average flow from 1994 to the present is 0.351 mgd which is 0.051 mgd over the permitted capacity. Diazinon has been consistently reported as a violation. However, Diazinon will be excluded from the new NPDES permit (See Appendix B).

There have been problems with Copper. Most of the DMRs from 1995 show copper excursions. The source of the copper is unknown. The new permit calls for copper to be part of the next Toxic Reduction Evaluation (TRE).

Malathion has also been in exceedance. However, it does not appear on a consistent basis. The current TRE evaluation could not determine the source of the Malathion.

Other parameters such as BOD and Total Suspended Solids (TSS) have been intermittently over the permitted level. Typically it is the loading, calculated by flow, not the concentration which is the problem. Recently, this has been caused more by hydraulic conditions or upsets than the WWTP efficiency.

2.0 Hydraulic Loading

Hydraulic loading in this report is defined by four parameters. Annual Average Flow, Maximum Monthly Average Flow (MMAF), Peak Hourly Flow and Peak Instantaneous are used to estimate the hydraulic capacity of the WWTP. These terms and parameters are taken directly from the PA DEP "Domestic Wastewater Facilities Manual".

2.1 Annual Average Flow

Annual Average Flow is defined as the total flow received at the facility during any one calendar year divided by 365 days. This is typically considered the design flow and it is used to determine allowable mass loadings in the National Pollution Discharge Elimination System (NPDES) permit.

2.2 Monthly Average Flow

The Monthly Average Flow is defined as the total flow received at the facility during any one calendar month divided by the number of days in that month. This parameter is used in the DMR submitted to the PA DEP. This flow constitutes the permitted flow. The WWTP is currently permitted for a Monthly Average Flow of 0.300 mgd.

Table 1 shows the Monthly Average flow rate from 1994 through December of 1996. The average of the Monthly Average Flow rate is 0.351 mgd. This is 0.051 mgd over the permitted flow.

2.3 Maximum Monthly Average Flow

The Maximum Monthly Average Flow (MMAF) is the highest monthly average flow during any one calendar year. The MMAF is used to determine the overall hydraulic design of the WWTP.

Table 1 shows all of the MMAF. 1994 had a MMAF of 0.440 mgd, 1995 had 0.328 mgd and 1996 had a MMAF of 0.642 mgd. The average of these MMAF is 0.470 mgd. This is 1.57 times greater than the permitted flow. Since the units will be compared to the permitted Annual Average Flow, a peaking factor of 1.57 will be used to convert MMAF to Monthly Average Flow.

2.4 Peak Hourly Flow

The Peak Hourly Flow is defined as the maximum flow rate received at the facility averaged over a period of one hour. The Peak Hourly Flow is used to size clarifiers, CCTs and other hydraulically sensitive units.

In the absence of actual documented values at the WWTP for Peak Hourly Flow, a correlation to monthly average flow will be used. The most recent edition of "Wastewater Engineering" by Metcalf and Eddy, suggests an hourly peaking factor of 4.0 for average flows of 0.351 mgd. The calculated Peak Hourly Flow is:

0.351 mgd * 4.0 = 1.404 mgd

However, based on the permitted Annual Average Flow the Peak Hourly is:

0.300 mgd * 4.0 = 1.200 mgd

2.5 Peak Instantaneous

Peak Instantaneous is defined as the maximum instantaneous flow rate received at the facility at any given time. The Peak instantaneous is used to design comminutors, pump stations, piping and other units subject to peak flow conditions.

Very little information is available to correlate Peak Instantaneous to the Monthly Average Flow. For the purposes of this report it can be assumed that the Peak Instantaneous occurs during the Peak Hourly. Based on the small size of the system, past experience, and the current problems with Inflow and Infiltration (I/I) it is assumed that the Peak Instantaneous is twenty percent greater than the peak hourly. The Peak Instantaneous is calculated to be:

1.20 * 1.404 mgd = 1.685 mgd
based on the average flow from 1994 through 1996

The Peak Instantaneous based on the permitted flow is 1.20 * 1.20 mgd = 1.440 mgd

3.0 Organic Loading

Typically organic loads are described in terms of BOD. Chapter 94 reports and DMRs both use BOD to illustrate capacity or loading. This report also uses BOD to define loading. However, in addition to BOD, Ammonia as Nitrogen is also used. Specifically, Ammonia as Nitrogen is used in determining the capacity of the aeration tanks.

The removal of Ammonia requires the proper amount of oxygen and a long enough aeration detention time. This report uses Ammonia nitrogen loadings to verify the capacity of the WWTP to meet this demand.

3.1 Average and Maximum Daily BOD

Table 1 shows the BOD loading from 1994 through December 1996. The average influent BOD concentration was 146.8 mg/l. Some of the data for 1996 was not available. However, enough data was available to characterize the BOD load to the plant.

There is no data on the maximum daily BOD. This report assumes a BOD peaking factor of fifty percent. This value was taken from Environmental Protection Agency's (EPA) design manual for "Fine Pore Aeration Systems" (EPA/625/1-89/023). The calculated maximum daily BOD is:

$$146.8 \text{ mg/l} * 1.50 = 220.2 \text{ mg/l}$$

3.2 Average and Maximum Daily Ammonia Loading

There is only a small amount of data on influent Ammonia to the WWTP. The data was collected from October of 1996 to the present. The data shows the average influent ammonia concentration to be 17.5 mg/l.

The limited data was used for this report. The Average influent Ammonia is less than typical Ammonia values. Most designs assume an influent concentration of 25 mg/l. However, the average influent BOD was also lower than expected. This confirms that the influent wastewater is organically weaker in strength than typical domestic wastewater.

The maximum daily ammonia was calculated in the same way as the peak BOD. Assuming an organic peaking factor of 1.50 the peak influent Ammonia is:

$$17.5 \text{ mg/l} * 1.5 = 26.3 \text{ mg/l}$$

4.0 Treatment Unit Capacity Review

All of the significant process equipment was reviewed. All of the data on the equipment was researched from original drawings or actual field measurements were taken. The units were reviewed in the order they appear in the process scheme.

4.1 Wetwell and Raw Sewage Pumps

The wetwell is located in the basement of the control building. The wetwell is separated into two tanks. Each tank has a working volume of approximately 700 gallons. The flow is split between the two tanks with slide gates and a splitter box. There is a valve and pipe which allows the two tanks to be connected.

Each side of the wetwell is equipped with a Fairbanks Morse vertical sewage pump. Each pump is rated for 500 gpm at 35 feet of Total Dynamic Head (TDH). When both pumps are running they have a combined capacity of approximately 700 gpm.

The design criteria for wetwells is based on maximum retention time. PA DEP requires that the retention time in the wetwell cannot exceed 10 minutes based on MMAF. Retention time for a wetwell was calculated using the following formula:

$$T = V/i + V/(q-i)$$

Where:

T = time (minutes)
V = wetwell volume (gallons)
i = inflow rate (gpm)
q = pump capacity (gpm)

The maximum allowable inflow rate was solved for by using a wetwell volume of 1,400 gallons, a maximum retention time of 10 minutes and a combined pump capacity of 700 gpm. The maximum allowable inflow rate was calculated to be 507 gpm or 0.730 mgd.

The PA DEP requirement for wetwell pumps is that each pump shall be capable of Peak Instantaneous Flow. Each pump is rated for 500 gpm or 0.720 mgd.

4.2 Bar Screen

The bar screen is located in a channel 24.5 inches wide by a depth of 1'-10". The approximate slope of the channel is 0.009 ft./ft.. PA DEP guidelines require the approach velocity to the bar screen to be greater than 1.25 fps and less than 3.00 fps at Peak Instantaneous Flow.

The approach velocity is calculated using the following formula:

$$v = 1.49/n * (R_h)^{2/3} * S^{1/2}$$

Where:

v = velocity (fps)
n = roughness coefficient (0.013 for this case)
R_h = hydraulic Radius
S = slope

Using this formula it was determined that the maximum allowable Peak Instantaneous Flow is 0.650 mgd at an approach velocity of 3.0 fps. However, even at this flow the normal hydraulic depth is calculated to be approximately 2 inches.

4.3 Grit Removal System

The grit removal system is a Link-Belt Company, Inclined screw type 30, with washing nozzle. The screw is located in the same channel as the bar screen. The volume of the screw chamber is approximately 570 gallons depending on the water depth.

The PA DEP requirement for the grit screw is to maintain velocities of 1 fps or less during normal flow conditions. Based on the average depth and width of the chamber the grit screw has an approximate capacity of 3.60 mgd before exceeding the 1 fps requirement.

4.4 Equalization Tank and Pumps

The equalization tank is a partially buried steel tank with a storage volume of 80,000 gallons. The tank is equipped with two submersible pumps rated for 220 gpm at 12.6 TDH. The tank has a diffused air system that has the capacity to deliver 160 scfm.

Equalization tanks must meet three criteria established by the PA DEP. The following is a list of the criteria:

1. The aeration system must be sufficient to maintain a Dissolved Oxygen (D.O.) concentration of 1.0 mg/l.

2. The aeration system must be sufficient to supply 1.25 scfm per 1,000 gallons of tank capacity.

3. The aeration system/blower must be separate from the other aeration processes at the WWTP.

Several calculations were done to determine the aeration systems ability to maintain a D.O. concentration of 1.0 mg/l. Appendix A shows the assumptions and equations used for the oxygen transfer calculations. Using a Standard Oxygen Transfer Efficiency (SOTE) of 10 percent (this is based on information from EPA Design Manual EPA/625/1-89/023), a density of air of 0.0752 lbs./ cu. ft., an oxygen percentage in air of 22 percent and a flow rate of 160 scfm the Standard Oxygen Transfer Rate (SOTR) was calculated.

160 scfm * 10% * 0.0752 lbs./cu. ft. * 22% * 1440 min./day = 381 lbs. O_2/day

The SOTR was converted to an Oxygen Transfer Rate (OTR) using the equation and assumptions in Appendix A. The OTR was calculated to be 173.07 lbs./day. The OTR was converted to units of flow using the following calculation.

173.07 lbs. O_2/day/(8.341 * 1.0 mg/l) = 20.7 mgd

This assumes that the influent concentration to the equalization tank is zero and must be raised to a concentration of 1.0 mg/l.

The second criteria reviewed the air flow rate per 1,000 gallons of equalization tank. The equalization tank is 80,000 gallons. The air flow rate is 160 scfm. Therefore:

160 scfm/80,000 gallons/1,000 gallons = 2.0 scfm/1,000 gallons

This is greater than the requirement of 1.25 scfm/1,000 gallons.

The equalization tank does not meet the third criteria. The blower for the equalization tank is also shared with the digester. Depending on the level in the equalization tank, the air may not be appropriately distributed. This criteria by itself may not be a limiting factor. Adequate plant performance could justify a waiver of this single item.

Although there is no requirement for the forward flow pumps in the equalization tank their capacity was reviewed. The pumps can transfer 0.316 mgd individually and 0.444 mgd when combined.

4.5 Aeration Tanks

The aeration tanks are split into two parallel trains. Each train is divided into three cells. The first cells have both diffused air and mechanical aerators. The second and third cells have mechanical aerators only.

The following are the dimensions for each cell.

CELL	DIMENSIONS	VOLUME (gal.)
1	34' x 17' x 10.50' swd	45,402
2	15' x 17' x 9.97' swd	17,302
3	17' x 17' x 9.01' swd	19,480
	TOTAL	82,184

Combining both trains gives the plant a total aeration volume of 164,368 gallons.

The aeration capacity of the system comes from the coarse bubble diffusers in the first cells in each train and the mechanical aerators in each train. The following list specifies the equipment in the aeration tanks:

Quantity	Description
1	Coarse bubble diffused air system, rated for 540 scfm over first cells in each train
4	3 hp surface aerators, 2 aerators per first cell of each train
2	7.5 hp surface aerators, 1 aerator per second cell of each train
2	10 hp surface aerators, 1 aerator per second cell of each train

Aeration tanks are required to meet the following criteria.

1. Maintain a minimum hydraulic retention time of 12 hours based on MMAF.

2. Maximum allowable BOD loading at peak BOD is 20 lbs. BOD/1,000 cu. ft.

3. The Food to Microorganism (F/M) shall not exceed 0.16.

4. Maintain a minimum aeration rate of 1,500 scfm per pound of BOD at the maximum daily loading.

Based on the first criteria the minimum hydraulic retention time of 12 hours was used to calculate the MMAF. The following is the calculation for the allowable MMAF.

164,368 gallons/12 hours = 13,697 gph or 0.329 mgd

Based on the second criteria the maximum allowable BOD at peak BOD loading is:

20 lbs. BOD/day/1,000 cu. ft. * 164,368 gallons/7.48 gal./cu. ft.
= 439 lbs. BOD/day

To convert the lbs. of BOD/day into a flow the peak BOD concentration of 220.2 mg/l was used. It is assumed that the peak BOD loading occurs during the Average Daily flow. Therefore, the following calculation converts the allowable pounds of BOD into maximum allowable Average Daily Flow.

439 lbs. BOD/day/220.2 mg/l/8.34 = 0.239 mgd

The F/M ratio described in the third criteria was checked using the actual average daily BOD concentration of 146.8 mg/l and a Mixed Liquor Volatile Suspended Solids (MLVSS) concentration of 2,800 mg/l. The aeration tanks hold 3,839 pounds of MLVSS. Therefore, the allowable daily pounds of BOD is calculated to be:

3,839 pounds MLVSS * 0.16 (F/M) = 614 lbs. BOD

Using the average concentration of 146.8 mg/l the Average Daily Flow was calculated to be:

614 lbs. BOD/8.34/146.8 mg/l = 0.501 mgd

The fourth criteria was not applied. The aeration tanks are a combination of diffused air and mechanical aerators. Applying a aeration flow rate requirement to a mixture of systems in not appropriate.

Besides the PA DEP criteria the aeration tanks must insure proper oxygen transfer. Proper oxygen transfer is defined as maintenance of a D.O. concentration of 2.0 mg/l or greater in the aeration tanks.

The oxygen transfer rate is the product of the mechanical aeration and the diffused air system. Based on information submitted in the Water Quality management Part II permit submitted for Avondale in May 1992, each mechanical aerator has an OTR of 1.70 lbs. O_2/hp*hr. The maximum OTR is based on all of the aerators in operation. The calculated oxygen transfer is:

1.70 lbs. O_2/hp*hr * 47 hp (total aerators) * 24 hrs./day = 1,917 lbs. O_2/day

The diffused air system has the capacity for 540 scfm. Using an SOTE of 10 percent, a standard density of air of 0.0752 lbs./cu. ft., a oxygen percentage in air of 22 percent and a flow rate of 540 scfm the calculated SOTR is 1,286 lbs. O_2/day. Using the calculations in Appendix A the OTR is 520 lbs. O_2/day.

The combined maximum capacity of the mechanical aerators and the diffused air system is:

$$1{,}917 \text{ lbs. } O_2/\text{day} + 520 \text{ lbs. } O_2/\text{day} = 2{,}437 \text{ lbs. } O_2/\text{day}$$

The average influent concentrations for BOD and Ammonia are 146.8 and 17.5 mg/l respectively. This converts to 1.22 lbs. of BOD per 1,000 gallons and 0.15 lbs. Of Ammonia per 1,000 gallons. Using an O_2 requirement of 1.10 lbs. of O_2 per lbs. of BOD and 4.60 lbs. of O_2 per lbs. of Ammonia the oxygen demand from the influent wastewater was calculated to be:

$$1.22 \text{ lbs. } O_2/1{,}000 \text{ gal. } * 1.1 \text{ lbs. } O_2/\text{lbs. BOD} + 0.15 \text{ lbs. } NH_3/1{,}000 \text{ gal. } * 4.60 \text{ lbs. } O_2/\text{lbs. } NH_3 = 2.03 \text{ lbs. } O_2/1{,}000 \text{ gal.}$$

The capacity of the aeration tanks based on the oxygen transfer capacity and average hydraulic and organic loading is calculated to be:

$$2{,}437 \text{ lbs. } O_2/\text{day (OTR)}/2.03 \text{ lbs. } O_2/1{,}000 \text{ gal.} = 1.200 \text{ mgd}$$

This is based on the ultimate capacity of the aeration equipment. It should be noted that putting this much energy into the aeration tanks could disrupt the settling qualities of the floc.

4.6 Clarifiers

The clarifiers are attached to the end of the aeration tanks. The clarifiers are square with a circular bottom scraper. Each clarifier has a surface area of 221 sf, and a combined surface area of 442 sf. Each clarifier has a weir length of 38.4 feet and a combined length of 76.8 ft.

The following table shows the PA DEP requirements for the clarifiers.

	Average	Peak (based on Peak Hourly Flow)
Surface Overflow Rate (gpd/sq.ft.)	800	1,200
Solids Loadings (lbs./day/sf) based on wastewater and return sludge flow	40	50

Using the surface area and the given surface overflow rates the allowable Average Daily Flow and Peak Hourly Flow is calculated to be:

800 gpd/sq. ft. * 442 sq. ft. = 0.354 mgd

1,200 gpd/sq. ft. * 442 sq. ft. = .530 mgd

The average and Peak Daily Flow was also calculated using the solids loading rate. For the calculations it was assumed that the return flow was equal to the forward flow and the Mixed Liquor Suspended Solids (MLSS) concentration was 4,000 mg/l. The allowable average flow was calculated to be:

40 lbs./sq. ft./day * 442 sq. ft./8.34/4,000 mg/l * .50 (account for return sludge)
= 0.265 mgd

The allowable peak flow was calculated to be:

50 lbs./sq. ft./day * 442 sq. ft./8.34/4,000 mg/l * .50 (account for return sludge)
= 0.331 mgd

In addition to the surface loading rates, clarifiers must also satisfy weir loading rates. The PA DEP requirement is no more that 10,000 gpd/lf based on the MMAF. Using this guideline the calculated MMAF is:

76.8 lf * 10,000 gpd/lf = 0.768 mgd

4.7 Chlorine Contact Tank

The CCTs have a total volume of 8,140 gallons. The minimum allowable contact period, based on the MMAF is 30 minutes. Therefore, the allowable MMAF is calculated to be:

8,140 gallons/30 minutes = 271.3 gpm = 0.391 mgd

The minimum allowable contact period based on Peak Hourly flow is 15 minutes. Therefore, the allowable Peak Hourly flow is calculated to be:

8,140 gallons / 15 minutes = 542.7 gpm = 0.781 mgd

The chlorine dosage requirements for a nitrified effluent are 6 mg/l. The chlorinators have a capacity of 100 lbs./day. The flow that can be properly disinfected is calculated to be:

100 lbs./day/8.34/6 mg/l = 2.00 mgd

4.8 Gravity Sludge Thickener

The gravity sludge thickener receives flow from the Return Activated Sludge (RAS) pumps. The gravity sludge thickener has a diameter of 15.3 ft or a surface area of 185 sq. ft. The thickener, based on PA DEP requirements, has a maximum hydraulic loading of 800 gal./day/sq. ft. and a solids loading rate of 12 lbs./day/sq. ft.

The calculated hydraulic capacity is:

185 sq. ft. * 800 gal./day/sq. ft. = 148,000 gpd

Assuming a waste sludge concentration of 0.8 percent solids, 9,876 pounds of sludge can be wasted per day. This report assumed a yield coefficient (lb. MLSS Created/lb. BOD Destroyed) of 0.60. This was based on general design criteria and information taken from WPCF Manual of Practice No.8. Using the yield coefficient of 0.60 the waste sludge was converted to BOD loading.

9,876 pounds MLSS/day/0.60 lb. MLSS/lb. BOD = 16,460 lbs. BOD/day

Based on the average influent BOD concentration the BOD was converted to a flow.

16,460 lbs. BOD/day/8.34/146.8 mg/l = 13.4 mgd

The same process was applied to the solids loading criteria of 12 lbs. MLSS/ sq. ft./day. The maximum solids loading was calculated to be:

12 lbs. MLSS/ sq. ft./day * 185 sq. ft. = 2,220 lbs. MLSS/day

Using the yield coefficient this converts to:

2,220 lbs. MLSS/day/0.60 lb. MLSS/lb. BOD = 3,700 lb. BOD/day

This is also translated into units of flow.

3,700 lbs. BOD/day/8.34/146.8 mg/l = 3.02 mgd

4.9 Aerobic Digester

The aerobic digester has a working of volume of 20,000 gallons. The digester is provided aeration at a rate of 80 scfm from the blower also used by the equalization tank. The air is dispersed with coarse bubble diffusers. Please note, the calculations for this unit are based on sludge being sent directly to the digester without being processed in the gravity sludge thickener.

The Domestic Wastewater Facilities Manual outlines four requirements for aerobic digesters.

1. The aeration system must provide 30 scfm per 1,000 cu. ft.

2. The aeration system must maintain a D.O. concentration of 2.0 mg/l.

3. MLVSS loading to the Digester can be no greater than 100 lbs. per 1,000 cu. ft.

4. The solids retention time in the Digester must be 15 days or greater.

The digester meets the first criteria. The required air flow rate is calculated to be:

20,000 gal./7.481 gal./cu. ft. * 30 scfm/1,000 cu. ft. = 80.2 scfm

The capacity of the aeration system to meet the second requirement is illustrated in Appendix A. The calculated OTR is 77 lbs. O_2/day. Using the following formula (Biological Process Design for Wastewater Design, Benefield et al. 1985, pg. 492) the Capacity of the Digester was calculated.

OTR = 2.0 lbs. O_2/MLVSS destroyed * 8.34 * Q * R * 0.77 * MLVSS

Where:

OTR = Oxygen Transfer Rate Required
Q = Flow to Digester in mgd
R = Reduction of MLVSS fraction during digestion (assumed to be 35 percent)
MLVSS = Mixed Liquor Volatile Suspended Solids in Digester feed (assumed to be 5,600 mg/l)

Note: 2.0 lbs. O_2/MLVSS was used to account for nitrification as per EPA design manual 625/1-79-011.

Using the assumptions, Q was calculated to be 3,058 gallons of sludge per day. Using the average influent BOD concentration, a yield coefficient of 0.60 lb. MLSS/lb. BOD, a MLSS concentration of 8,000 mg/l the allowable flow was calculated to be:

3,058 gal./day * 0.8 percent solids * 8.34 lbs./gal. = 204 lbs. MLSS/day

204 lbs. MLSS/day/0.60 lb. MLSS/lb. BOD/146.8 mg/l BOD/8.34 =
0.277 mgd

The third criteria requires the MLVSS to be no greater than 100 lb./1,000 cu.ft.. Assuming a yield coefficient of 0.60 and an average influent BOD concentration of 146.8 mg/l the calculated hydraulic capacity based on the digester is 0.364 mgd.

To determine the maximum flow allowable while maintaining a solids retention time of 15 days an iterative solution was used. A mass balance was constructed around the digester to begin the solution. To complete the process it was assumed that the yield coefficient was 0.60 lb. MLSS/lb. BOD, the VSS destruction was 35 percent and a significant amount of the solids were disposed of instead of being discharged with the supernatant. Using this process it was determined that the allowable flow to the WWTP is 0.361 mgd.

4.10 RAS Pumps

The criteria for the RAS pumps is that they must have the capacity to deliver 50 to 150 percent of the forward flow based on the MMAF. The current pumps are rated for 160 gpm individually and 320 gpm combined. Based on this information the MMAF is:

320 gpm / 1.50 * 1440 minute/day = 0.307 mgd

4.11 WAS Pump

The WAS pump must deliver a maximum of 25 percent of the average forward flow. The pump is rated for 145 gpm. Therefore the allowable average forward flow is:

145 gpm/0.25 = 580 gpm or 0.835 mgd

5.0 Conclusions and Recommendations

A review of the hydraulic data shows the WWTP to be hydraulically overloaded. The average flow from 1994 through 1996 is 0.051 mgd over the permitted flow. The excess flow is coming from Inflow and Infiltration (I/I). It has recently been determined that approximately 0.100 mgd in excess flow may be attributed to a direct leak from the water supply system to the collection system. The excess flow places large demands on the WWTP capabilities.

A large portion of the past exceedances were attributed to hydraulic overloading. The TSS excursions were typically caused by either high flows washing solids from the system or loading violations based on mass. Effluent concentrations of BOD and Ammonia only increased due to wash outs of the system. The only other consistent permit exceedances were flow and Diazinon. However, Diazinon is expected to be a monitor only parameter.

The WWTP has organic capacity. The information in Table 1 shows a consistent removal of BOD and Ammonia. BOD has an average effluent concentration of 10.2 mg/l. The average effluent Ammonia concentration is 1.3 mg/l. These averages are well below their permitted concentrations of 25 mg/l and 2 mg/l (summer) respectively.

The aeration tank is the main reason that the WWTP has organic capacity. The information in Table 2 shows that they can handle an average flow of over 0.500 mgd when running at full capacity. Although other criteria shows the aeration tank capacity to be less than 0.239 mgd these criteria do not take into account the equalization tank. Because of the equalization tank hydraulic retention time and peak BOD loading are not as significant.

The clarifiers and the CCT are the weakest link. Both of these units are sensitive to large variations in flow. As can be seen in Table 2 the clarifiers are the most limiting unit. This is significant considering the large function clarifiers play in the treatment process. In addition recent DMRs show minor exceedances for Fecal Coliform. Proper chlorination will be more significant since the new permit has a limit for Total Residual Chlorine.

The following is a list of recommendation based on the findings of this report.

1. The Borough of Avondale should focus their resources on the remediation of the I/I. By decreasing the I/I the performance of the WWTP will improve. Demonstrating improved performance is a basis for rerating the WWTP.

2. Plan on upgrading the clarifiers and CCT. These units are the most limiting to the capacity of the WWTP. By increasing their capacity it is estimated that the WWTP can be increased to a Annual Average Flow of 0.500 mgd or greater. It is estimated that the addition of 2,300 S.F. to the clarifiers and 13,000 gallons to the CCT would accomplish this.

3. The capacity of the raw sewage and RAS pumps should be increased. Besides the clarifiers and the CCT these items contribute the most significantly to the process. Based on the information in Table 2 these units are undersized. The raw sewage pumps need 1,200 gpm more capacity, and the RAS pumps need 600 gpm more capacity. This is based on an Annual Average Flow of 0.500 mgd.

TABLE 1

ORGANIC AND HYDRAULIC STATISTICS

SUMMARY
TABLE 1
ORGANIC and HYDRAULIC STATISTICS

	MINIMUM	AVERAGE	MAXIMUM	PERMIT VALUE
Monthly Average Flow (mgd)	0.250	0.351	0.642	0.300
Influent BOD (mg/l)	88.0	146.8	215.0	
Average Effluent BOD (mg/l)	3.0	10.2	21.0	25
Average BOD Percent Removal	84%	92%	98%	
Influent Ammonia (mg/l)	13.7	17.5	22.2	
Average Effluent Ammonia (mg/l)	0.2	1.3	6.6	6 winter 2 summer
Average Ammonia Percent Removal	98%	98%	98%	

TABLE 1 (cont.)
ORGANIC and HYDRAULIC STATISTICS

Year	1994	1994	1994	1994	1994	1994	1994	1994	1994	1994	1994	1994
Month	January	February	March	April	May	June	July	August	September	October	November	December
Monthly Average Flow (mgd)	0.320	0.360	0.440	0.430	0.360	0.290	0.260	0.260	0.270	0.250	0.330	0.250
Influent BOD (mg/l)	143.0	140.0	123.0	152.0	101.0	178.0	121.0	130.0	170.0	177.0	175.0	187.0
Average Effluent BOD (mg/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average BOD Percent Removal	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Influent Ammonia (mg/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Effluent Ammonia (mg/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Ammonia Percent Removal	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND - No Data Available

TABLE 1 (cont.)
ORGANIC and HYDRAULIC STATISTICS

Year	1995	1995	1995	1995	1995	1995	1995	1995	1995	1995	1995	1995
Month	January	February	March	April	May	June	July	August	September	October	November	December
Monthly Average Flow (mgd)	0.270	0.274	0.294	0.261	0.270	0.280	0.250	0.283	0.276	0.310	0.328	0.296
Influent BOD (mg/l)	117.0	118.0	130.0	112.0	88.0	215.0	117.0	101.0	160.0	184.0	148.0	143.0
Average Effluent BOD (mg/l)	6.0	16.0	14.0	12.0	14.0	12.0	7.0	4.0	10.0	3.0	16.0	8.0
Average BOD Percent Removal	95%	86%	89%	89%	84%	94%	94%	96%	94%	98%	89%	94%
Influent Ammonia (mg/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Effluent Ammonia (mg/l)	2.5	5.7	6.3	6.6	1.3	0.2	0.9	0.2	0.3	0.3	0.3	0.8
Average Ammonia Percent Removal	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND - No Data Available

TABLE 1 (cont.)
ORGANIC and HYDRAULIC STATISTICS

Year	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996	1996
Month	January	February	March	April	May	June	July	August	September	October	November	December
Monthly Average Flow (mgd)	0.399	0.413	0.437	0.500	0.472	0.430	0.417	0.438	0.385	0.453	0.441	0.642
Influent BOD (mg/l)	ND	ND	ND	ND	ND	ND	ND	ND	215.0	131.8	189.3	145.3
Average Effluent BOD (mg/l)	15.0	17.0	13.0	15.0	6.0	3.0	6.0	3.0	21.0	6.7	7.0	10.4
Average BOD Percent Removal	ND	ND	ND	ND	ND	ND	ND	ND	90%	95%	96%	93%
Influent Ammonia (mg/l)	ND	ND	ND	ND	ND	ND	ND	ND	17.8	13.7	22.2	16.4
Average Effluent Ammonia (mg/l)	0.7	0.5	0.7	0.8	0.4	0.2	0.2	0.3	0.3	0.3	0.4	0.3
Average Ammonia Percent Removal	ND	ND	ND	ND	ND	ND	ND	ND	98%	98%	98%	98%

ND - No Data Available

TABLE 2

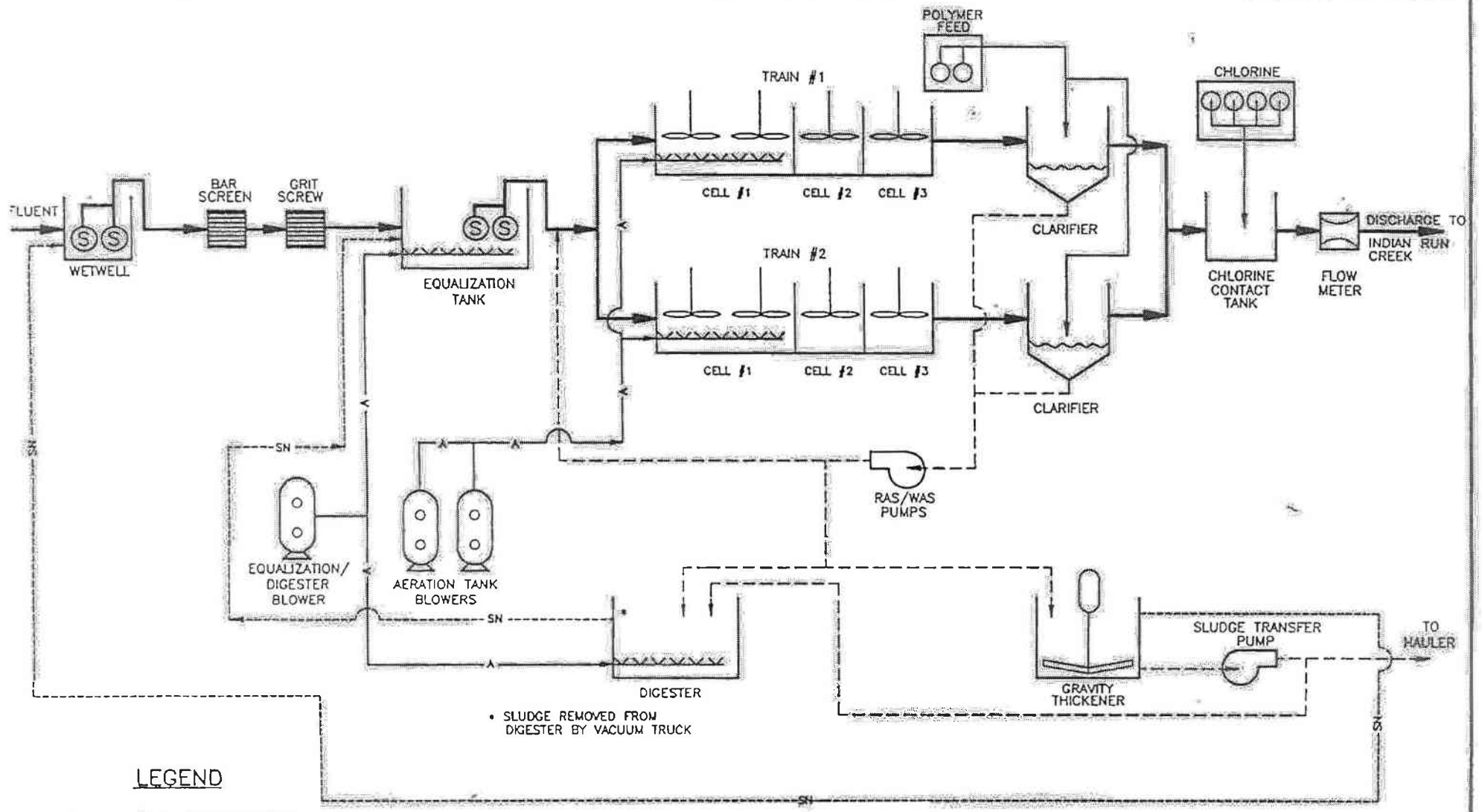
SUMMARY OF UNIT CAPACITIES

TABLE 2
Summary of Unit Capacities
AVONDALE WWTP
AVONDALE, PENNSYLVANIA

Unit	PADEP Criteria	Calculated Capacity	Peaking Factor	Equivalent Annual Average Flow
Clarifiers	Solids Loading Rate not to exceed 50 lbs./day/sf based on Peak Hourly Flow	0.331 mgd	4	0.083 mgd
Clarifiers	Surface Overflow Rate not to exceed 1,200 gpd/sq. ft. based on Peak Hourly Flow	0.530 mgd	4	0.133 mgd
Bar Screen	Approach velocity to screen must be less than 3.0 fps and greater than 1.25 fps at Peak Instantaneous Flow	0.650 mgd	4.8	0.135 mgd
Raw Sewage Pumps	Each pump shall be capable of Peak Instantaneous flow	0.720 mgd	4.8	0.150 mgd
Chlorine Contact Tank	15 minutes retention time at the Peak Hourly	0.781 mgd	4	0.195 mgd
RAS Pumps	Deliver 150 percent of the forward flow based on the MMAF	0.307 mgd	1.57	0.196 mgd
Aeration Tanks	Maintain hydraulic retention time of 12 hours at MMAF	0.329 mgd	1.57	0.210 mgd
Aeration Tanks	Maximum CBOD loading is 20 lbs. per 1,000 cu. ft.	0.239 mgd	1	0.239 mgd
Chlorine Contact Tank	30 minutes retention time at the MMAF	0.391 mgd	1.57	0.249 mgd
Clarifiers	Solids Loading Rate not to exceed 40 lbs./day/sf based on Average Flow	0.265 mgd	1	0.265 mgd
Aerobic Digester	Maintain a D.O. concentration of 2.0 mg/l	0.277 mgd	1	0.277 mgd
Clarifiers	Surface Overflow Rate not to exceed 800 gpd/sq. ft. based on Average Flow	0.354 mgd	1	0.354 mgd
Grit Screw	Average approach velocity less than 1 fps	0.360 mgd	1	0.360 mgd
Aerobic Digester	Solids retention time of 15 days	0.361 mgd	1	0.361 mgd
Aerobic Digester	MLVSS loading of no greater than 100 lb/ 1,000 cu. ft.\day	0.364 mgd	1	0.364 mgd
Wetwell	10 minute retention at MMAF	0.730 mgd	1.57	0.465 mgd
Clarifiers	Weir loading rate of 10,000 gpd/lf based on MMAF	0.768 mgd	1.57	0.489 mgd
Aeration Tanks	F/M not to exceed 0.16	0.501 mgd	1	0.501 mgd
WAS Pumps	Deliver 25 percent of the Average forward flow	0.835 mgd	1	0.835 mgd
Aeration Tanks	Maintain D.O. concentration of 2.0 mg/l at all times	1.200 mgd	1	1.200 mgd
Chlorine Contact Tank	6 mg/l dosage rate at all times	2.00 mgd	1	2.00 mgd
Gravity Sludge Thickener	Solids loading rate of 12 lbs./day/sf	3.02 mgd	1	3.02 mgd
Gravity Sludge Thickener	Hydraulic loading rate of 800 gal/day/sf	13.40 mgd	1	13.40 mgd
Equalization Tank	Maintain a D.O. concentration of 1.0 mg/l or greater	20.7 mgd	1	20.7 mgd

FIGURE 1

PROCESS FLOW DIAGRAM



LEGEND

- WASTEWATER FLOW
- SLUDGE FLOW
- ----SN---- SUPERNATANT FLOW
- —— A —— AIR
- CHLORINE OR POLYMER SOLUTION
- ←— OR —→ DIRECTION OF FLOW
- (S) SUBMERSIBLE PUMP
- CENTRIFUGAL PUMP

PROCESS FLOW DIAGRAM

AVONDALE
WASTEWATER TREATMENT PLANT

FIGURE 1

SSM
SPOTTS, STEVENS and McCOY, INC.
ENGINEERS • PLANNERS • SCIENTISTS
P.O. BOX 6307
WYOMISSING, PENNSYLVANIA

AWA	CMH				1/14/97
MADE	CHECK	APPROVALS			DATE
NONE	5804-000-A-001				
SCALE					

Z:\5804000\W2309.DWG

APPENDIX A

AIR CALCULATIONS

The following equation was used to determine all oxygen transfer calculations for this report.

$SOTR = OTR * C_{\infty 20} / F*\alpha* \theta^{(T-20)} * (\tau*\beta*\Omega*_{C\infty 20}-C)$

SOTR = Standard Oxygen Transfer Rate

OTR = Actual Oxygen Transfer Rate

α = Alpha

F = Fouling Correction Factor

θ = Theta

T = Wastewater Temperature (Celsius)

C = Dissolved Oxygen Concentration Required

Ω = Omega = Barometric Pressure (site) / Barometric Pressure (sea level)

τ = Tau = Saturation D.O. at Design Temperature / Saturation D.O. at 20°C

β = Beta

$C_{\infty 20}$ = D.O. Saturation Concentration at 20°C

C = Required D.O. Concentration

Oxygen Transfer Calculations
Equalization Tank

SOTE (based on Coarse Bubble Diffusion)	10.0%
Density of Air	0.0752
Percentage Oxygen in Air	22.0%
SCFM	160.0
SOTR (lbs/day)=	381
Alpha=	0.75
Fouling Correction Factor (F)=	0.7
Theta (typically 1.024)=	1.024
Temperature (C) =	20
Site Atm. Press. (psi)=	14.6
Std. Atm Press.(psi)=	14.7
D.O. Saturation Concentration at site Temp. (mg/l)=	10.5
D.O. Saturation Concentration at 20 C (mg/l)=	10.5
Omega=	0.99
Tau=	1.00
Beta=	0.97
Required D.O. Concentration (mg/l)=	1.0
OTR (lbs/day)=	173.07

Oxygen Transfer Calculations
Aeration Tanks

SOTE (based on Coarse Bubble Diffusion)	10.0%
Density of Air	0.0752
Percentage Oxygen in Air	22.0%
SCFM	540.0
SOTR (lbs/day)=	1,286
Alpha=	0.75
Fouling Correction Factor (F)=	0.7
Theta (typically 1.024)=	1.024
Temperature (C) =	20
Site Atm. Press. (psi)=	14.6
Std. Atm Press.(psi)=	14.7
D.O. Saturation Concentration at site Temp. (mg/l)=	10.5
D.O. Saturation Concentration at 20 C (mg/l)=	10.5
Omega=	0.99
Tau=	1.00
Beta=	0.97
Required D.O. Concentration (mg/l)=	2.0
OTR (lbs/day)=	519.80

Oxygen Transfer Calculations
Aerobic Digester

SOTE (based on Coarse Bubble Diffusion)	10.0%
Density of Air	0.0752
Percentage Oxygen in Air	22.0%
SCFM	80.0
SOTR (lbs/day)=	191
Alpha=	0.75
Fouling Correction Factor (F)=	0.7
Theta (typically 1.024)=	1.024
Temperature (C) =	20
Site Atm. Press. (psi)=	14.6
Std. Atm Press.(psi)=	14.7
D.O. Saturation Concentration at site Temp. (mg/l)=	10.5
D.O. Saturation Concentration at 20 C (mg/l)=	10.5
Omega=	0.99
Tau=	1.00
Beta=	0.97
Required D.O. Concentration (mg/l)=	2.0
OTR (lbs/day)=	77.01

APPENDIX B

DRAFT NPDES PERMIT

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER MANAGEMENT PROGRAM

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

DRAFT

DEC 13 1996

NPDES PERMIT NO. PA 0025488

In compliance with the provisions of the Clean Water Act, 33 U.S.C. Section 1251 et seq. (the "Act") and Pennsylvania's Clean Streams Law, as amended, 35 P.S. Section 691.1 et seq.,

Avondale Borough Sewer Authority

is authorized to discharge from a facility located at

West State Street
Avondale, PA 19311

Municipality Avondale Borough County Chester

to receiving waters named Unnamed Tributary to East Branch White Clay Creek (Indian Run)

In accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts A, B, and C hereof.

THIS PERMIT SHALL EXPIRE AT MIDNIGHT, _____

The authority granted by this permit is subject to the following further qualifications:

1. If there is a conflict between the application, its supporting documents and/or amendments and the terms and conditions of this permit, the terms and conditions shall apply.

2. Failure to comply with the terms, conditions, or effluent limitations of this permit is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

3. Complete application for renewal of this permit, or notification of intent to cease discharging by the expiration date, must be submitted to the Department at least 180 days prior to the above expiration date (unless permission has been granted by the Department for submission at a later date), using the appropriate NPDES permit application form.

   In the event that a timely and complete application for renewal has been submitted and the Department is unable, through no fault of the permittee, to reissue the permit before the above expiration date, the terms and conditions of this permit, including submission of the Discharge Monitoring Reports, will be automatically continued and will remain fully effective and enforceable pending the grant or denial of the application for permit renewal.

4. This NPDES permit does not constitute authorization to construct or make modifications to wastewater treatment facilities necessary to meet the terms and conditions of this permit.

DATE PERMIT ISSUED _____ ISSUED BY _____

DATE PERMIT AMENDMENT ISSUED _____ TITLE: Regional Manager
Water Management

DATE EFFECTIVE _____

DISCHARGE REQUIREMENTS FOR PUBLICLY OWNED TREATMENT WORKS (POTWs) Permit No. PA0[illegible]488

PART A - EFFLUENT LIMITATIONS, MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

1. For Outfall 001, Latitude 39°49'18", Longitude 75°47'06", River Mile Index 1.7, Stream Code 00449

a. The permittee is authorized to discharge during the period from issuance through expiration

b. Based on the anticipated wastewater characteristics and flows described in the permit application and its supporting documents and/or amendments, the following effluent limitations and monitoring requirements apply (see also Additional Requirements, Footnotes and Supplemental Information on page 2d).

DRAFT

Discharge Parameter	Effluent Limitations								Monitoring Requirements		
	Mass Units (lbs/day)(1)			Concentrations (mg/l)							
	Average Monthly	Average Weekly	Max. Daily	Inst. Min.	Average Monthly	Average Weekly	Max. Daily	Inst. Max.	Minimum Measurement Frequency	Required Sample Type	24 Hour Report Under A3.C(4)
FLOW (MGD)	Monitor/ Report								Continuous	Recorded	
CBOD$_5$	63	94			25	40		50	1/Week	24 HC	
SUSPENDED SOLIDS	75	113			30	45		60	1/Week	24 HC	
AMMONIA AS N (5-1 TO 10-31)	5.0	7.5			2.0	3.0		4.0	1/Week	24 HC	
AMMONIA AS N (11-1 TO 4-30)	15	23			6.0	9.0		12.0	1/Week	24 HC	
FECAL COLIFORM					200/100 ml				1/Week	Grab	
DISSOLVED OXYGEN				2.0					Daily	Grab	
pH				6.0				9.0	Daily	Grab	
TOTAL RESIDUAL CHLORINE					0.5			1.3	Daily	Grab	

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 001

Re 30 (KAL)255.45

DISCHARGE REQUIREMENTS FOR PUBLICLY OWNED TREATMENT WORKS (POTWs) Permit No. PA0 488

PART A - EFFLUENT LIMITATIONS, MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

1. For Outfall 001, Latitude 39°49'18", Longitude 75°47'06", River Mile Index 1.7, Stream Code 00449

a. The permittee is authorized to discharge during the period from issuance through four years from permit issuance

b. Based on the anticipated wastewater characteristics and flows described in the permit application and its supporting documents and/or amendments, the following effluent limitations and monitoring requirements apply (see also Additional Requirements, Footnotes and Supplemental Information on page 2d).

DRAFT

Discharge Parameter	Effluent Limitations								Monitoring Requirements		
	Mass Units (lbs/day)(1)				Concentrations (mg/l)						
	Average Monthly	Average Weekly	Max. Daily	Inst. Min.	Average Monthly	Average Weekly	Max. Daily	Inst. Max.	Minimum Measurement. Frequency	Required Sample Type	24 Hour Report Under A3.C(4)
COPPER	0.11				0.045			0.11	1/Week	24 HC	
ZINC	1.0				0.40			1.0	1/Week	24 HC	
LINDANE					0.00006			0.00015	1/Week	24 HC	
4,4'-DDD					0.000001				1/Week	24 HC	
MALATHION					Monitor/ Report				1/Month	24 HC	
DIAZINON					Monitor/ Report				1/Month	24 HC	

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 001

* See Part C, Other Requirement No. 8

Re 30 (KAL)255.46

PART A - EFFLUENT LIMITATIONS, MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

I. For Outfall 001, Latitude 39°49'18", Longitude 75°47'06", River Mile Index 1.7, Stream Code 00449

a. The permittee is authorized to discharge during the period from four years from permit issuance through expiration

b. Based on the anticipated wastewater characteristics and flows described in the permit application and its supporting documents and/or amendments, the following effluent limitations and monitoring requirements apply (see also Additional Requirements, Footnotes and Supplemental Information on page 2d).

DRAFT

Discharge Parameter	Effluent Limitations								Monitoring Requirements		
	MassUnits (lbs/day)[1]			Concentrations (mg/l)							
	Average Monthly	Average Weekly	Max. Daily	Inst. Min.	Average Monthly	Average Weekly	Max. Daily	Inst. Max.	Minimum Measurement Frequency	Required Sample Type	24 Hour Report Under A3.C(4)
COPPER *	0.033				0.013			0.033	1/Week	24 HC	
ZINC *	0.20				0.081			0.20	1/Week	24 HC	
LINDANE					0.00006			0.00015	1/Week	24 HC	
4,4'-DDD **					0.000001				1/Week	24 HC	
MALATHION					Monitor/ Report				1/Month	24 HC	
DIAZINON					Monitor/ Report				1/Month	24 HC	

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 001

** See Part C, Other Requirement No. 8

Rc 30 (KAL)255.47

APPENDIX 10

TOXICS REDUCTION EVALUATION REPORT

TOXICS REDUCTION EVALUATION

BOROUGH OF AVONDALE
AVONDALE WASTEWATER TREATMENT PLANT

PREPARED FOR:
MILLER ENVIRONMENTAL, INC.

FEBRUARY 1997

Note: Appendices F and G of this document (industrial wastewater users questionnaire and responses) have been omitted from this copy of the TRE to reserve space within the Act 537 Plan document. This information can be provided upon request if needed for review.

5804-000

BOROUGH OF AVONDALE
AVONDALE WASTEWATER TREATMENT PLANT
TOXICS REDUCTION EVALUATION

PREPARED FOR
MILLER ENVIRONMENTAL, INC.
902 COLONIAL DRIVE
BIRDSBORO, PENNSYLVANIA 19508

FEBRUARY 1997

58004-000

BOROUGH OF AVONDALE
AVONDALE WASTEWATER TREATMENT PLANT

TABLE OF CONTENTS

1.0 Introduction

The Borough of Avondale discharges treated wastewater to the Indian Run Creek. The discharge is permitted under National Pollution Discharge Elimination System (NPDES) permit No. PA0025488. A draft version of the permit is included in Appendix A. Under conditions of the old permit a Toxic Reduction Evaluation (TRE) was to be conducted. The original TRE focused on the minimization of the following parameters:

Lindane
4,4 - DDD
Diazinon
Malathion
Methoxychlor

The original TRE report was finalized and submitted in October of 1995. In a letter from the Pennsylvania Department of Environmental Protection (PA DEP) the TRE report was considered late and inadequate (see Appendix B).

Between October of 1995 and August of 1996 the Borough Administration and the Wastewater Treatment Plant (WWTP) underwent staff revisions. Miller Environmental Inc., was hired to operate the Avondale WWTP. Miller Environmental retained Spotts, Stevens and McCoy \ SSM to complete the TRE report. This report was done on the behalf of the Borough of Avondale.

SSM conducted an initial inquest to determine the shortcomings of the original report. Based on conversations with the PA DEP and research, the original TRE was found to be lacking in the Phase II of the work. Phase II uses the findings from Phase I to create a compliance strategy and implementation schedule. This had not been fully completed.

As part of the Phase II work, the original report defined the sewage plant treatment effectiveness for toxics removal. However, the original report did not discuss the sewage treatment process for control of toxics, nor did it discuss the options and projected schedule for achieving the necessary control.

This report uses the finding of the original report to finalize the TRE. In addition this report expands on the findings of the original report to focus in on sources of the listed toxic substances.

1.1 Original Findings

The original report is included in appendix C.

The original report conducted a sufficient sampling program. All of the tributary basins in the collection system were isolated and sampled. The influent and effluent of the WWTP was also sampled. All of the sampling occurred from 1989 to 1995.

The results of the sampling showed Diazinon to be the only listed toxic substance found on a consistent basis. The sampling procedures and analytical methods in the original report were reviewed. All of the methods used were found to be consistent and appropriate.

This report accepts the findings of the original report. The focus of this report is on the minimization of Diazinon. Although other parameters do appear, their appearance is sporadic. Also, any of the initiatives applied to Diazinon will also be applied to compounds such as 4,4 - DDD and Malathion.

1.2 Additional Findings

Diazinon is a pesticide used predominantly by the mushroom growing industry in Avondale. Appendix D shows a chemical fact sheet for Diazinon. It is used to control flies. The flies transport a green mold to the mushroom growing bins. Green mold is detrimental to the mushrooms. Because the mold is a type of fungi and so are the mushrooms, a fungicide cannot be used.

The flies are present in larger numbers during the summer months. The use of Diazinon is mostly limited to use during the summer months. The sampling results of the original report verify this. Although some of the colder months show influent Diazinon, the concentrations to the WWTP increase from June through October.

SSM expanded the sampling work performed in the original report. Four grab samples were taken from both of the Borough's public water supply wells and from Indian Run Creek. The first stream sample was taken directly downstream of the WWTP effluent discharge pipe. The second stream sample was taken upstream of the WWTP. All of the samples had Diazinon concentrations less than the detection limit (see appendix E). It is reasonable to assume that Diazinon is limited to the mushroom growing industry. Detectable concentrations in either the wells or the stream would be an indication that the Diazinon was running off the fields or percolating into the groundwater.

1.3 Additional Source Investigation

The most likely time to detect Diazinon is during the summer months. This project started in the fall and winter months. It was assumed that a site specific sampling plan would probably not detect the Diazinon during the winter months. Also, Diazinon is an expensive parameter to analyze. To expend a large amount of capital to search for a parameter that was not likely to be present was not a prudent use of the Borough's limited funds. This was discussed with personnel from the PA DEP.

Instead of site specific sampling, a questionnaire was created. The questionnaire focused on pesticide use and disposal. A copy of the original questionnaire is in appendix F. The questionnaire was sent to all industries that discharge to the Avondale WWTP. The industrial users list was derived from the Borough's billing system.

Thirty-eight questionnaires were sent out via certified mail. At the time of this writing, 3 questionnaires were still outstanding. A follow up letter was sent to those individuals reminding them their response was late. The follow up letters were also sent via certified mail. The results of the survey concluded three things.

1. A large portion of the industrial users are in the mushroom growing industry. This includes packaging and spawning.

2. Based on the results of the questionnaire only one grower uses Diazinon.

3. The packaging and spawning industries do not use Diazinon. However through washing or reuse of mushroom soil, Diazinon can enter the collection system.

Included in appendix G is a copy of all of the returned questionnaires.

2.0 Compliance Strategy and Implementation Schedule

The compliance strategy focuses on the three entities contributing to the effluent quality of the WWTP. They include the Borough, the WWTP and the industrial users.

2.1 Compliance Strategy Pertaining to the Borough

The Borough has a sewer use ordinance, and provisions for limiting the discharge to the WWTP. However there are no specific guidelines pertaining to any type of pretreatment program. As a compliance strategy, a general pretreatment program is needed. The following are the guidelines for creating the pretreatment program.

2.1.1 Defined Industrial Users

The Borough of Avondale needs a formal definition of industrial or significant user. Many of the industries listed in appendix G are service industries, or have a limited discharge. These users may not discharge anything more than domestic wastewater. The intent of the definition should be to categorize those industries that could significantly effect the discharge of the WWTP.

The criteria for categorizing industrial users will be based on flow, discharge parameters and the users ability to upset the operations at the WWTP. The EPA has reference material that will be used during the definition process.

2.1.2 Revised Sewer Use Ordinance

The Borough Council of Avondale needs to control the wastewater sent to the WWTP. Control can be attained through an amendment to the sewer ordinance.

The proposed amendment would control the effluent by one of two methods. The first method would require semi-annual sampling by the dischargers. The alternative method would surcharge users based on their effluent quality. In addition, both methods would supply data on the characteristics of the wastewater discharged to the sewer. This information would be used to locate site specific wastewater characteristics.

2.1.3.1 Semi-Annual Sampling Requirements

The sampling program would be applied to the defined industrial or significant user. The sampling would occur twice a year. One of the samples would be required to be taken between and including the months of June and August. Sampling in the summer months would increase the likelihood of pinpointing sources of Diazinon.

The users would conduct the sampling at their expense. The sampling would be done on a 24 hour composite basis. The samples would be analyzed for those parameters found on the WWTP NPDES permit. All sampling results would be forwarded to the Borough.

Allowable effluent concentrations would have to be established prior to any sampling. Those dischargers who could not meet the discharge criteria would have to resample. Those dischargers who could not consistently meet the discharge criteria would be refused sewer service. The exact criteria and allowable number of violations would have to be determined if this alternative was selected.

Please note, those dischargers consistently meeting the criteria, could ask to be waived from further sampling. These dischargers would have to demonstrate a long term compliance before they could be waived. The exact requirements for a waiver would have to be determined if this option was selected.

In conjunction with the self-sampling program, the Borough would have to create a wastewater audit program. The program would randomly select a few industries and sample their effluent. The sampling would be done unannounced to provide representative samples. The Borough is authorized to do this type of unannounced sampling under the sewer ordinance.

2.1.3.2 Industrial Users Surcharge

The alternative to semi-annual sampling is to surcharge the industrial user. The surcharge would be charged based the characteristics of the wastewater compared to typical domestic wastewater. The stronger the wastewater compared to domestic wastewater, the higher the surcharge. Typical parameters for surcharge include the following:

Biochemical Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)
Total Suspended Solids (TSS)
Total Kjeldahl Nitrogen (TKN)

In addition to these parameters, all pesticides on the NPDES permit would be added to the list. Removal of pesticides increases the operation and maintenance cost of the WWTP. By surcharging for pesticides, the increased operation and maintenance costs are borne by those using them. If other pesticides became present on a consistent basis, they could be added to the list.

The surcharge sampling would have to be done by the Borough for billing purposes.

2.1.3.3 Borough Response to Industrial Users

Either of the methods proposed in the previous sections will affect the industrial users. They will have to budget for either sampling or a surcharge. For some users, the surcharge will probably be greater than their current fee.

Some of the mushroom growers may have to curtail the use of Diazinon or change their discharge practices. This will affect their business practices and their revenues. They will be entitled to an explanation of how and why these changes occurred.

The local industrial users will need to be educated on the reasoning behind these changes. The responsibility for educating the local industrial dischargers will be the Borough's. The Borough must plan an awareness and education meeting for the local dischargers.

2.2 Compliance Strategy Pertaining to the WWTP

The WWTP does not have a process unit specifically designed to remove Diazinon. As a by product of the activated sludge process, some of the Diazinon is removed. Modifications to the WWTP would be required to remove Diazinon from the effluent.

2.2.1 Existing Process Scheme

Figure 1 shows a simplified process flow scheme.

The Avondale WWTP is located in the Borough of Avondale. The plant receives flow from Avondale and New Garden Township. The flow enters the plant at the wetwell inside the control building. The wastewater is pumped from the wetwell through a bar screen and a grit removal device. The flow is discharged to the aerated equalization tank. From the equalization tank it is pumped to a conventional activated sludge process.

The activated sludge process is used to remove the organic load from the wastewater. The activated sludge process is separated into two parallel treatment trains. Each train is broken into three cells. Each cell is equipped with a mechanical aerator and or a diffused air system. Flow leaves the aeration cells and enters the clarifiers.

Each train has its own square clarifier. The clarifiers are used to separate the inert and biological solids from the wastewater.

The forward flow exits the clarifiers and enters the Chlorine Contact Tanks (CCT). The flow is disinfected in the CCT. The final effluent is discharged to Indian Run Creek.

Bio-solids removed at the clarifiers are transferred to either the aerobic digester, gravity thickener or returned to the head of the process. The digester is used to destroy the volatile fraction of the bio-solids. The thickener is used to remove the excess water form the solids. Excess bio-solids are disposed off-site by a licensed hauler.

2.2.2 WWTP Modifications to Remove Diazinon

Diazinon can be removed from domestic wastewater using Granular Activated Carbon (GAC) filters or Powdered Activated Carbon addition to Activated Sludge (PACT). Included in appendix H is removal efficiency information for GAC and PACT. The information is supplied from the Environmental Protection Agency's (EPA) Risk Reduction Environmental Laboratory (RREL) database.

If GAC filters were used, they would be inserted into the process after the CCT. Flow would be pumped from the CCT through the filters and discharged to Indian Run Creek.

GAC could present operational problems. Large amounts of solids passing through the system would foul the GAC unit. Microorganism from the aeration tanks could form colonies on the GAC. The colonies would clog the GAC units and limit flow. GAC units require regeneration and disposal. This would significantly increase the operating costs of the WWTP. GAC units would have to be reviewed in detail before they could be recommended.

PACT would require modifications to the Return Activated Sludge (RAS) pumps, Waste Activated Sludge (WAS) pumps and possibly the piping. Pact uses GAC in a powdered form. The GAC is added directly to the MLSS. The GAC becomes part of the MLSS. GAC is abrasive. As the MLSS is pumped and collected it would wear unprotected mechanical parts. Specialized pumps and increased maintenance would be required.

The advantage of PACT is increased removal of Diazinon. The GAC in the MLSS adsorbs the Diazinon. The adsorbed Diazinon is used as a source of energy by the microorganism in the MLSS. PACT is a more feasible approach to plant modifications than GAC.

The WWTP supports a Borough that is surrounded by agriculture. Most agricultural processes use pesticides. It is reasonable to assume that a WWTP in this position should have some mechanism that removes pesticides from the wastewater. Both GAC and PACT remove other pesticides (4,4 - DDD, Malathion) in addition to Diazinon.

The WWTP is currently going through a review process. The process examines the overall capacity of the WWTP. Modifications to the plant may be recommended due to this review. As part of this review, the addition of either GAC or PACT should be considered.

2.3 Compliance Strategy Pertaining to the Industrial Users

The most effective way to minimize Diazinon in the wastewater is to limit it at the source. The way to limit it at the source is through the application of best management practices. The following is a listing of practices that can limit Diazinon in industrial wastewater.

1. All employees who handle Diazinon must be educated on the proper disposal practices for unused portions of Diazinon. The manufacturer has specific methods of disposing of the chemicals. These practices must be applied to all pesticides.

2. Those individuals applying the Diazinon should be clothed in a disposable coverall. After applying the pesticide, the coverall is disposed of as solid waste. This will eliminate Diazinon being transported to the sewer system via showers or laundry facilities.

3. The drain system in the areas were the Diazinon is used should be capped or diverted from the sewer system. The collected flow can then be hauled or treated. The treated effluent can be discharged to the sewer.

These are the most apparent methods of reducing the discharge of Diazinon to the sewer system. In addition to these methods, a manufacturer of Diazinon is committed to helping with the education process. The manufacturer has educated users of pesticides throughout the country. Their expertise will supplement all of the other initiatives.

2.4 Compliance Schedule

The following is a schedule outlining the target dates for all of the initiatives.

February 18, 1997 - The TRE will be submitted to the Avondale Borough Council. At this time the definition of industrial users and the pretreatment program will be discussed.

April 15, 1997 - SSM provides draft definition of industrial user. SSM will explain what industries will be categorized and why. If required, the Borough Council will be given two weeks to agree on the definition. If Borough Council is satisfied with the definition, it can be adopted immediately.

June 17, 1997 - SSM provides draft sampling and surcharge program to the Avondale Borough Council. SSM will explain the basis of both programs and the anticipated costs or revenues from each program.

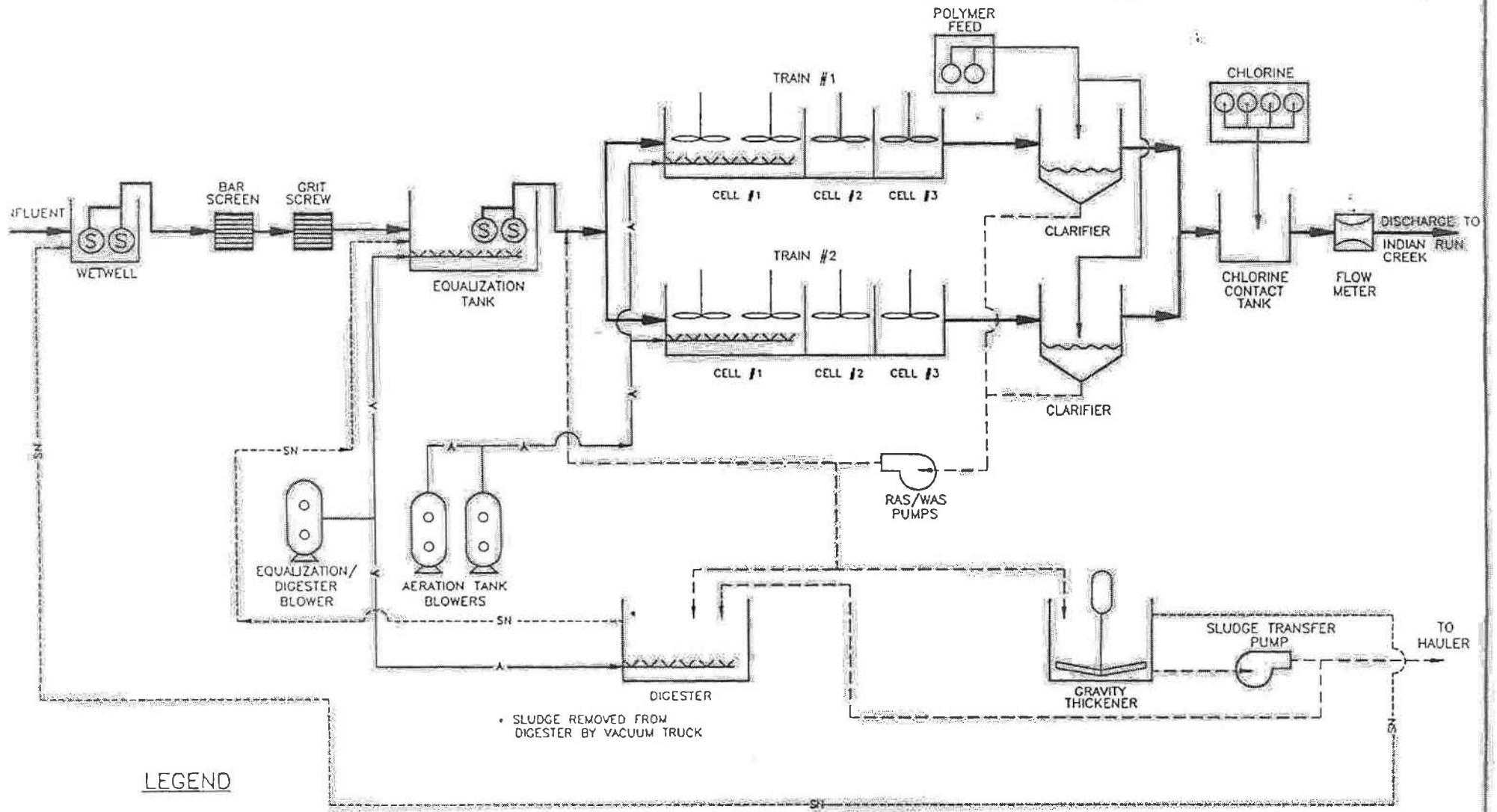
July 15, 1997 - Avondale Borough Council adopts one of the pretreatment programs.

August 1, 1997 - Avondale Borough Council drafts letter to local industries. The letter explains the reasons behind the pretreatment program. The letter also informs the user of the requirements that must be met. The letter also establishes a date for a question and answer session.

September 15, 1997 - Question and answer session at Borough Hall. This session will be used to educate the local industries on best management practices and explain the basis of the program. The best management practices will be supported by information from pesticide manufacturers.

December 1, 1997 - Pretreatment program is instituted.

June 1, 1998 - Review letter on the findings of the program submitted to PA DEP. The letter is intended to keep PA DEP updated on the results of the program.



LEGEND

- WASTEWATER FLOW
- SLUDGE FLOW
- SUPERNATANT FLOW
- AIR
- CHLORINE OR POLYMER SOLUTION
- DIRECTION OF FLOW
- SUBMERSIBLE PUMP
- CENTRIFUGAL PUMP

PROCESS FLOW DIAGRAM

AVONDALE
WASTEWATER TREATMENT PLANT

FIGURE 1

SSM
SPOTTS, STEWART and McCOY, INC.
ENGINEERS • PLANNERS • SCIENTISTS
P.O. BOX 6307
WYOMISSING, PENNSYLVANIA

MADE	CHECK	APPROVALS	DATE
AWA	CMH		1/14/97

SCALE	DRAWING NUMBER	REV.
NONE	5804-000-A-001	

C:\5804000\DWG\5804000-001.DWG

APPENDIX A - Draft NPDES Permit

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER MANAGEMENT PROGRAM

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

DRAFT

DEC 13 1996

NPDES PERMIT NO. PA 0025488

In compliance with the provisions of the Clean Water Act, 33 U.S.C. Section 1251 et seq. (the "Act") and Pennsylvania's Clean Streams Law, as amended, 35 P.S. Section 691.1 et seq.,

Avondale Borough Sewer Authority

is authorized to discharge from a facility located at

West State Street

Avondale, PA 19311

Municipality Avondale Borough County Chester

to receiving waters named Unnamed Tributary to East Branch White Clay Creek (Indian Run)

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts A, B, and C hereof.

THIS PERMIT SHALL EXPIRE AT MIDNIGHT, _____

The authority granted by this permit is subject to the following further qualifications:

1. If there is a conflict between the application, its supporting documents and/or amendments and the terms and conditions of this permit, the terms and conditions shall apply.

2. Failure to comply with the terms, conditions, or effluent limitations of this permit is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

3. Complete application for renewal of this permit, or notification of intent to cease discharging by the expiration date, must be submitted to the Department at least 180 days prior to the above expiration date (unless permission has been granted by the Department for submission at a later date), using the appropriate NPDES permit application form.

   In the event that a timely and complete application for renewal has been submitted and the Department is unable, through no fault of the permittee, to reissue the permit before the above expiration date, the terms and conditions of this permit, including submission of the Discharge Monitoring Reports, will be automatically continued and will remain fully effective and enforceable pending the grant or denial of the application for permit renewal.

4. This NPDES permit does not constitute authorization to construct or make modifications to wastewater treatment facilities necessary to meet the terms and conditions of this permit.

DATE PERMIT ISSUED _____ ISSUED BY _____

DATE PERMIT AMENDMENT ISSUED _____ TITLE: Regional Manager
Water Management

DATE EFFECTIVE _____

(KAL)255.40

PART A - EFFLUENT LIMITATIONS, MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

1. For Outfall 001 , Latitude 39°49'18" , Longitude 75°47'06" , River Mile Index 1.7 , Stream Code 00449

a. The permittee is authorized to discharge during the period from issuance through expiration

b. Based on the anticipated wastewater characteristics and flows described in the permit application and its supporting documents and/or amendments, the following effluent limitations and monitoring requirements apply (see also Additional Requirements, Footnotes and Supplemental Information on page 2d).

DRAFT

Discharge Parameter	Effluent Limitations								Monitoring Requirements		
	Mass Units (lbs/day)(1)			Concentrations (mg/l)							
	Average Monthly	Average Weekly	Max. Daily	Inst. Min.	Average Monthly	Average Weekly	Max. Daily	Inst. Max.	Minimum Measurement Frequency	Required Sample Type	24 Hour Report Under A3.C(4)
FLOW (MGD)	Monitor/ Report								Continuous	Recorded	
$CBOD_5$	63	94			25	40		50	1/Week	24 HC	
SUSPENDED SOLIDS	75	113			30	45		60	1/Week	24 HC	
AMMONIA AS N (5-1 TO 10-31)	5.0	7.5			2.0	3.0		4.0	1/Week	24 HC	
AMMONIA AS N (11-1 TO 4-30)	15	23			6.0	9.0		12.0	1/Week	24 HC	
FECAL COLIFORM					200/100 ml				1/Week	Grab	
DISSOLVED OXYGEN				2.0					Daily	Grab	
pH				6.0				9.0	Daily	Grab	
TOTAL RESIDUAL CHLORINE					0.5			1.3	Daily	Grab	

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 001

DISCHARGE REQUIREMENTS FOR PUBLICLY OWNED TREATMENT WORKS (POTWs) Permit No. PA0 [illegible]

PART A - EFFLUENT LIMITATIONS, MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

1. For Outfall 001 , Latitude 39°49'18" , Longitude 75°47'06" , River Mile Index 1.7 , Stream Code 00449

a. The permittee is authorized to discharge during the period from issuance through four years from permit issuance

b. Based on the anticipated wastewater characteristics and flows described in the permit application and its supporting documents and/or amendments, the following effluent limitations and monitoring requirements apply (see also Additional Requirements, Footnotes and Supplemental Information on page 2d).

DRAFT

Discharge Parameter	Effluent Limitations								Monitoring Requirements		
	MassUnits (lbs/day)(1)				Concentrations (mg/l)						
	Average Monthly	Average Weekly	Max. Daily	Inst. Min.	Average Monthly	Average Weekly	Max. Daily	Inst. Max.	Minimum Measurement. Frequency	Required Sample Type	24 Hour Report Under A3.C(4)
COPPER	0.11				0.045			0.11	1/Week	24 HC	
ZINC	1.0				0.40			1.0	1/Week	24 HC	
LINDANE					0.00006			0.00015	1/Week	24 HC	
4,4'-DDD *					0.000001				1/Week	24 HC	
MALATHION					Monitor/ Report				1/Month	24 HC	
DIAZINON					Monitor/ Report				1/Month	24 HC	

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 001

* See Part C, Other Requirement No. 8

Re 30 (KAL)255.46

PART A - EFFLUENT LIMITATIONS, MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

I. For Outfall 001 , Latitude 39°49'18" , Longitude 75°47'06" , River Mile Index 1.7 , Stream Code 00449

a. The permittee is authorized to discharge during the period from four years from permit issuance through expiration

b. Based on the anticipated wastewater characteristics and flows described in the permit application and its supporting documents and/or amendments, the following effluent limitations and monitoring requirements apply (see also Additional Requirements, Footnotes and Supplemental Information on page 2d).

DRAFT

Discharge Parameter	Effluent Limitations								Monitoring Requirements		
	MassUnits (lbs/day) (1)			Concentrations (mg/l)							
	Average Monthly	Average Weekly	Max. Daily	Inst. Min.	Average Monthly	Average Weekly	Max. Daily	Inst. Max.	Minimum Measure-ment Frequency	Required Sample Type	24 Hour Report Under A3.C(4)
COPPER *	0.033				0.013			0.033	1/Week	24 HC	
ZINC *	0.20				0.081			0.20	1/Week	24 HC	
LINDANE					0.00006			0.00015	1/Week	24 HC	
4,4'-DDD **					0.000001				1/Week	24 HC	
MALATHION					Monitor/ Report				1/Month	24 HC	
DIAZINON					Monitor/ Report				1/Month	24 HC	

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 001

** See Part C, Other Requirement No. 8

APPENDIX B - PA DEP Response Letter

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

- Please note our new name -
DEPARTMENT OF ENVIRONMENTAL PROTECTION
D E P
Lee Park, Suite 6010
555 North Lane
Conshohocken, PA 19428
February 16, 1996

Southeast Regional Office
610-832-6130
Fax 610-832-6259

Spencer J. Andress
Government Specialists, Inc.
59 S. Third Street
P.O. Box 336
Oxford, PA 19363-0336

Re: Avondale Borough Sewage Treatment Plant
NPDES Permit PA0025488
Avondale Borough
Chester County

Dear Mr. Andress:

This is in response to your submission of the Toxics Reduction Evaluation (TRE) report for the referenced facility received in our office on November 28, 1995. We have reviewed the report and have the following comments:

1. The report was submitted over three years late. The report was due in our office on August 27, 1992; within one year of permit issuance on August 27, 1991.

2. The final limits for the parameters studied in the TRE, Diazinon, Lindane, 4,4 DDD, Malathion and Methoxychlor have been in effect since August 27, 1994. There have been chronic compliance problems with Diazinon and occasional violations with 4,4 DDD and Malathion.

3. The results of your 1995 sampling program indicate that there is a high probability that higher than desirable levels of Diazinon are entering the collection system, however, the exact source(s) of the pollutant have not been determined.

4. The report recommends that the most efficient and cost effective manner of controlling the level of Diazinon is through aggressive source(s) monitoring and possibly pretreatment at the source(s).

5. The renewal application for this permitted discharge is due in our office on February 27, 1996, six months before the permit expires.

In light of the above comments, we request that you proceed with Phase II of the TRE as outlined in the 1993 TRE Guidance used to prepare your report. The Phase II TRE is due in our office twelve months from the date of this letter. Efforts should be made to locate and control sources of Diazinon. When the renewal application is submitted at the end of the month, we will reevaluate the effluent limits in the permit. It is likely that some of the parameters in your current permit, which have not been present in the effluent, will not be limited in the renewal permit.

If you have any questions, please contact Nancy Crickman of my staff.

Sincerely,

James Newbold
Chief, Permits Section
Water Management

cc: Mr. Goldberg
Mr. Piller
RE 30 (RN)45-7

APPENDIX C - Original Report

TRE

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PHASE I - SOURCE REDUCTION REVIEW

BACKGROUND

Introduction

On August 29, 1991 the Department of Environmental Resources granted a renewal of Authorization to Discharge Under The National Pollutant Discharge Elimination System (NPDES) and issued a permit accordingly. The current Permit Expires at midnight on August 29, 1996.

There are a multitude of operating requirements contained within the permit, as there are in every NPDES permit, one of which is the preparation of a Toxics Reduction Evaluation (TRE) report/program.

Basically the Toxics Reduction Evaluation has three main elements. First, to determine the actual quantity of toxic pollutants in the wastewater stream, second, to determine the source(s) of pollutants entering the wastewater stream and third, to formulate a program to reduce or eliminate the pollutants and prevent discharges that exceed permit limits.

This report presents the findings and conclusions that are the result of having undertaken the Toxics Reduction Evaluation.

Current NPDES Permit Parameters

The term *TOXIC POLLUTANT* is defined in the Department of Environmental Protection's regulations as *"Those pollutants, or combinations of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the Administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, including malfunctions in reproduction, or physical deformations in such organisms or their offspring."*

The current permit establishes discharge limitations on FREE CYANIDE, TOTAL ZINC, TOTAL COPPER, LINDANE and 4,4DDD, all of which are considered to be priority pollutants. Also included in the permit are DIAZINON, MALATHION and METHOXYCHLOR which are considered to be of concern.

Priority pollutants are the primary focus of concern because the EPA has determined them to be the most commonly used, persistent and toxic substances in wastewater discharges. They include many heavy metals and solvents. However, other pollutants are of concern and will be of interest.

The discharge limitations of DIAZINON, LINDANE, 4,4DDD, MALATHION and METHOXYCHLOR, as measured in mg/l, are established in two parts. The initial limitations were established for the first three years of the permit (8/27/91 to 8/27/94) while more stringent limitations were established for the last two years of the permit (8/28/94 to 8/28/96).

A copy of PART A of the permit regarding effluent limitations and monitoring requirements for discharge is included as Appendix A for reference.

Existing Wastewater Treatment Facilities

The Borough of Avondale Sewer Authority owns the sewage collection and treatment system. The Borough Council leases the system from the Authority and operates it.

The system was constructed in 1969 and 1970 and commenced operating in 1970. Planning for and construction of the system was a joint undertaking between the Borough of Avondale and New Garden Township. The system continues to serve both municipalities today. Based on the 1994 Chapter 94 report, the average daily flow originating in New Garden Township was 123,583 gallons or 40.3% of the total flow while the average daily flow originating in Avondale was 186,600 gallons or 59.7% of the total flow of 306,749 gallons/day.

The treatment facility is located along Avondale-New London Road near Indian Run Road. Discharge from the plant is to Indian Run which is a tributary to the White Clay Creek. The permitted hydraulic capacity of the plant is 300,000 GPD.

The treatment process provides secondary biological treatment with the complete mix activated sludge process with disinfection accomplished by chlorine contact prior to discharge.

The sewage treatment plant consists of a bar screen and grit chamber, four aeration tanks operated in two parallel trains, two parallel secondary clarifiers, two parallel chlorine contact tanks, two aerobic sludge digesting tanks and a sludge thickener tank.

In 1993, an 80,000 gallon flow equalization tank was added following the degritter, two of the aerobic digestion tanks were converted to diffused air aeration tanks, each clarifier weir length was extended and a 20,000 gallon sludge holding tank was added.

Since completion of the recent upgrades, the overall quality of the effluent has improved noticeably and the treatment process is more uniform and consistent.

A site plan, Drawing 1, showing the treatment components, before the recent modifications, is included as Appendix B. A site plan, Drawing 2, showing the treatment components, after the recent modifications, is also included as Appendix B.

INFLUENT/EFFLUENT QUALITY REVIEW

Review of Existing Data

During the years 1989, 1990 and 1991 an extensive amount of testing of the influent, effluent and sludge associated with the treatment process was conducted. The toxics (pesticides) tested were LINDANE, DIAZINON, MALATHION, 4,4DDD and METHOXYCHLOR. The data are presented in the following tables; Table 1 lists the test results of the influent and effluent sampling regiment and Table 2 lists the test results of the sludge sampling.

The tables show that virtually all but one of the monitored toxics have been consistently below the detectable limits of the laboratory testing equipment. Excluding DIAZINON, there were only 4 sample results out of 108 total samples analyzed and reported that exceeded detectable limits.

Efforts were made to locate the source(s) of DIAZINON entering the system and to eliminate or reduce its presence. That effort was successful as evidenced by the data.

The data in Table 3, although a different format, is a continuation of the tabulation of the results of on-going sampling of the listed pesticides. Data from Table 2 for the years 1989, 1990 and a part of 1991 are again presented in Table 3 along with additional data for the years 1991 and 1992. The samples from 01/09/90 through 04/02/91 fall within the period of time during which the old NPDES permit was in force. The samples from 11/06/91 through 11/06/92 fall within the period of time during which the current NPDES permit was in force.

During the period 01/09/90 through 12/10/91 there were 19 separate samples of influent to the plant analyzed for each of the listed pesticides. For LINDANE, 15 of the 19 samples (79%) were below detectable limits, for DIAZINON, 2 of the 19 (11%) samples were below detectable limits, for MALATHION 18 of the 19 (95%) were below detectable limits, for 4,4DDD, 19 of the 19 (100%) were below detectable limits and for METHOXYCHLOR, 17 of the 19 (90%) were below detectable limits. Of the 4 LINDANE samples above detectable limits, 2 were

:low the current NPDES permit limits (if that limit were to be applied to the influent) and 1 was equal to the limit (if that limit were to be applied to the influent). Of the 17 DIAZINON samples above detectable limits, 17 were above the current NPDES limit (if that limit were to be applied to the influent). The 1 MALATHION sample above detectable limits was also above the current NPDES permit limit (if that limit were to be applied to the influent). The 2 METHOXYCHLOR samples above detectable limits were also above the current NPDES permit limit (if that limit were to be applied to the influent).

During the period 01/09/90 through 11/06/92 there were 50 separate samples of effluent from the plant analyzed for each of the listed pesticides. For LINDANE, 18 of the 50 samples (36%) were below detectable limits, for DIAZINON, 35 of the 50 samples (70%) were below detectable limits, for MALATHION, 49 of the 50 samples (98%) were below detectable limits, for 4,4DDD, 25 of the 50 samples (50%) were below detectable limits and for METHOXYCHLOR, all 50 samples were below detectable limits. Of the 32 LINDANE samples above detectable limits, none were above the current NPDES permit limit. Of the 15 DIAZINON samples above detectable limits, all 15 were above the current NPDES permit limit. The 1 MALATHION sample above detectable limits was also above the current NPDES permit limit. Of the 25 4,4DDD samples above detectable limits, there is no maximum stated in the permit.

During the period 01/90/90 through 12/10/91 there were 42 separate samples of sludge from the plant analyzed for each of the listed parameters. Of the 42 samples for each of the pesticides LINDANE, DIAZINON and 4,4DDD, all 42 samples for each were below detectable limits. Of the 42 samples tested for MALATHION, 4 were above detectable limits and of the 42 samples tested for METHOXYCHLOR, 2 were above detectable limits. There are no NPDES permit limits established for the tested pesticides in sludge.

By way of summary, based on the data in Tables 1, 2 and 3, it appears that of the 5 tested pesticides in the influent stream, DIAZINON exceeded the NPDES permit limit for this pesticide if that limit were to be applied to influent. It also appears that of the 5 tested pesticides in the effluent stream, METHOXYCHLOR, MALATHION and LINDANE are

routinely below the NPDES permit limit for each, that DIAZINON exceeded the NPDES permit limit occasionally, however, the latest 25 of 27 samples are below detectable limits, and that 4,4DDD exceeded detectable limits but no specific concentration limit is established in the current NPDES permit. Because of the quality of the sludge sample matrix, it is not appropriate to draw any specific conclusions from the sludge data.

The overall conclusion, therefore, is that of the five listed toxics (pesticides), DIAZINON appears to be, both from an influent and effluent perspective, the one pesticide that has most often exceeded the current NPDES permit limit while the remaining four are generally below the current NPDES permit limits for each of them respectively.

Avondale WWTP Pesticides Sampling Summary

Date	Source	Lindane	Diazinon	Reduction	Malathion	DDD	Methoxychlor	% Water	% Solids
12/08/89	Influent	<0.05	30.1		<0.5	<0.05	<1.		
02/07/90	Influent	<0.02	12.6		<0.1	<0.02	<0.5		
03/07/90	Influent	<0.05	0.6		<0.2	<0.05	<1.		
06/06/90	Influent	<0.05	302		<0.2	<0.05	<1.		
07/03/90	Influent	<0.05	34		<0.2	<0.05	<1.		
08/07/90	Influent	<0.2	93		<0.2	<0.05	<1.		
09/04/90	Influent	<0.05	257		<0.3	<0.05	0.65		
10/02/90	Influent	<0.3	180		<0.3	<0.05	<1.		
11/12/90	Influent	<0.3	1.9		<0.3	<0.05	<0.2		
12/04/90	Influent	<0.3	2.6		<0.3	<0.05	<0.3		
03/05/91	Influent	<0.2	0.5		<0.1	<0.02	<0.5		
08/24/89	Effluent	<0.05	<0.5		<0.1	<0.05	<0.5		
09/08/89	Effluent	<0.05	<0.5		<0.2	<0.05	<0.5		
09/14/89	Effluent	<20.	<30.		<20.	<5.	<50.		
10/11/89	Effluent	<0.2	<2.		<1.	<0.05	<1.		
11/10/89	Effluent	<20.	<20.		<5.	0.8	16		
12/08/89	Effluent	<0.05	1.2	96%	<0.2	<0.05	<1.		
02/07/90	Effluent	<0.02	8.9	29%	<0.5	<0.02	<0.5		
03/07/90	Effluent	<0.05	18.8	N/A	<0.2	<0.05	<1.		
06/06/90	Effluent	<0.05	130	57%	<0.02	<0.05	<1.		
07/03/90	Effluent	<0.02	<0.5	100%	<0.1	<0.02	<0.5		
08/07/90	Effluent	<0.05	<1.0	100%	<0.2	<0.05	<1.0		
09/04/90	Effluent	0.14	<1.	100%	<0.1	<0.02	<0.4		
10/02/90	Effluent	<0.2	<2.	100%	<1.	<0.2	<4.		
11/12/90	Effluent	<0.1	<0.5	100%	<0.3	<0.05	<0.2		
12/04/90	Effluent	<0.1	<1.0	100%	0.9	<0.05	<0.3		
03/05/91	Effluent	<0.2	<0.5		<0.1	<0.02	<0.5		
08/07/90	RR Meter Pit		350						

Table 2

Avondale WWTP Pesticides Sampling Summary

Date	Source	Lindane	Diazinon	Reduction	Malathion	DDD	Methoxychlor	% Water	% Solids
12/08/89	Sludge (A R)	<0.05	<0.5		<0.5	<0.05	<0.5	97.4%	2.6%
02/07/90	Sludge (A R)	<0.02	<0.2		<0.1	<0.02	<0.1	95.6%	4.4%
03/07/90	Sludge (A R)	<0.02	<0.2		<0.1	<0.02	<0.1	98.0%	2.0%
06/06/90	Sludge (A R)	<0.02	<0.5		<0.1	<0.02	<0.1	98.6%	1.4%
07/03/90	Sludge (A R)	<0.03	<0.3		<0.2	<0.03	<0.2	99.1%	0.9%
08/07/90	Sludge (A R)	<0.02	<0.4		<0.1	<0.02	<0.1	97.0%	3.0%
09/04/90	Sludge (A R)	<0.3	<0.6		<0.1	<0.03	<0.1	97.9%	2.1%
10/02/90	Sludge (A R)	<0.02	<0.2		<0.1	<0.02	<0.1	98.4%	1.6%
11/12/90	Sludge (A R)	<0.02	<0.2		<0.1	<0.02	<0.1	98.4%	1.6%
12/04/90	Sludge (A R)	<0.03	<0.3		<0.2	<0.03	<0.2	98.7%	1.3%
03/05/91	Sludge (A R)	<0.03	<0.3		<0.2	<0.03	<0.2	98.9%	1.1%
12/08/89	Sludge (D W)	<2.	<20.		<20.	<2.	<20.	97.4%	2.6%
02/07/90	Sludge (D W)	<0.5	<5.		<2.	<0.5	<2.	95.6%	4.4%
03/07/90	Sludge (D W)	<1.	<10.		<5.	<1.	<5.	98.0%	2.0%
06/06/90	Sludge (D W)	<1.	<40.		<7.	<1.	<7.	98.6%	1.4%
07/03/90	Sludge (D W)	<3.	<30.		<20.	<3.	<20.	99.1%	0.9%
08/07/90	Sludge (D W)	<0.7	<10.		<3.	<0.7	<3.	97.0%	3.0%
09/04/90	Sludge (D W)	<10.	<30.		<10.	<1.	<10.	97.9%	2.1%
10/02/90	Sludge (D W)	<1.	<10.		<6.	<1.	<6.	98.0%	2.0%
11/12/90	Sludge (D W)	<1.	<10.		<5.	<1.	<5.	98.0%	2.0%
12/04/90	Sludge (D W)	<2.	<20.		<20.	<2.	<20.	98.7%	1.3%
03/05/91	Sludge (D W)	<3.	<30.		<20.	<3.	<20.	98.9%	1.1%

Table 3

HISTORICAL ANALYSIS OF EFFLUENT PARAMETER
AVONDALE WWTF

DATE	INFLUENT (ug/l)					EFFLUENT (ug/l)					SLUDGE (mg/kg) (95%H20)				
	LIND	DIAZ	MALA	DDD	METH	LIND	DIAZ	MALA	DDD	METH	LIND	DIAZ	MALA	DDD	METH
01/09/90	<0.02	13.0	<0.1	<0.02	<0.5	0.02	8.0	<0.1	<0.02	<0.5	<0.2	<2.	<1.	<0.2	1.
01/09/90											<0.01	<0.1	<0.05	<0.01	0.05
02/06/90	<0.02	12.6	<0.1	<0.02	<0.5	<0.02	8.9	<0.5	<0.02	<0.5	<0.02	<0.2	<0.1	<0.02	<0.1
03/06/90	<0.05	8.8	<0.2	<0.05	<1.	<0.05	0.6	<0.2	<0.05	<1.	<1.	<10.	<5.	<1.	<5.
03/06/90											<0.02	<0.2	<0.1	<0.02	<0.1
05/01/90	<0.05	62.	<0.2	<0.05	<1.	<0.02	1.3	<0.2	<0.02	<0.5	<0.02	<0.2	<0.05	<0.02	<0.1
05/01/90											<0.8	<8.	<2.	<0.8	<4.
06/06/90	<0.05	302.	<0.2	<0.05	<1.	<0.05	130.	<0.2	<0.05	<1.	<0.02	<0.5	<0.1	<0.02	<0.1
06/06/90											<1.	<40.	<7.	<1.	<7.
07/03/90	<0.05	<34.	<0.2	<0.05	<1.	<0.02	<0.5	<0.1	<0.02	<0.5	<3.	<30.	<20.	<3.	<20.
07/03/90											<0.03	<0.3	<0.2	<0.03	<0.2
08/07/90											<0.02	<0.4	<0.1	<0.02	<0.1
08/07/90											<0.7	<10.	<3.	<0.7	<3.
08/07/90											<0.02	<0.4	<0.2	<0.02	<0.1
09/04/90	<0.05	257.	<0.3	<0.05	0.65	0.14	<3.	<0.1	<0.02	<0.4	<10.	<30.	<10.	<1.	<10.
09/04/90											<0.3	<0.6	<0.2	<0.03	<0.2
10/02/90	<0.3	180.	<0.3	<0.05	<1.	<0.2	<2.	<1.	<0.2	<4.	<1.	<10.	<6.	<1.	<6.
10/02/90											<0.02	<0.2	<0.1	<0.02	<0.1
11/06/90	<0.2	6.3	0.3	<0.02	0.3	<0.02	<0.2	<0.1	<0.02	<0.1	<5.	<10.	<5.	<1.	<5.
11/06/90											<0.1	<0.2	<0.1	<0.02	<0.1
12/04/90	<0.3	2.6	<0.3	<0.05	<0.3	<0.1	<1.	0.9	<0.05	<0.3	<0.03	<0.3	<0.2	<0.03	<0.2
12/04/90											<2.	<20.	<20.	<2.	<20.
01/03/91	<0.05	0.9	<2.	<0.05	<1.	<0.05	<0.2	<0.1	<0.02	<0.4	<0.02	<0.2	<0.1	<0.02	<0.1
01/03/91											<1.	<10.	<7.	<1.	<7.
02/05/91	0.9	3.4	<1.	<0.05	<1.	<0.05	<0.5	<1.	<0.05	<1.	<1.	<10.	<9.	<1.	<9.
02/05/91											<0.03	<0.3	<0.2	<0.03	<0.2
03/05/91	<0.02	0.5	<0.1	<0.02	<0.5	<0.02	<0.5	<0.1	<0.02	<0.5	<3.	<30.	<20.	<3.	<20.
03/05/91											<0.03	<0.3	<0.2	<0.03	<0.2
04/02/91	<0.05	<3.	<0.3	<0.05	<1.	<0.05	<2.	<0.3	<0.05	<1.	<0.9	<9.	<5.	<0.9	<5.
04/02/91											<0.02	<0.2	<0.1	<0.02	<0.1
11/06/91						<0.01	0.2	<0.1	0.21	<0.2	<0.03	<0.3	<0.2	<0.03	<0.2
11/06/91											<3.	<30.	<20.	<3.	<20.
11/14/91	<0.01	0.4	<0.5	<0.01	<0.2	0.04	0.4	<0.05	<0.01	<0.2	<0.03	<0.3	<0.2	<0.03	<0.2
11/14/91											<4.	<40.	<30.	<4.	<20.
11/20/91	<0.06	0.6	<0.1	<0.02	<0.4	0.05	1.1	<0.05	<0.01	<0.2	<0.02	<0.2	<0.1	<0.02	<0.1
11/20/91											<1.	<10.	<7.	<1.	<7.
11/25/91	0.3	0.5	<0.05	<0.01	<0.05	0.03	1.0	<0.05	<0.01	<0.05	<0.03	<0.3	0.2	<0.03	<0.2
11/25/91											<3.	<20.	14.	<3.	<20.
12/03/91	0.03	0.4	<0.1	<0.02	<0.4	0.05	0.6	<0.05	<0.01	<0.2	<0.03	<0.3	<0.2	<0.03	<0.2
12/03/91											<3.	<30.	<20.	<3.	<20.
12/10/91	0.05	1.1	<0.05	<0.01	<0.05	0.05	0.4	<0.05	<0.01	<0.05	<2	<20.	14.	<2.	<10.
12/10/91											<0.03	<0.3	0.2	<0.03	<0.2
12/17/91						<0.05	<0.5	<0.3	<0.05	<0.3					
12/26/91						0.06	0.4	<0.05	<0.01	<0.05					
12/31/91						0.07	0.5	<0.05	<0.01	<0.05					
01/07/92						<0.01	<0.01	<0.05	<0.1	<0.05					
01/14/92						0.04	<0.01	<0.05	0.4	<0.05					
01/21/92						0.02	<0.01	<0.05	0.3	<0.05					
01/28/92						0.02	<0.01	<0.2	<0.1	<0.05					
02/04/92						0.01	<0.01	<0.2	0.4	<0.05					
02/11/92						0.03	<0.01	<0.2	0.6	<0.05					
02/18/92						0.01	<0.01	<0.2	1.1	<0.05					
02/25/92						0.06	<0.01	<0.2	0.7	<0.05					
03/03/92						0.03	<0.01	<0.2	0.6	<0.05					
03/10/92						0.02	<0.01	<0.05	0.6	<0.05					
03/17/92						<0.01	<0.01	<0.05	0.2	<0.05					
03/24/92						0.02	<0.01	<0.05	0.5	<0.05					
03/31/92						0.07	<0.01	<0.05	0.3	<0.05					
05/19/92						0.12	<0.01	<0.05	<0.1	<0.05					
06/02/92						0.02	<0.01	<0.05	0.3	<0.05					
06/09/92						0.03	<0.01	<0.05	0.2	<0.05					
07/01/92						0.02	<0.01	<0.05	0.3	<0.05					
07/14/92						<0.01	<0.01	<0.05	1.2	<0.05					
07/28/92						0.02	<0.01	<0.05	0.5	<0.05					
08/04/92						0.03	<0.01	<0.05	0.3	<0.05					
08/21/92						0.14	<0.01	<0.05	1.2	<0.05					
09/01/92						0.07	<0.01	<0.05	1.3	<0.05					
09/15/92						0.04	0.24	<0.8	0.8	<1.					
09/22/92						0.05	0.17	<0.05	0.2	<0.05					
10/06/92						0.03	<0.02	<0.05	0.3	<0.05					
10/20/92						0.05	<0.01	<0.05	0.3	<0.05					
11/06/92						<0.01	<0.01	<0.05	0.3	<0.05					

Prior Permit - Monitor Only

Current Permit

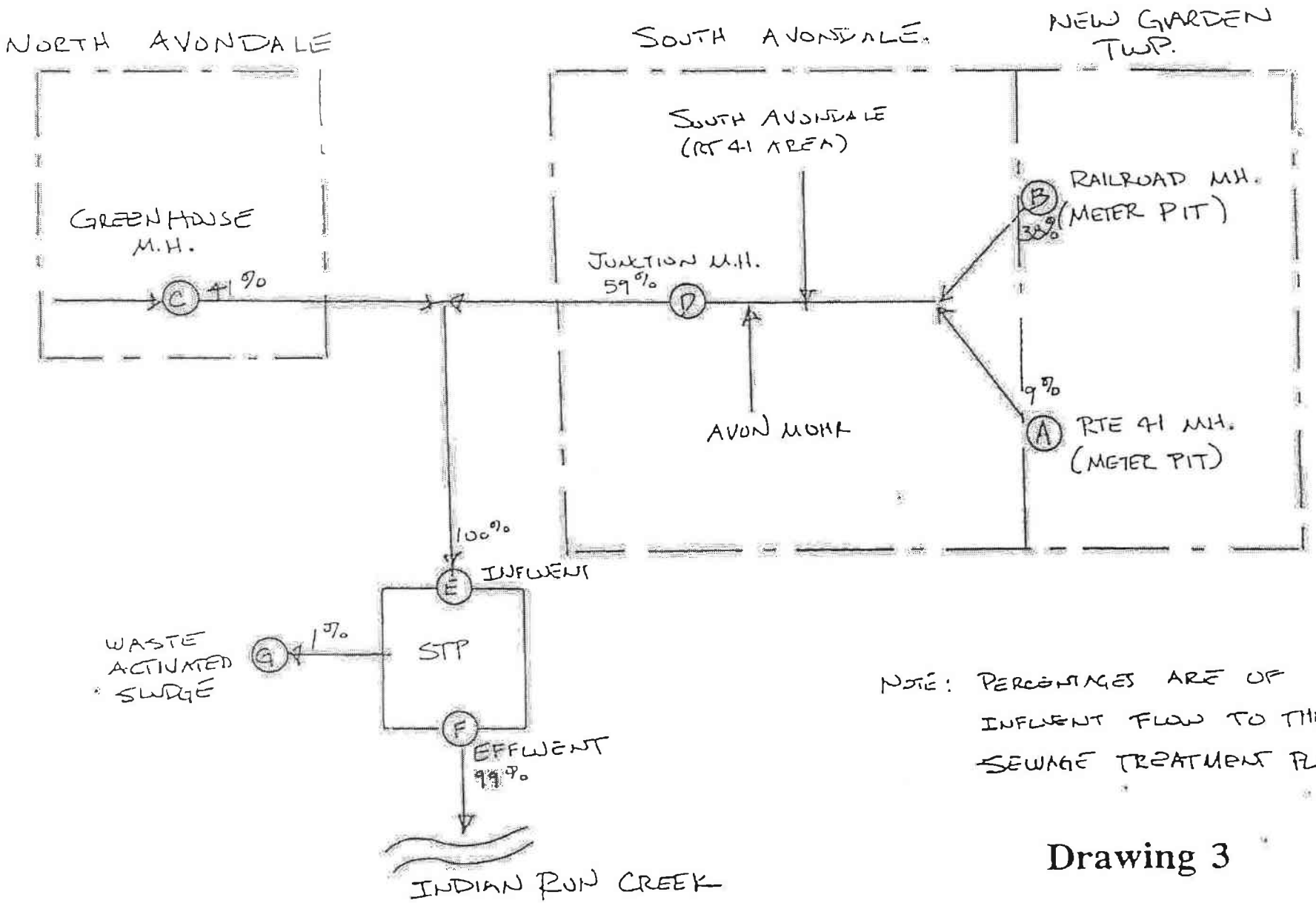
The 1995 Sampling Program

A sampling regiment was designed and implemented to capture samples from 7 locations throughout the entire sewer system over a continuous period of 7 days. Sampling began on the afternoon of May 3, 1995 and concluded on May 11, 1995.

Drawing 3 shows schematically the location of each of the 7 sampling points. Sample location A was at the meter pit on the Route 41 line coming from New Garden Township where it connects to the Borough collection system. Sample location B was at the meter pit on the railroad line coming from New Garden Township where it connects to the Borough collection system. Sample location C was at a manhole, near a greenhouse, through which the entire northern section of the Borough flows. Sample location D was at a manhole through which the southern section of the Borough and the Avon Mohr subdivision flows. Sample location E was at the head of the treatment plant and represents 100% of the influent entering the treatment process. Sample location F was at the process point of discharge to Indian Run. Sample location G was at the activated sludge recycle path.

Samples were taken at locations A, B, C, and D twice each hour for 48 hours by a composite sampler. This resulted in three composite samples at each of the four locations over a seven day period. The seven samples obtained at location E were taken twice each hour for 24 hours by a composite sampler. Sampling at location E began two hours after sampling began at locations A, B, C, and D in order to ensure complete overlapping of sampling periods and to allow for lag time throughout the collection system between locations A, B, C and D and location E. Sampling at location F began 16 hours after sampling began at location E in order to ensure the effluent sample was taken at about the time the flow that was sampled at location E would be finished the treatment process and be exiting the plant. Samples obtained at location F were taken twice each hour for 24 hours by a composite sampler. Sampling at location G began about 24 hours after the sample taken at location E entered the treatment process. Sampling at location G was done as a grab sample each day.

SIMPLIFIED SEW - SYSTEM



NOTE: PERCENTAGES ARE OF INFLUENT FLOW TO THE SEWAGE TREATMENT PLANT

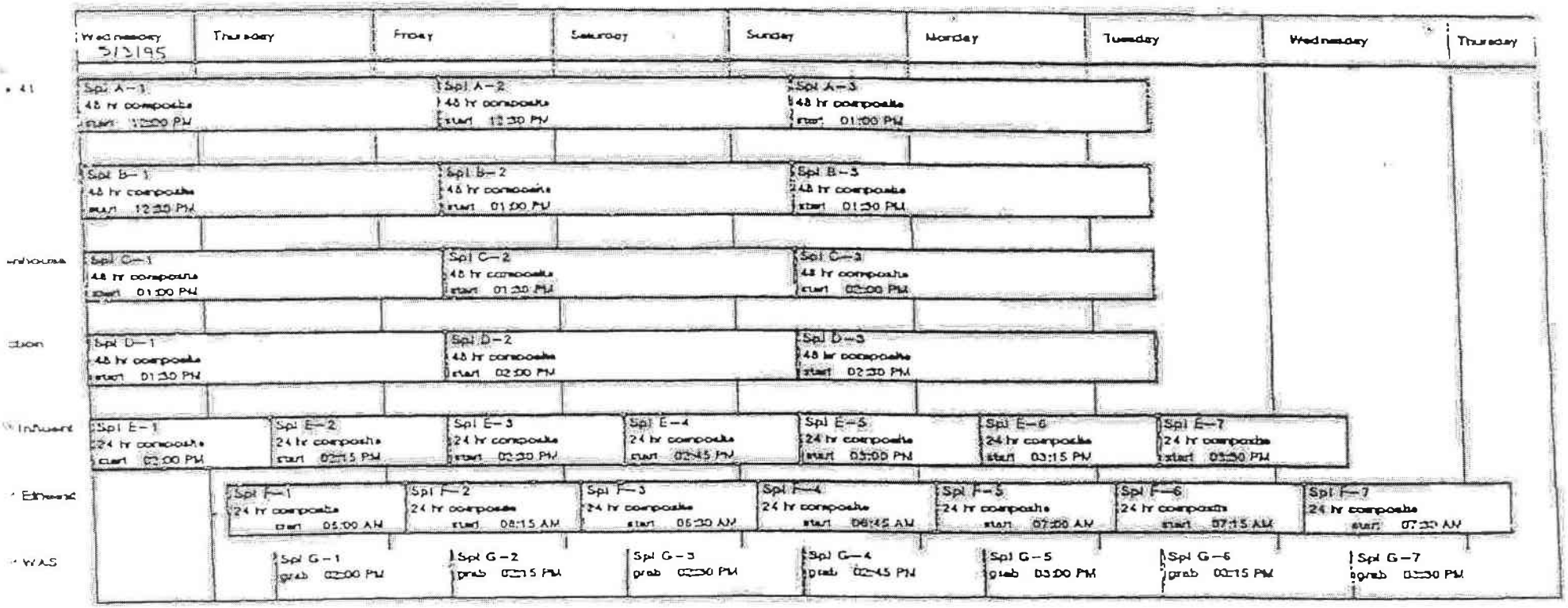
Drawing 3

A summary of the sampling procedure is included as Appendix C. A table depicting the sampling schedule is included as Table 4.

The sampling regiment described above was developed in order to provide an extended period of time during which samples would be taken thereby increasing the probability of sampling any unusual discharge entering the system. Also, the offset between the start of sampling and frequency of sampling among the collection system, influent and effluent locations was intentional in order to help ensure correlation of data.

The entire program was executed as planned without any disruptions or events that could compromise the integrity of the data. There was no rainfall during the entire sampling period and the treatment process was working smoothly.

AVONDALE TRE SAMPLING SCHEDULE



The 1995 Sampling Results

A summary of the analytical results from the sampling program are presented in Table 5 for each of the 9 toxics evaluated. A copy of the laboratory reports are included as Appendix D.

The format of the presentation of the data is self-explanatory. The permit limits shown at the bottom of each data grouping represents the limits currently in effect. **These permit limits apply to effluent only.**

It is important to note that the ability of the analytical instrumentation to identify and quantify the presence of a particular material is, in large part, dependent upon how free each sample is of other elements that could cause detection interference. Although dilution of the sample is one way to try to "clean it up", there is the potential to dilute the sample too much and not detect the presence of the element of interest. The reader should keep the foregoing in mind as the data are reviewed. In several cases the limit of detection is rather high as a result of the quality of the sample matrix. In the case of DIAZINON this analytical consideration is apparent.

Following is an overview of the sample analysis for the 8 toxics tested plus oil and grease.

DIAZINON

The results of the collection system sampling for DIAZINON suggest there is a high probability that higher than desirable levels of this chemical are entering the system. Four of the seven effluent samples measurably exceeded the current permit limit which further suggests the presence of DIAZINON in the system at higher than desirable levels. This finding is generally consistent with previous findings.

LINDANE

All but one of the sample results were below detectable limits and the detectable limit was well below the instantaneous maximum value established in the current permit. This suggests that the level of LINDANE in the system is generally acceptable. This finding is consistent with previous findings.

4,4DDD

With one exception, the Route 41 line, the sample results suggest the level of 4,4DDD in the system is generally acceptable. Although no specific permit limit is established for this pesticide, there generally appears to be a sufficient amount present in the Route 41 line to achieve measurable results in all three samples. Even though all effluent samples were below detectable limits, the level of 4,4DDD entering the system should be further evaluated. This finding is generally consistent with previous findings.

MALATHION

All but one of the sample results were below detectable limits and the detectable limit was well below the instantaneous maximum value established in the current permit. This suggests the level of MALATHION in the system is generally acceptable. This finding is consistent with previous findings.

METHOXYCHLOR

All but three of the sample results were below detectable limits. In this case, the three sample results above detectable limits were from the same sampling time period but from three different locations in the collection system. During the same period, three 24 hour composite samples were taken of the influent. These results were below the detectable limit. The effluent sample results over the 7 day period were all below a consistent detectable limit. This suggests the level of METHOXYCHLOR in the system is generally acceptable. This finding is consistent with previous findings.

In addition to the pesticides discussed above, three additional toxics plus oil and grease were evaluated. Following is an overview of the sample analysis for these four parameters. In these cases, the sampling locations were limited to the influent, location E, and effluent, location F, but used the 24 hour composite sample described previously.

CYANIDE

All of the influent sample results were below detectable limits while three effluent samples were below detectable limits. This is most likely a result of the condition of the sample matrix described at the beginning of the section. In any event, the sample results for the samples above detectable limits were all below the permit maximum value. This suggests that levels of CYANIDE in the system are acceptable.

COPPER

Two of the seven effluent sample results exceeded current permit limits. It appears from the data, comparing influent sample data to effluent sample data, that COPPER is removed by the treatment process.

The results suggest the level of COPPER in the wastewater effluent is usually below the permit limit but does occasionally exceed it. The required monthly sample analysis data reporting should be monitored to determine if trends in the level of COPPER in the system develop over time.

ZINC

All of the sample results are well below the current permit maximum limit. It appears from the data, comparing influent sample data to effluent sample data, that ZINC is removed by the treatment process.

Oil & Grease

Although no mention of oil and grease exists in the permit, it was evaluated anyway because in many treatment facilities oil and grease levels are significant and negatively impact the plant operations and effluent quality. The sample results from the recent evaluation indicate the influent oil and grease levels are very reasonable, the treatment process reduces the levels further and the effluent quality is extremely good.

Summary

The analytical results from the 1995 Sampling Program generally follow the results that were observed during previous testing between 1989 and 1992. It appears that DIAZINON is the only toxic that tends toward being consistently at or above current permit limits. The levels of other toxics that were analyzed are generally well below current permit limits.

Although sample quality is a factor which impacts the level of detections of the specified substance, it does not appear that sample quality would invalidate any results or lead to changing any conclusions.

In an attempt to establish a reasonable context in which to view the DIAZINON sample results, consider the following. DIAZINON is a common pesticide that is available for purchase at almost any garden center, home center or hardware store. Usually, the concentration of the off the shelf solution is 25%. In this form, one-half of one milliliter, or roughly ten drops, contains 113 mg of DIAZINON. If the same 113 mg were added to a daily flow of 300,000 gallons (the rated capacity of this plant) the concentration would be 0.1 ug/l which is the current permit instantaneous maximum limit. In order to meet the average monthly limit of 0.04 ug/l, the average daily loading of DIAZINON should not exceed 45 mg.

Table 5

AVONDALE TRE SAMPLING SURVEY
MAY 1995

1. DIAZINON (ug/l)

Date	SAMPLING LOCATION						
	Route 41	Railroad	Greenhouse	Junction MH	STP Influent	STP Effluent	STP WAS
3							
4					0.7		0.6
5	< 0.2	< 0.1	< 3	< 1	< 1	0.7	< 0.05
6					0.5	0.4	< 10
7	< 0.2	< 7	< 1	< 2	1.1	0.54	3
8					0.9	0.7	< 2
9	< 1	1.2	< 0.1	0.5	0.7	< 1	3
10					0.7	< 0.8	< 2
11						< 1	

permit limits: monthly average = 0.04 ug/l, instantaneous maximum = 0.1 ug/l
Bold values are permit violations of the instantaneous maximum.

2. LINDANE (ug/l)

Date	SAMPLING LOCATION						
	Route 41	Railroad	Greenhouse	Junction MH	STP Influent	STP Effluent	STP WAS
3							
4					< 0.01		< 0.05
5	< 0.02	< 0.02	< 0.05	< 0.1	< 0.1	< 0.01	< 0.05
6					< 0.01	< 0.01	< 0.1
7	< 0.04	< 0.05	< 0.1	< 0.01	< 0.01	< 0.01	< 0.5
8					< 0.01	< 0.01	< 0.1
9	< 0.05	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.1
10					< 0.01	< 0.01	< 0.1
11						< 0.01	

permit limits: monthly average = 0.3 ug/l, instantaneous maximum = 0.75 ug/l

3. 4,4 – DDD (ug/l)

Date	SAMPLING LOCATION						
	Route 41	Railroad	Greenhouse	Junction MH	STP Influent	STP Effluent	STP WAS
3							
4					< 0.1		< 0.01
5	0.04	< 0.02	< 0.05	< 0.1	< 0.1	< 0.01	< 0.07
6					< 0.02	< 0.01	< 0.5
7	0.02	< 0.05	< 0.1	0.03	< 0.02	< 0.01	< 0.5
8					< 0.01	< 0.01	< 0.3
9	0.06	< 0.03	< 0.01	< 0.02	< 0.01	< 0.02	< 0.3
10					< 0.02	< 0.01	< 0.2
11						< 0.03	

permit limits: non – detectable, using EPA 608

Table 5 (continued)

AVONDALE TRE SAMPLING SURVEY
MAY 1995

4. MALATHION (ug/l)

Date	SAMPLING LOCATION						
	Route 41	Railroad	Greenhouse	Junction MH	STP Influent	STP Effluent	STP WAS
3							
4					0.07		< 0.05
5	< 0.1	< 2	< 0.6	< 2	< 0.5	< 0.05	< 2
6					< 0.05	< 0.05	< 3
7	< 0.1	< 3	< 2	< 0.8	< 0.05	< 0.05	< 0.5
8					< 2	< 0.05	< 1
9	< 0.2	< 0.05	< 0.05	< 0.1	< 0.05	< 0.05	< 1
10					< 0.05	< 0.05	< 1
11						< 0.05	

permit limits: monthly average = 0.15 ug/l, instantaneous maximum = 0.38 ug/l

5. METHOXYCHLOR (ug/l)

Date	SAMPLING LOCATION						
	Route 41	Railroad	Greenhouse	Junction MH	STP Influent	STP Effluent	STP WAS
3							
4					< 0.1		< 0.05
5	< 0.3	< 0.3	< 0.3	< 1	< 1	< 0.05	< 0.3
6					< 0.05	< 0.05	< 3
7	< 0.3	< 0.5	< 1	< 0.05	< 0.05	< 0.05	< 0.8
8					< 0.05	< 0.05	< 0.5
9	0.11	0.09	< 0.05	0.06	< 0.1	< 0.05	< 0.5
10					< 0.06	< 0.05	< 0.5
11						< 0.05	

permit limits: monthly average = 0.08 ug/l, instantaneous maximum = 0.2 ug/l

6. CYANIDE (mg/l)

Date	SAMPLING LOCATION	
	STP Influent	STP Effluent
3		
4	< 0.005	
5	< 0.005	< 0.005
6	< 0.005	0.006
7	< 0.005	0.005
8	< 0.005	0.006
9	< 0.005	0.01
10	< 0.005	< 0.005
11		< 0.005

permit limits: monthly average = 0.019 mg/l, instantaneous maximum = 0.048 mg/l

Table 5 (continued)

AVONDALE TRE SAMPLING SURVEY
MAY 1995

7. COPPER (mg/l)

Date	SAMPLING LOCATION	
	STP Influent	STP Effluent
3		
4	0.256	
5	0.358	**0.219**
6	0.086	**0.116**
7	0.109	0.030
8	0.077	0.036
9	0.121	0.033
10	0.088	0.036
11		0.090

permit limits: monthly average = 0.045 mg/l, instantaneous maximum = 0.113 mg/l
Bold values are permit violations of the instantaneous maximum.

8. ZINC (mg/l)

Date	SAMPLING LOCATION	
	STP Influent	STP Effluent
3		
4	0.311	
5	0.497	0.280
6	0.120	0.148
7	0.152	0.053
8	0.092	0.062
9	0.137	0.052
10	0.094	0.044
11		0.107

permit limits: monthly average = 0.40 mg/l, instantaneous maximum = 1.0 mg/l

9. OIL & GREASE (mg/l)

Date	SAMPLING LOCATION	
	STP Influent	STP Effluent
3		
4	70	
5	40	< 6
6	30	< 6
7	40	< 6
8	60	< 6
9	80	< 6
10	70	< 6
11		< 6

no permit limits for this parameter

Notes:
1. Samples are reported on the day the composite was finished.
2. Results below detection are reported with a less-than (<) sign.

SOURCE INVENTORY

Identification of Industrial and Commercial Contributors of Toxics

The one toxic material, DIAZINON, identified as generally being present in the system at levels exceeding the permit maximum is a rather common pesticide that is easily obtained through retail channels in addition to commercial and wholesale sources.

The analytical results do not provide an indication of where DIAZINON may be entering the system, eg location A, B, C or D, but only that it is present. There are several mushroom growing facilities connected to the system in addition to a greenhouse and a mushroom supply distributor. Each of these are potential sources in addition to residential connections where the chemical may be in use for gardening or yard purposes.

Further work should be undertaken to accurately identify potential sources of DIAZINON entering the system. This effort could first of all be on a census basis, then site visit and then, as necessary, site specific sampling.

The other toxic that exceeded current permit limits on two occasions was COPPER. The other five COPPER sample analysis results were well below the current permit maximum limit. There are no known industrial or commercial entities connected to the sewer system that handle or process COPPER. The two excursions noted may represent an anomaly or very infrequent occurrence.

Identification of Other Potential Sources of Toxics

There are no provisions to accept septage, waste, stormwater or other sources of discharge that might account for the presence of DIAZINON.

Because of the very small amount of DIAZINON needed to exceed the current permit maximum limit, there could be any number of sources, including residences. Background contributions represent a portion of the waste stream associated only with domestic wastewater. Household use of pesticides in and around sinks, drains, showers or toilet facilities is common and can take the form of washing fruits and vegetables, washing clothes, showering, caring for pets, and so forth. Individually these sources are generally small but cumulatively may become measurable. However, residential sources are, for the most part, uncontrollable unless a specific discharge is identified through sampling efforts.

A priority list of possible sources of DIAZINON, including industrial, commercial and residential, should be developed as the basis of further investigation.

System Sampling Survey

Once potential sources of DIAZINON entering the system have been identified, a comprehensive sampling survey to accurately determine the nature and extent of the discharge will be prepared and sent to the identified sources for completion.

Summary

The inventory of potential sources was not undertaken prior to obtaining and analyzing the most current data in order to keep costs down and to clearly identify which toxies are exceeding maximum permit limits.

A clearly defined course of action can now be prepared to identify potential and actual sources of discharge of DIAZINON. Once potential sources of DIAZINON have been determined, a comprehensive sampling survey to more accurately pinpoint the extent of DIAZINON entering the system from each of the identified sources should be undertaken.

POLLUTANT CONTROL EVALUATION

Treatment Plant Effectiveness for Toxics Removal

The analytical results obtained from evaluation of the various samples were converted from concentrations to mass loadings. These date were then further evaluated with respect to removal of the toxic by the treatment process.

In the case of DIAZINON, there is no clear statistical evidence that significant amounts are removed by the current treatment process as shown in the following table, Table 6.

Table 6

Mass Loading

DIAZINON (mg/day)

Date	SAMPLE LOCATION							
	Route 41	Railroad	Greenhouse	Junction Mill	STP Influent	STP Effluent	STP WAS	Removal (mg/day)
3								
4					754		5	
5	22	33	1259	638	[illegible]	765	[illegible]	11
6					540	434	76	N/A
7	16	2279	341	1101	994	484	23	-62
8					827	638	15	336
9	[illegible]	521	42	329	770	[illegible]	23	266
10					609	689	15	-81
11						1013		404

In the case of COPPER, there does appear to be statistical evidence that significant amounts are removed by the current treatment process as shown in the following table, Table 7.

Table 7

Mass Loading

COPPER (grams/day)

Date	SAMPLING LOCATION		
	STP Influent	STP Effluent	Removal (grams/day)
3			
4	276		
5	386	234	42
6	93	124	262
7	117	32	61
8	83	39	79
9	130	35	48
10	95	39	92
11		96	1

Since the other toxics studied do not present a concern and because the levels present were rather low, further evaluation of the effect of the current treatment process on removal of those toxics was not undertaken.

Sewer Use Codes and Ordinances

One of the more effective and useful tools for controlling the discharge of toxics into the collection and treatment system is enactment and enforcement of a sewer use ordinance and/or other related ordinances. Another useful tool is implementation of an industrial pretreatment program.

The current sewer user ordinance of the Borough of Avondale contains appropriate provisions concerning the type, quality and quantity of discharge that is permitted to enter the system. There is room for strengthening some of its provisions to reflect current implementation and enforcement strategies. Aggressive enforcement of the ordinance provisions is somewhat lacking.

Borough officials should also ensure the ordinances, rules and regulations of New Garden Township are kept current and reflect the same priorities and enforcement provisions as those of the Borough.

Industrial Waste Pretreatment

There is no separate industrial pretreatment ordinance currently in effect in the Borough. There are general provisions regarding industrial discharges contained in the sewer user ordinance.

There does not appear to be a compelling need at the present time to enact a comprehensive industrial waste pretreatment ordinance. However, the present sewer user ordinance could be updated to expand and strengthen certain sections which address industrial discharges.

The Borough should be ready at any time to adopt and implement a stringent industrial waste pretreatment ordinance as and when circumstances dictate. The Borough should also encourage New Garden Township to be prepared to do the same.

Treatment Process Modification for Control of Toxics

Based on historical and current data and the information prepared for and contained in this report, there does not appear to be a compelling need to modify the current treatment process to address the control of toxics.

Further data acquisition and analysis is appropriate as is further identification of potential sources of DIAZINON being discharged into the system.

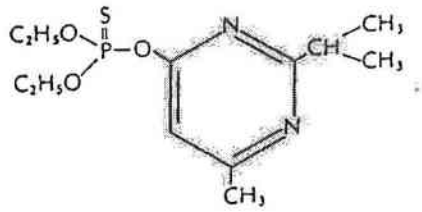
APPENDIX D - Diazinon Fact Sheet

DIAZINON

CAS: 333-41-5

Basudin®; O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate; Spectracide®

$C_{12}H_{21}N_2O_3PS$



Skin

TLV–TWA, 0.1 mg/m³

1970: TLV–TWA, 0.1 mg/m³; Skin, proposed

1972–present: TLV–TWA, 0.1 mg/m³; Skin

1976–1985: TLV–STEL, 0.3 mg/m³

1986: TLV–STEL, deleted

1991: Documentation revised

Chemical and Physical Properties

Pure diazinon is a colorless liquid, while the technical grade is pale yellow to dark brown with a faint, ester-like odor. Chemical and physical properties include:

- Molecular weight: 304.36
- Specific gravity: 1.116–1.118 at 20°C
- Boiling point: 83°–84°C at 0.002 torr
- Vapor pressure: 1.4×10^{-4} torr at 20°C
- Solubility: slightly soluble in water; freely soluble in petroleum solvents; miscible with alcohol, ether, benzene, and similar hydrocarbons

Major Uses or Sources of Occupational Exposure

Diazinon is a nonsystemic insecticide and acaricide used on a wide variety of agricultural crops, lawns and gardens, ornamentals, domestic animals, and household pests.

Animal Studies

Acute

The acute oral LD_{50} for diazinon, as reported by Gaines,[1] was 108 mg/kg body weight for male rats and 76 mg/kg for females. For a later sample, the same laboratory found corresponding values of 250 mg/kg for male rats when the diazinon was received in the laboratory but a toxicity of 34 mg/kg after the substance was exposed to air with consequent crystallization.[2] The acute oral LD_{50} in guinea pigs has been reported as 240–320 mg/kg and in rabbits as 130 mg/kg.[3] Although the common laboratory animals do not vary much in their susceptibility to single doses of diazinon, 10 mg/kg was lethal in calves but the same dosage was harmless in steers.[3] Domestic birds were highly susceptible, with the oral LD_{50} being less than 10 mg/kg for turkeys and goslings.[3]

Chronic

Laboratory animals vary in their susceptibility to repeated doses of diazinon. Rats tolerated 50 mg/kg/day for 72 weeks without illness but with complete inhibition of red cell cholinesterase and marked inhibition of brain cholinesterase.[4] Rats that received 10, 100, or 1000 ppm of active diazinon as a wettable powder for 72 weeks had no apparent gross signs of toxicity.[5]

Dogs dosed at 4.6 mg/kg/day for 46 weeks showed no gross signs of toxicity but had an inhibited cholinesterase activity within 12 weeks.[5] Dogs promptly lost weight and showed signs of poisoning and complete cholinesterase inhibition when given 9.3 mg/kg/day.[4] Woodard et al.[6] found that monkeys were poisoned at a dosage of 5 mg/kg/day administered over 2 years.

Human Studies

Two patients, treated dermally with diazinon for control of a parasitic infestation, were seriously poisoned by a dosage of about 1.1 mg/kg according to Hayes.[7] In contrast, a man, who had received an oral dosage of 250 mg diazinon/kg, recovered following treatment that included gastric lavage.[3] In a series of five tests, each involving two to four men, oral doses of diazinon at the rate of 0.05 mg/kg/day for a total of 28 days reduced plasma cholinesterase activity by 35%–40% but did not affect the red cell enzyme. A dosage of 0.02 mg/kg/day for 37 days reduced plasma cholinesterase activity by only 14%, an amount difficult to distinguish from normal variation.[3]

Diazinon may be absorbed through the skin.[3] Symptoms associated with diazinon poisoning are weakness, headache, tightness in the chest, blurred vision, nonreactive pinpoint pupils, salivation, sweating, nausea, vomiting, diarrhea, abdominal cramps, slurred speech, and moist rales in the lungs.[3]

TLV Recommendation

For many mammals and under most circumstances, diazinon is less toxic than parathion; however, under certain circumstances (viz., the series of five tests in men wherein a dosage of 0.02 mg/kg/day for 37 days reduced plasma cholinesterase), this is not true.[3] Therefore, a TLV–TWA of 0.1 mg/m³, the same as that for parathion, is recommended for diazinon. Because of the systemic effects resulting from skin absorption in humans,[3] a skin notation is also recommended. At this time, no STEL is

recommended until additional toxicological data and industrial hygiene experience become available to provide a better base for quantifying on a toxicological basis what the STEL should be. The reader is encouraged to review the section on *Excursion Limits* in the "Introduction to the Chemical Substances" of the current TLV/BEI Booklet for guidance and control of excursions above the TLV–TWA, even when the 8-hour TWA is within the recommended limits. Diazinon is a substance for which Biological Exposure Indices (BEI) have been established. See BEI Documentation for Organophosphorus Cholinesterase Inhibitors.

Other Recommendations

OSHA PEL: OSHA established a PEL–TWA of 0.1 mg/m^3, with a skin notation, for diazinon. OSHA concluded that these limits would protect exposed workers from the significant risk of cholinesterase inhibition, weakness, headache, nausea, vomiting, and other symptoms and signs of diazinon poisoning associated with exposures at levels above the PEL.[8] The PEL is consistent with the recommended ACGIH TLV.

NIOSH REL/IDLH: NIOSH [Ex 8-47, Table N1] established a REL–TWA of 0.1 mg/m^3, with a skin notation, by concurrence with the OSHA PEL for diazinon.[8] NIOSH has not established an IDLH value for this substance.

NTP Studies: Negative evidence for carcinogenesis effects of diazinon was obtained when the substance was incorporated in the diets of male and female Fischer 344 rats and B6C3F1 mice. Diazinon was negative in the *Salmonella* assay and in cultured Chinese hamster ovary cells for increased frequencies of both chromosomal aberrations and sister-chromatid exchanges but was positive in the mouse lymphoma assay.

Other Nations

Australia: 0.1 mg/m^3, skin (1990); Federal Republic of Germany: 1 mg/m^3 total dust, short-term level 10 mg/m^3, 30 minutes, once per shift, skin, Pregnancy group C, no reason to fear a risk of damage to the developing embryo or fetus when MAK or BAT values are adhered to (1990); United Kingdom: 0.1 mg/m^3, 10-minute STEL 0.3 mg/m^3, skin (1991).

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3. Hayes, Jr., W.J.; Laws, Jr., E.R. (Eds.): Diazinon. In: Handbook of Pesticide Toxicology. Vol. 2, Classes of Pesticides, pp. 1049–1053. Academic Press, New York (1991).

4. Bruce, R.B.; Howard, J.W.; Elsea, J.R.: Toxicity of O,O Diethyl O-(2-Isopropyl-6-methyl-4-pyrimidyl)Phosphorothioate (Diazinon). J. Agr. Food Chem. 3:1017–1021 (1955).

5. Weir, R.J.; Hazelton, L.W.: Organic Phosphates. In: Patty's Industrial Hygiene and Toxicology, 3rd Rev. ed., Vol. 2C, Toxicology, pp. 4815–4817. G.D. Clayton and F.E. Clayton, Eds. John Wiley & Sons, New York (1982).

6. Woodard, G.; Woodard, M.; Cronin, M.T.L.: Safety Evaluation of the Pesticide Diazinon by a Two-Year Feeding Trial in Rhesus Monkeys. Fed. Proc. 27:597 (1968).

7. Hayes, Jr., W.J.: Clinical Handbook on Economic Poisons. Emergency Information for Treating Poisoning. PHS Pub. No. 476. U.S. Government Printing Office, Washington, DC (1963).

8. U.S. Department of Labor, Occupational Safety and Health Administration: 29 CFR Part 1910, Air Contaminants; Final Rule, Fed. Reg. 54(12):2625 (January 19, 1989).

o-Dianisidine-Based Dyes
IMIS D116 CAS 119-90-4
SLC1 MEDIA: Polytetraflouroethylene (FH) filter 0.5 micron
MAX V: 500 Liters MAX F: 3.0 L/min
ANL 1: High Performance Liquid Chromatography; HPLC/UV
. REF: 1 (NIOSH 5013) CLASS: Fully Validated
NOTE: This method does not differentiate between different o-Dianisidine Dyes. Protect samples from heat & light.
MEDIA: Glass Fiber Filter (37 mm)
REC V: 100 Liters REC F: 1 L/min
ANL 1: High performance liquid chromatography; HPLC/UV/Visible
. REF: 2 (OSHA In-house File) CLASS: Not Validated
NOTE: This method differentiates between different o-dianisidine based dyes. See individual dye of interest. Protect samples from heat & light.
WIPE Yes, with Glass Fiber Filter.
BULK For any dye analysis, a bulk sample of the dye must be sent to the SLCAL. Limit the amount of bulk submitted to one gram or approx. one mL.

Diazinon
IMIS 2720 CAS 333-41-5
SYN 0,0-Diethyl O-(2-isopropyl-4-methyl-6-pyrimidinyl)-phosphorthioate; Spectracide
NIOSH RTECS TF3325000
OSHA FINAL RULE (Table Z-1-A): TWA (Skin) 0.1 mg/m3
DESC Liquid. MW: 304
HLTH Cholinesterase inhibition (HE6)
Suspect teratogen (HE5); Mutagen (HE2)
SLC1 MEDIA: OSHA Versatile Sampler (OVS-2) - 13 mm XAD-2 tube
. (270/140 mg sections, 20/60 mesh) with Glass Fiber
. Filter enclosed
MAX V: 480 Liters MAX F: 1.0 L/min
ANL 1: Gas Chromatography; GC/FPD
. REF: 2 (OSHA 62) SAE: 0.09 CLASS: Fully Validated
NOTE: Obtain sampling tubes from SLCAL.
BULK Limit the amount of bulk submitted to one gram or one mL.

Diazomethane
IMIS 0861 CAS 334-88-3
SYN Azimethylene; Diazirine
NIOSH RTECS PA7000000; 47875
OSHA TRANSITIONAL LIMITS (Table Z-1): TWA 0.2 ppm, 0.4 mg/m3
FINAL RULE (Table Z-1-A): TWA 0.2 ppm, 0.4 mg/m3

APPENDIX E - Additional Sampling Results

SSM/Laboratories, Inc.

ANALYTICAL REPORT

Client: Miller Environmental

Report to: G.A. DeBalko
SSM/Spotts, Stevens and McCoy, Inc.

Project: 154074
Received: 13-SEP-96
Reported: 27-SEP-96

WORK ORDER: 5804-000

	RESULT	UNITS	METHOD	DATE	ANALYST
Avondale - Well No. 1 (Drinking Water) Grab					
SSM Sample: 1227783					
sampled: 13-SEP-96 13:30					
Copper, Total	0.008	mg/l	200.7	23-SEP-96	KWC
Zinc, Total	0.081	mg/l	200.7	23-SEP-96	KWC
Cyanide, Free	0.006	mg/l	412H	17-SEP-96	JWK
4,4'-DDD	< 0.10	ug/l	608	20-SEP-96	SWH
4,4'-DDE	< 0.10	ug/l	608	20-SEP-96	SWH
Heptachlor	< 0.05	ug/l	608	20-SEP-96	SWH
Lindane	< 0.05	ug/l	608	20-SEP-96	SWH
Methoxychlor	< 0.50	ug/l	608	20-SEP-96	SWH
Toxaphene	< 5.0	ug/l	608	20-SEP-96	SWH
Malathion	< 0.05	ppb	8140	25-SEP-96	SUB
Diazinon	< 0.02	ppb	8140	25-SEP-96	SUB
Avondale - Well No. 2 (Drinking Water) Grab					
SSM Sample: 1227784					
sampled: 13-SEP-96 12:00					
Copper, Total	0.003	mg/l	200.7	23-SEP-96	KWC
Zinc, Total	< 0.020	mg/l	200.7	23-SEP-96	KWC
Cyanide, Free	< 0.005	mg/l	412H	17-SEP-96	JWK
4,4'-DDD	< 0.10	ug/l	608	20-SEP-96	SWH
4,4'-DDE	< 0.10	ug/l	608	20-SEP-96	SWH
Heptachlor	< 0.05	ug/l	608	20-SEP-96	SWH
Lindane	< 0.05	ug/l	608	20-SEP-96	SWH
Methoxychlor	< 0.50	ug/l	608	20-SEP-96	SWH
Toxaphene	< 5.0	ug/l	608	20-SEP-96	SWH
Malathion	< 0.05	ppb	8140	25-SEP-96	SUB
Diazinon	< 0.02	ppb	8140	25-SEP-96	SUB
Avondale - Stream No. 1 (Wastewater) Grab					
SSM Sample: 1227785					
4,4'-DDD	< 0.10	ug/l	608	20-SEP-96	SWH
4,4'-DDE	< 0.10	ug/l	608	20-SEP-96	SWH

SSM/Laboratories, Inc.

Client: Miller Environmental
Project: 154074

	RESULT	UNITS	METHOD	DATE	ANALYST
Avondale - Stream No. 1 (Wastewater) Grab					
SSM Sample: 1227785 - continued					
Heptachlor	< 0.05	ug/l	608	20-SEP-96	SWH
Lindane	< 0.05	ug/l	608	20-SEP-96	SWH
Methoxychlor	< 0.50	ug/l	608	20-SEP-96	SWH
Toxaphene	< 5.0	ug/l	608	20-SEP-96	SWH
Malathion	< 0.05	ppb	8140	25-SEP-96	SUB
Diazinon	< 0.02	ppb	8140	25-SEP-96	SUB
Avondale - Stream No. 2 (Wastewater) Grab					
SSM Sample: 1227786					
4,4'-DDD	< 0.10	ug/l	608	20-SEP-96	SWH
4,4'-DDE	< 0.10	ug/l	608	20-SEP-96	SWH
Heptachlor	< 0.05	ug/l	608	20-SEP-96	SWH
Lindane	< 0.05	ug/l	608	20-SEP-96	SWH
Methoxychlor	< 0.50	ug/l	608	20-SEP-96	SWH
Toxaphene	< 5.0	ug/l	608	20-SEP-96	SWH
Malathion	< 0.05	ppb	8140	25-SEP-96	SUB
Diazinon	< 0.02	ppb	8140	25-SEP-96	SUB

< Indicates less than the limit of quantitation.

The current permit establishes discharge limitations on FREE CYANIDE, TOTAL ZINC, TOTAL COPPER, LINDANE and 4,4DDD, all of which are considered to be priority pollutants. Also included in the permit are DIAZINON, MALATHION and METHOXYCHLOR which are considered to be of concern.

Priority pollutants are the primary focus of concern because the EPA has determined them to be the most commonly used, persistent and toxic substances in wastewater discharges. They include many heavy metals and solvents. However, other pollutants are of concern and will be of interest.

The discharge limitations of DIAZINON, LINDANE, 4,4DDD, MALATHION and METHOXYCHLOR, as measured in mg/l, are established in two parts. The initial limitations were established for the first three years of the permit (8/27/91 to 8/27/94) while more stringent limitations were established for the last two years of the permit (8/28/94 to 8/28/96).

A copy of PART A of the permit regarding effluent limitations and monitoring requirements for discharge is included as Appendix A for reference.

Existing Wastewater Treatment Facilities

The Borough of Avondale Sewer Authority owns the sewage collection and treatment system. The Borough Council leases the system from the Authority and operates it.

The system was constructed in 1969 and 1970 and commenced operating in 1970. Planning for and construction of the system was a joint undertaking between the Borough of Avondale and New Garden Township. The system continues to serve both municipalities today. Based on the 1994 Chapter 94 report, the average daily flow originating in New Garden Township was 123,583 gallons or 40.3% of the total flow while the average daily flow originating in Avondale was 186,600 gallons or 59.7% of the total flow of 306,749 gallons/day.

The treatment facility is located along Avondale-New London Road near Indian Run Road. Discharge from the plant is to Indian Run which is a tributary to the White Clay Creek. The permitted hydraulic capacity of the plant is 300,000 GPD.

The treatment process provides secondary biological treatment with the complete mix activated sludge process with disinfection accomplished by chlorine contact prior to discharge.

The sewage treatment plant consists of a bar screen and grit chamber, four aeration tanks operated in two parallel trains, two parallel secondary clarifiers, two parallel chlorine contact tanks, two aerobic sludge digesting tanks and a sludge thickener tank.

In 1993, an 80,000 gallon flow equalization tank was added following the degritter, two of the aerobic digestion tanks were converted to diffused air aeration tanks, each clarifier weir length was extended and a 20,000 gallon sludge holding tank was added.

Since completion of the recent upgrades, the overall quality of the effluent has improved noticeably and the treatment process is more uniform and consistent.

A site plan, Drawing 1, showing the treatment components, before the recent modifications, is included as Appendix B. A site plan, Drawing 2, showing the treatment components, after the recent modifications, is also included as Appendix B.

APPENDIX 11

INFLOW/INFILTRATION REPORT
AVONDALE BOROUGH

INFILTRATION AND INFLOW STUDY

BOROUGH OF AVONDALE
CHESTER COUNTY, PENNSYLVANIA

MAY 1997

5685-004

BOROUGH OF AVONDALE

INFLOW AND INFILTRATION STUDY

MAY 1997

5865-004

BOROUGH OF AVONDALE
INFILTRATION AND INFLOW STUDY

TABLE OF CONTENTS

1.0 INTRODUCTION

Inflow and Infiltration(I/I) is unwanted flow that enters a sewer collection system. Inflow is that rainfall that enters the collection system directly through downspouts, storm sewers and sump pump connections. Inflow can also enter the system through broken vents, traps and cleanout connections on laterals. Infiltration is that groundwater that enters the system through cracks and joints of the sewer system. I/I increases the hydraulic loading to a sewage facility and therefore has the potential to upset operations.

The Avondale Wastewater Treatment Plant (WWTP) is located in the Borough limits of Avondale. The WWTP is permitted to process 0.300 mgd of wastewater per day. The yearly average flow at the WWTP exceeded 0.300 mgd three of the last five years. The average annual flow for 1996 was 0.452 mgd. Past analysis and inspection has determined that a large portion of this flow was due to I/I.

The purpose of this report was to determine the source of the I/I. The report used past findings and new investigations to locate the sources. Past findings, include I/I, reports done by others. The investigations included a statistical review, night-time inspections, plugging and weiring, smoke testing and portable flowmetering.

The secondary objective of this report was to determine the quantity of I/I. It was difficult to estimate the quantity of I/I. The water distribution system has had several leaks. The contract operations group (Miller Environmental Inc.) for the Borough has repaired the leaks. The average daily water consumption is down approximately 120,000 gpd.

Due to the leaks in the system the water consumption data is suspect. It is difficult to determine a base flow at the WWTP without consistent water consumption data. Without an accurate base flow, the quantity of I/I cannot be accurately estimated. This report used past I/I estimates and information gathered from the portable flowmeters to estimate the quantity of I/I.

1.1 MOORE ENVIRONMENTAL MANAGEMENT INC. REPORT

The Moore Environmental Management (MEM) Inc. report was published May 1992. The data for the report was collected from March 1992 through May 1992. MEM collected the data using night-time inspections and plugging and weiring. We have reviewed their report and findings. Their report and findings are valid.

The MEM report had three significant findings.

1. A steady flow of 40,000 gpd was entering the collection system from New Garden Township.

2. Most of the I/I from the Borough proper was coming in along the 10" gravity sewer trunk. The trunk runs from manhole 14 to the WWTP. Figure 1 shows the sewer plan including manhole numbers.

3. MEM recommended a T.V. inspection of the 10" trunk. In addition, they also recommended that Avondale begin a dialogue with New Garden Township to focus on the I/I coming from the Township.

1.2 SMITH ENVIRONMENTAL REPORT

The Smith Environmental (Smith) Inc. report was published June 1995. The data for the report was collected during April 1995. Smith collected the data using night-time inspections and plugging and weiring. In addition Smith also used a statistical review of the flow records to determine base flow and the estimated quantity of I/I. We have reviewed their report and findings. Their report and findings are valid.

The Smith Report had three significant findings.

1. Most of the I/I that is entering the collection system is in the form of infiltration.

2. Analysis of flow data shows that I/I reduction (assuming 30 percent reduction) will not relieve the overloading.

3. Smith found that the 10" trunk and the 10" branches from New Garden Township needed to be T.V. inspected.

2.0 STATISTICAL REVIEW

A statistical review was done for this report. The review analyzed rainfall data versus the flow to the WWTP. The data was reviewed on a weekly basis. The total rainfall for the week was plotted versus the total weekly flow to the WWTP. The rainfall data was obtained from the Northeast Regional Climate Center and the flow data was obtained from the WWTP records.

Charts 1, 2 and 3 show the results of the statistical review. Chart 1 shows the weekly rainfall versus the total flow to the WWTP. Chart 2 shows the weekly rainfall versus the isolated flow from the Borough of Avondale. Chart 3 shows the weekly rainfall versus the isolated flow from New Garden Township. The flows were isolated by subtracting the New Garden flowmeter readings (manhole 83 and upstream of manhole 79) from the total flowmeter reading at the WWTP. The results of the statistical review shows very little to no correlation between the weekly rainfall and the flow from the WWTP.

In addition, the two year rainfall data was compared to the flow from the WWTP. The data is illustrated on Chart 4. The data shows some correlation between rainfall and flow. Based on the weekly data results, it is assumed that the slight correlation in the monthly data is most likely caused by increased groundwater levels.

3.0 NIGHTTIME MANHOLE INSPECTIONS

Rainfall enhances nighttime inspections. Rainfall amplifies the effects of I/I, making it easier to detect leaks in the system. SSM/Spotts, Stevens and McCoy conducted a majority of the nighttime inspections in March 1997. The 30 year average rainfall for the month of March in the Avondale area is 3.43 inches. The actual rainfall for March 1997 was 3.49 inches. Based on this information, the weather conditions for March 1997 are considered normal. The results from the inspections are considered valid.

Nighttime inspections are typically done between the hours of 12:00 a.m. and 5:00 a.m.. This is done to minimize the affects of residential and industrial flow. The only flow during these hours is considered to be caused by I/I.

Nighttime manhole inspections were done to review the overall condition of the individual manholes. In addition weir readings were taken during the inspection. The results of the inspections are included in Appendix A.

The original sewer plan (created by Roy F. Weston Inc.) showed 112 manholes. 11 manholes were added with the construction of the Avon Mohr development. All 123 manholes were identified for inspection. 13 manholes could not be found or did not exist. Seven manholes were visibly leaking during the inspection. 26 manholes showed signs of leaking, such as water staining on the walls. The location and categorization of all the manholes is shown on Figure 1.

The weir readings were done in all of the inspected manholes where possible. The quantity of flow for each manhole is listed in Appendix A. The general findings are:

1. Approximately 100,000 to 140,000 gpd of I/I is entering the system from the Township of New Garden. The flow is coming from upstream of manhole 87.

2. The 10" trunk lines from both New Garden Township and interior to the Borough shows significant I/I.

3. Minor Street and the Avon Mohr system show I/I.

4.0 PLUGGING AND WEIRING

Plugging and weiring is done to isolate sections of pipe. The isolation locates source of I/I more accurately than simple weiring. Plugging is done by inflating a rubber cylinder into the influent pipe of an upstream manhole. The weiring is done at the downstream manholes. If there are no lateral connections between the plugged manhole and the weired manholes, the flow that is being read is I/I.

SSM/Spotts, Stevens and McCoy conducted plugging and weiring operations on April 16, 1997. The results of the operations are included in Appendix B. The findings from the plugging and weiring are:

1. There is I/I from manhole 13 to manhole 10. The approximate flow is 12,000 gpd.

2. Measurements taken in the metering manhole prior to plugging showed over 150,000 gpd in flow. By plugging manhole 85 the flow reading in manhole 83 was less than 3,000 gpd.

3. Plugging and weiring confirmed that I/I was present from manhole 70 to manhole 3.

5.0 SMOKE TESTING

Smoke testing is done to locate sources of inflow. Smoke testing is completed by dropping a smoke bomb into a given manhole. The manhole is then covered with a blower. The blower forces the smoke through all of the inlets into the system. Typically smoke testing is used to find downspouts and storm drains that are connected to the collection system. Smoke testing can also be used to find broken vents, cleanouts and traps.

SSM/Spotts, Stevens and McCoy conducted smoke testing in the Borough April 9 and 10, 1997. The results of the testing are included in Appendix C. The findings of the smoke testing are:

1. Except for minor items, such as broken vents, the Borough does not have significant sources of inflow.

2. The only notable source of inflow is at the Sunoco station on 1st Ave. The outdoor wash pad is connected to the collection system. The pad covers a large surface area and is directly open to the atmosphere. This was discovered during smoke testing and confirmed with dye testing.

6.0 PORTABLE FLOWMETERING

A portable flowmeter uses depth and velocity sensors to calculate flow. The flow readings are collected and stored in the computer memory incorporated into the meter. The data is collected over several days and downloaded to a common portable computer. The portable flowmeter can also measure flow data in one hour increments. By using one hour increments, off-peak flow characteristics can be viewed.

SSM/Spotts, Stevens and McCoy conducted portable flowmetering from mid-March till early April. The portable flowmeter was inserted into five manholes over the given time period. However, the meter malfunctioned in two of the manholes. The source of the malfunction was not determined. Results were obtained for manhole 72, 13 and 35. A summary table and the raw data is included in Appendix D.

The findings from the flowmetering are:

1. A significant amount of I/I is coming from the branches from New Garden Township (manhole 73 to 79 and manhole 73 to 87). The readings for manhole 72 show a flow rate of approximately 140,000 gpd at 3:00 a.m.. This was consistently seen over the monitoring period.

2. Very little correlation was shown between the between total daily flow and rainfall.

7.0 CONCLUSIONS

SSM/Spotts, Stevens and McCoy reviewed the findings of this investigation and the past reports. SSM/Spotts, Stevens and McCoy used this information to produce the following list of conclusions.

1. The 10" trunk lines are a significant source of I/I. The nighttime inspections, the plugging and weiring and the portable flowmetering showed this. In addition, the prior two reports also showed this.

2. The estimated I/I is approximately 180,000 to 210,000 gpd.

3. The I/I is predominantly in the form of infiltration. The statistical review showed little correlation between rainfall and plant flow. The portable flowmetering showed little correlation between rainfall and flow. The previous Smith report also found a majority of the I/I to be in the form of infiltration.

4. The majority of the I/I is coming from New Garden Township. The plugging and weiring showed over 150,000 gpd coming from New Garden Township. The nighttime inspections showed approximately 100,000 gpd coming from New Garden Township. The portable flowmetering showed flow rates of 140,000 gpd at 3:00 a.m. coming from New Garden Township. New Garden Township has an I/I problem.

5. Assuming that a 30 percent reduction of I/I could be achieved, the WWTP will still not meet the permit requirements of 300,000 gpd.

6. Minor Street and Avon Mohr have I/I. The areas are depicted on Figure 1.

8.0 RECOMMENDATIONS

The following recommendations are based on the conclusions from the previous section.

1. Clean and televise those sections of the collection system shown on Figure 1. Those sections where the leaks can be located should be grouted. In addition, the televising should show any leaky laterals. These laterals should be noted for possible future work.

2. Seal and repair those manholes that are leaking or show signs of leaking. These manholes are shown on Figure 1.

3. Repair those vents and traps listed in Appendix C. These vents and traps smoked during the smoke testing. In addition, the Sunoco on 1st Ave. should be contacted. They should either disconnect the wash pad from the collection system or cover the pad from rainfall.

4. Begin a discussion with New Garden Township. New Garden Township must reduce their I/I. Any corrections to the Avondale collection system are nullified if New Garden Township does not do the same. If one single repair project could be coordinated between the Borough and the Township the price for the repairs could be reduced.

5. Monitor groundwater levels. Infiltration rates are directly proportional to groundwater levels. The levels could be monitored via the production well system or special manhole site gauges could be added.

FIGURE 1

COLLECTION SYSTEM LAYOUT

CHART 1

RAINFALL VS. WEEKLY TOTAL PLANT FLOWS

Rainfall vs. Weekly Total Plant Flows
Chart 1

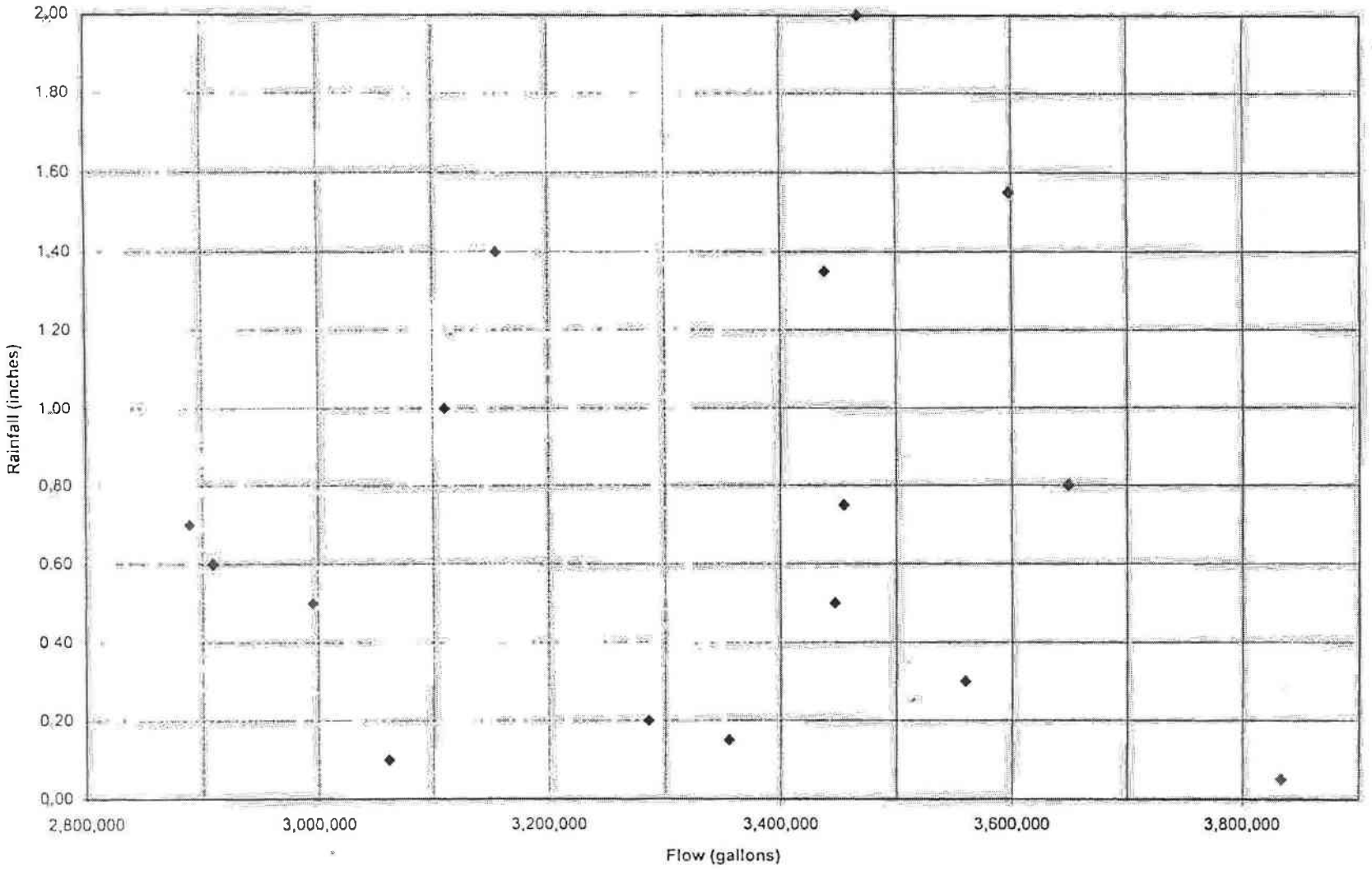

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CHART 2

RAINFALL VS. AVONDALE BOROUGH FLOW

Rainfall vs. Avondale Borough Flow
Chart 2

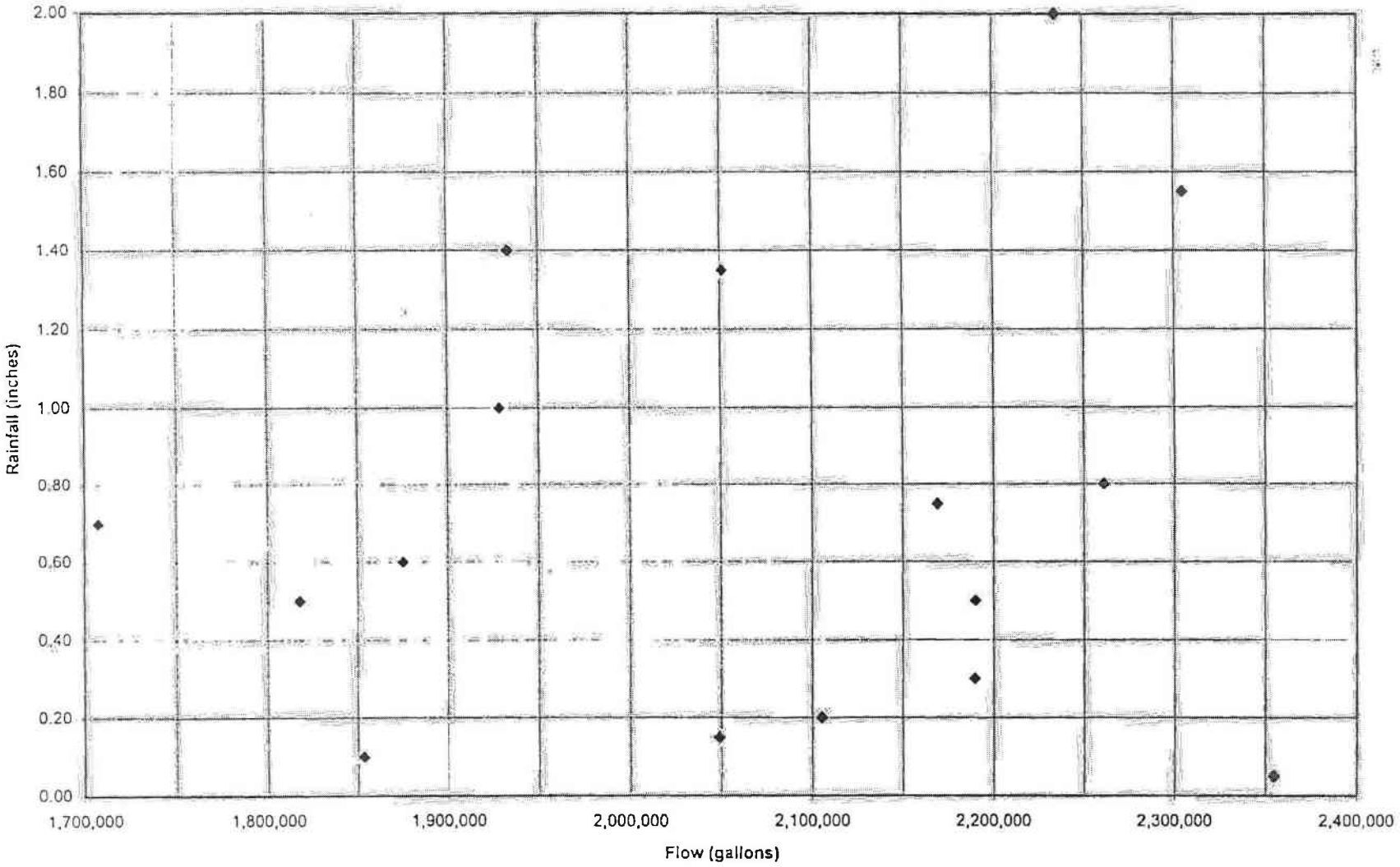

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CHART 3

RAINFALL VS. NEW GARDEN TOWNSHIP FLOW

Rainfall vs. New Garden Twp. Flow
Chart 3

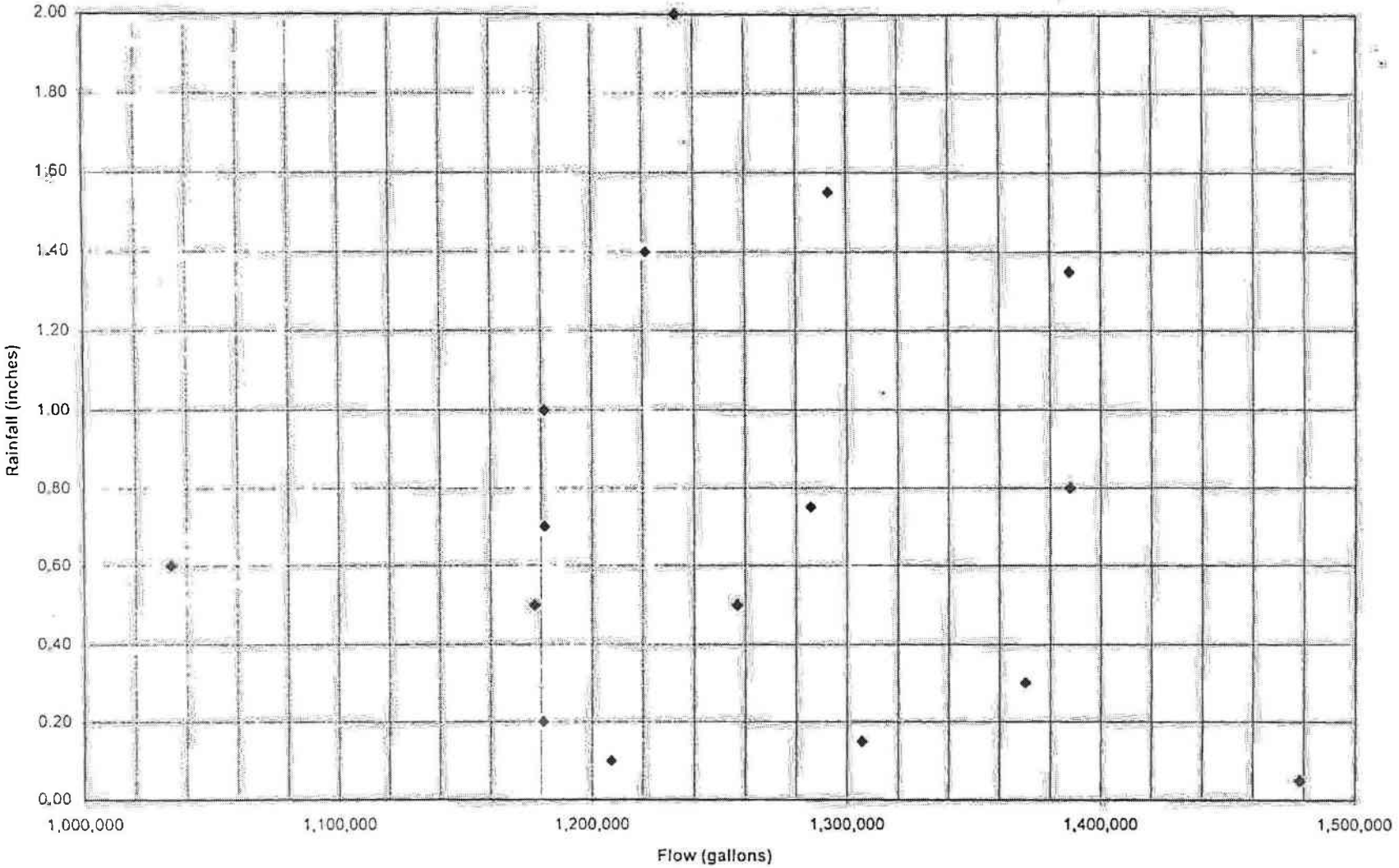

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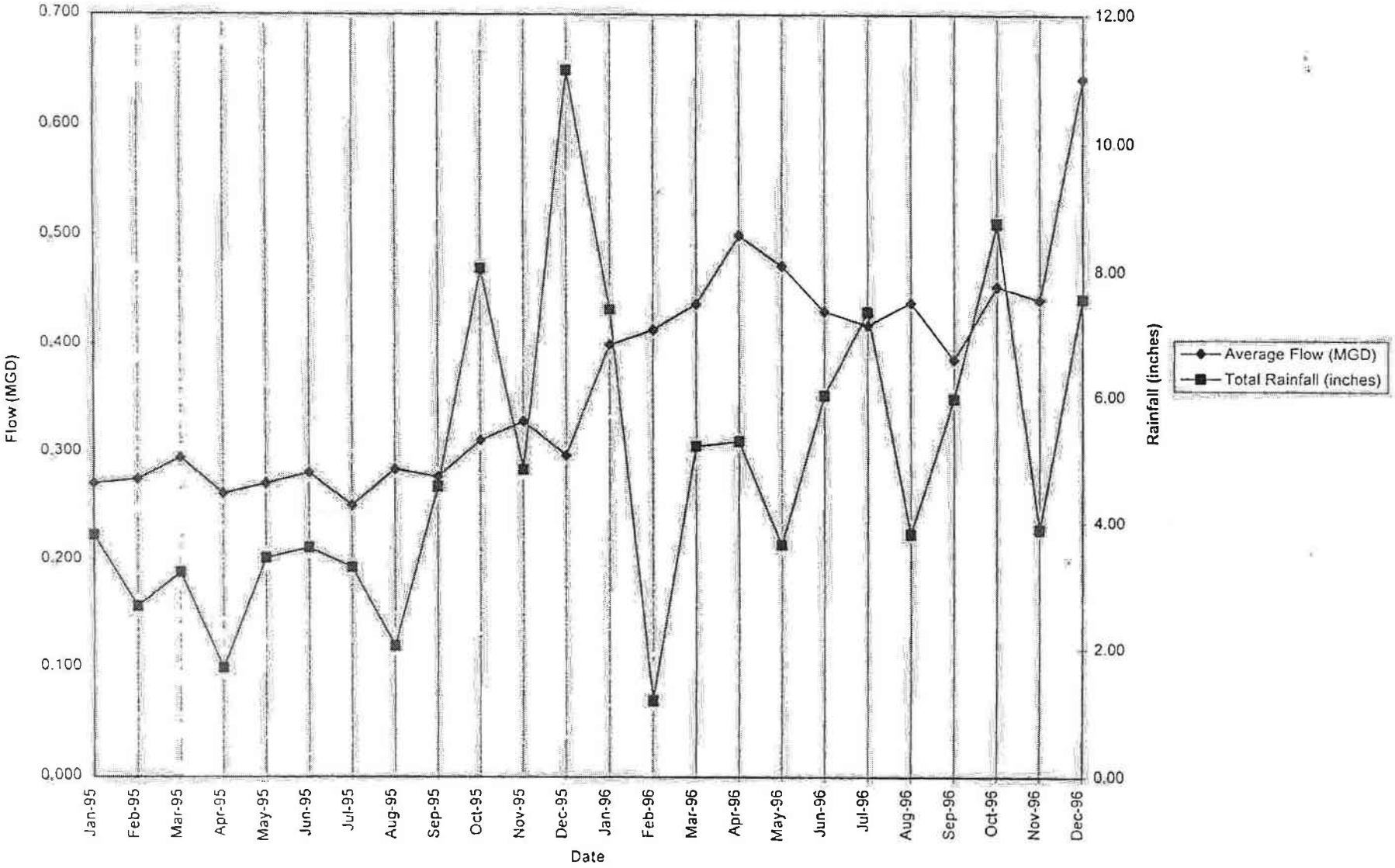
CHART 4

TWO YEAR RAINFALL AND FLOW HISTORY

AVONDALE I/I STUDY

Chart 4
2 Year History (1995-1996)
Rainfall & Flow vs. Date



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APPENDIX A

NIGHTTIME MANHOLE INSPECTIONS RESULTS

SSM/SPOTTS,STEVENS, AND McCOY

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/12/97	75	74	76	20000	6'	Precast Brick base	VCP	10	3	Flow is estimated due to concrete in channel which prevented weir insertion. Cover has pickholes w/handle No signs of leaking
3/12/97	73	72	74A 86	20000 80000	10'	Precast Brick base	VCP	10	3	20000 gpd flow is estimated due to concrete in channel which prevented weir insertion. Cover has pickholes w/handle(paved over). No signs of leaking.
3/12/97	72	71 (assumed-not found)	72	100000	10'	Precast Brick base	VCP	10	4	Flow is estimated due to concrete in channel which prevented weir insertion. Cover has pickholes w/handle(paved over). No signs of leaking. PLACED FLOWMETER IN MH @2:00 AM brown discharge w/white particulate
3/12/97	76	75	76	13000	7'	Precast Brick base	VCP	10	1	Bad leak above inlet pipe(5000 of 13000gpd). Cover has pickholes w/handle.
3/12/97	77	76	78	8000	6'	Precast Brick base	VCP	10	3	
3/12/97	78	77	79	3500	7'	Precast Brick base	VCP	10	3	Pickholes in lid
3/12/97	79	78	Meter Pit		5'	Precast Brick base	VCP	10	3	5 exposed pickholes in lid
3/12/97	Meter Pit	79	N/A	6000 (from chart)	5'		VCP	10	3	Palmer-Bowlus flume w/ plastic insert (10"), 1/2" deep in throat of flume.

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

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SSM/SPOTTS,STEVENS, AND McCOY

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/12/97	86	73	80	20000	7'	Precast Brick base	VCP	10	4	Curved MH channel, Lid 1.5' off ground
3/12/97	80	86	81	15000	9'	Precast Brick base	VCP	10	4	Curved MH channel, MH pickholes in lid.
3/12/97	81	80	82		12'	Precast Brick base	VCP	10	4	Curved MH channel, Lid 3' off ground
3/12/97	82	81	83 (meter pit)		8'	Precast Brick base	VCP	10	4	Very bad smell
3/12/97	83	82	84	187500 (from chart)	7'	Precast Brick base	VCP	10	1	METER PIT Obvious signs of leaking. 10" Palmer Bowlus flume, 2-1/4" deep.
3/13/97	A (63)	71 (assumed)	B	4000	12'	Precast	VCP	8	2	Signs of leaking Pickholes in lid Smell of oil and/or gas
3/13/97	B	A (63)	C	3000	17'	Precast Brick base	VCP	8	3	Gas station lateral into MH, plastic insert under lid
3/13/97	C	B	D (62)	3000	16'	Precast Brick base	VCP	8	3	Plastic insert under lid

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/13/97	D (62)	C	E (61)	3000	13'	Precast Brick base	VCP	8	3	Plastic insert under lid Pickholes in lid
3/13/97	E (61)	D (62)	60	2000	11'	Precast	VCP	8	3	Pickholes in lid
3/13/97	60	E (61)	N/A (terminal)	N/A	5'	Precast	VCP	8	4	Pickholes in lid
3/13/97	70	64 (assumed)	71 (assumed)		12'	Precast	VCP	10	4	Pickholes in lid
3/18/97	13	12	14	24000	9'	Precast Brick base	VCP	10	2	PLACED FLOWMETER IN MANHOLE 13 Brick riser chimney cracked Signs of leaking in manhole (stains) Pickholes in lid
3/18/97	14	13	15 95	10000 3000	8'	Precast Brick base	VCP	8" in 10" out	3	Broken handle on lid
3/18/97	15	14	16	10000	8'	Precast Brick base	VCP	8	2	MH 2' above grade Signs of leaking in manhole (stains) Pickholes in lid
3/18/97	95	15	22	3000	8'	Precast Brick base	VCP	8	3	Drop manhole, cracks in brick riser pickholes in lid, plastic insert

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

CSM/SCOTT STEVENS AND ASSOC.

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/18/97	22	95	96 93 23	0 0 3000	12'	Precast Brick base	VCP	8	3	MH in good condition, pickholes paved over
3/18/97	96	22	--	--	8'	Precast Brick base	VCP	8	3	Pickhole in lid, dirt & sediment on bottom of MH TERMINAL MH
3/18/97	93	22	--	--	5'	Precast Brick base	VCP	8	3	Cracked brick riser
3/18/97	23	22	24	0	10'	Precast Brick base	VCP	8	1	pickholes in lid, plastic insert Leak on side of MH (at joint) signs of other leaks
3/18/97	24	23	--	--	11'	Precast Brick base	VCP	8	4	pickholes in lid, plastic insert TERMINAL MH
3/18/97	17	16	--	--	5'	Precast Brick base	VCP	8	2	signs of leaking pickholes paved over
3/18/97	16	15	17 18	1000 8000	8'	Precast Brick base	VCP	8	2	pickholes in lid signs of leaking (stains)
3/18/97	18	16	19	5000	7'	Precast Brick base	VCP	8	3	pickholes in lid

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/18/97	19	18	20	5000	7'	Precast Brick base	VCP	8	3	pickholes in lid
3/18/97	20A	19	21	0	6'	Precast Brick base	VCP	8	3	pickholes in lid, plastic insert
			20	3000						Not on original plan
3/18/97	21	20A	--	--	5'	Precast Brick base	VCP	8	3	pickholes in lid, plastic insert
3/18/97	20	20A	92	3000	5'	Precast Brick base	VCP	8	3	pickholes in lid, plastic insert
			94	trickle						
3/18/97	94	20	--	--	5'	Precast Brick base	VCP	8	3	pickhole in lid, broken handle
										TERMINAL MH
3/18/97	91	92	--	--	5'	Precast Brick base	VCP	8	3	pickhole in lid
										TERMINAL MH
3/18/97	92	20	91	0	7'	Precast Brick base	VCP	8	3	pickholes in lid, plastic insert
			90	3000						
3/18/97	90	92	89	0	7'	Precast Brick base	VCP	8	3	pickholes in lid, plastic insert
			90A	1000						

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

CLIENT: Borough of Avondale — SEWER AND MANHOLE INSPECTION SHEET — INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/18/97	90A	90	90B 90C	0 0	5'	Precast Brick base	VCP	8	4	offset cover, plastic insert 90C-couldn't find (not on original plan) 90B-couldn't find, possibly serve business(not on original plan)
3/18/97	88	89	--	--	8'	Precast Brick base	VCP	8	3	pickhole in lid TERMINAL MH
3/18/97	87	89	--							NOT FOUND
3/18/97	89	90	88 87							NOT FOUND
3/18/97	90B	90A								NOT FOUND
3/18/97	90C	90A								NOT FOUND
3/24/97	10	9	11 98B	15000 1000	6'	Precast Brick base	VCP	10" (MH11) 8" (MH98B)	3	plastic insert, originally bolt down cover
3/24/97	98B	10	97 98A 99	0 (drop) 0 (drop) 0	13'	Precast Brick base	VCP	8"	3	plastic insert, pickholes in lid, 2 drops in MH handles on lid

RATING

1-Visible Leak

2-Signs of Leaking

3-Minor Deficiencies

4-No Deficiencies

CSM/SPOTTS STEVENS AND MCCOY

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/24/97	97	98B	--	--	6'	Precast Brick base	VCP	8"	3	pickholes in lid TERMINAL MH
3/24/97	98A	98B	--	--						pickholes in lid, plastic insert, could not remove insert TERMINAL MH
3/24/97	99	98B	100							couldn't open, paved over (possibly terminal MH)
3/24/97	9	8	10 59B	 5000	12'	Precast Brick base	VCP	10" (MH10) 8" (MH59B)	2	pickholes in lid, handles on lid possible leak below inlet of 59B
3/24/97	59B	9	49 59A	8000 0	8'	Precast Brick base	VCP	8"	4	pickhole in lid, plastic insert drop MH
3/24/97	49	59B	47	3000	7'	Precast Brick base	VCP	8"	4	pickholes paved over
3/24/97	47	49	--	--	6'	Precast Brick base	VCP	8"	2	pickholes in lid, signs of leaking-minimal TERMINAL MH

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

"SM"OT" ST"VENS "ND "ECC"

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/24/97	59A	59B	--	--	9'	Precast Brick base	VCP	8"	4	pickholes in lid TERMINAL MH
3/24/97	34	33	39 35 37	?? ?? ??	11'	Precast Brick base	VCP	8" 10" 8"	2	pickholes in lid extremely clogged(unweirable) will have to plug and weir
3/24/97	39									CAN'T FIND (possibly doesn't exist)
3/24/97	40	39	41	3000	8'	Precast Brick base	VCP	8"	3	Concrete in channel pickholes in lid
3/24/97	41	40	42	3000	8'	Precast Brick base	VCP	8"	3	handles on cover pickholes paved over
3/24/97	42	41	43 44	0 2000	11'	Precast Brick base	VCP	8"	3	pickholes in lid
3/24/97	44	42	45	0	10'	Precast Brick base	VCP	8"	4	pickholes in lid very dry, good condition
3/24/97	45	44	46	0	8'	Precast Brick base	VCP	8"	4	pickholes in lid very dry, good condition

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/24/97	46	45	--	--	8'	Precast Brick base	VCP	8"	4	pickholes in lid very dry, good condition Terminal MH
3/24/97	43	42	--	--	5'	Precast Brick base	VCP	8"	4	Terminal MH pickholes in lid
3/24/97	50	31	51	<1000	11'	Precast Brick base	VCP	10"	4	pickholes in lid
3/24/97	51	50	48 52	0 <1000	9'	Precast Brick base	VCP	8" (MH 48) 10" (MH52)	2	signs of leaking pickholes in lid
3/24/97	48	51	--	--	8'	Precast Brick base	VCP	8"	3	pickholes in lid TERMINAL MH
3/24/97	52	51	53	<1000	5'	Precast Brick base	VCP	10"	3	plastic insert in MH
3/24/97	53	52	54	<1000	10'	Precast Brick base	VCP	10"	2	signs of leaking, pickholes in MH
3/26/97	35	34	36	37000	8'	Precast Brick base	VCP	10"	2	pickholes in lid, plastic insert signs of leaking FLOWMETER PLACED IN MH

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
3/26/97	25A	25B	--	--	9'	Precast Brick base	VCP	8"	4	TERMINAL MH pickholes in lid
3/26/97	25B	26	25A	<1000	6'	Precast Brick base	VCP	8"	3	pickholes in lid
3/26/97	26	28	25B	2500	7'	Precast Brick base	VCP	8"	4	pickholes in lid, paved over
3/26/97	28	27	26	2500	7'	Precast Brick base	VCP	8"	2	signs of leaking pickholes in lid MH raised 2' above ground
3/26/97	4A	4	5	4000	10'	Precast Brick base	VCP	8"	2	no pickholes - newer lid leaking around chimney frame
3/26/97	5	4A	6	4000	10'	Precast Brick base	VCP	8"	2	1 pickhole in lid (others paved over) plastic insert, offset frame and cover signs of leaking
3/26/97	6	5	7	4000	8'	Precast Brick base	VCP	8"	2	pickholes in lid (paved over) plastic insert signs of leaking at frame and chimney
3/26/97	7	6								extremely paved over, couldn't open Found other MH's in subdivision above MH 7 (Not shown on original plan)

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

SM OT ST ENS ND CC

CLIENT: Borough of Avondale

SEWER AND MANHOLE INSPECTION SHEET

INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
4/2/97	2AM	7	3AM plug	3000 0	4'	Precast	PVC	8"	3	Lots of solids in channel, no pickholes in lid solid NEENAH lid
4/2/97	3AM	2AM	4AM	3000	8'	Precast Poured Bottom	PVC	8"	2	Doghouse MH, pipe offset in channel, signs of leaking
4/2/97	4AM	3AM	5AM 4-1AM Plug	3000 0 0	8'	Precast Poured Bottom	PVC	8"	4	solids in channel, no pickholes in top of lid
4/2/97	4-1AM	4AM	4-2AM	0	8'	Precast Poured Bottom	PVC	8"	4	solids in channel, no pickholes in top of lid
4/2/97	4-2AM	4-1AM	plug?	0	8'	Precast Poured Bottom	PVC	8"	3	Possible plug upstream, no evidence of MH upstream
4/2/97	5AM	4AM	6AM	3000	7'	Precast Poured Bottom	PVC	8"	3	Flat cover, no pickhole on top
4/2/97	5-1AM	5AM	6AM	<2000	10'	Precast Poured Bottom	PVC	8"	1	visible leak (1500 gpd) around exiting pipe signs of leaking around joints and other parts of MH
4/2/97	6AM	5-1AM	7AM	150	6'	Precast Poured Bottom	PVC	8"	1	plastic insert, flat cover visible leak in wall (400gpd) above exiting pipe, visible leak at 1st joint ring above base signs of leaking in other parts of MH

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

"SM""POTT" ST""ENS, ND "":CC"

CLIENT: Borough of Avondale — SEWER AND MANHOLE INSPECTION SHEET — INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
4/2/97	7AM	6AM	7-1AM plug	<1000 0	7'	Precast Poured Bottom	PVC	8"	3	flat cover
4/2/97	7-1AM	7AM	7-2AM	<500	5'	Precast Poured Bottom	PVC	8"	2	flat cover, cracks around joints
4/2/97	7-2AM	7-1AM	--	0	7'	Precast Poured Bottom	PVC	8"	3	Terminal MH, flat cover
4/2/97	32	33	31	40000 approximate not weired	15'	Precast Brick Base	VCP	10"	4	Solids in bottom of channel (unweirable) MH needs to be flushed pickholes in lid
4/2/97	33	32	34							COULDN'T FIND
4/2/97	32A	31	32 Z(plug?)	65000 0	16'	Precast Brick Base	VCP	10" 8"	3	Drop MH, pickholes in lid, Time 6:00 AM (some sewer flow)
4/2/97	31	30	32A 50		18'	Precast Brick Base	VCP	10" 10"	1	It's clogged severely, impossible to weir, Drop MH from MH 50 plastic insert, pickholes in lid
4/2/97	30	29	31		20'	Precast Brick Base	VCP	10"	2	pickholes in lid, signs of leaking

RATING

1-Visible Leak

2-Signs of Leaking

3-Minor Deficiencies

4-No Deficiencies

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
4/2/97	29	27	30		16'	Precast Brick Base	VCP	10"	3	pickholes in lid channel clogged with grease
4/2/97	1	2	29		16'	Precast Brick Base	VCP	10"	2	raised 2.5 ' above ground signs of leaking
4/2/97	27	1	28		17'	Precast Brick Base	VCP	8" 10"	3	pickholes in lid, offset frame and cover MH should have insert or be reset couldn't estimate flow from 28 (full of suds)
			29	70000						
4/2/97	37	34	38B	3000 (during day)	12'	Precast Brick Base	VCP	8"	4	pickholes in lid, Time 10:00 AM
4/9/97	89	90	88	<500	7'	Precast Brick Base	VCP	8"	2	found w/ smoke test plastic insert, pickholes in lid signs of leaking inspected @ 9:30 AM
			87	<500						
4/9/97	87	89	--		7'	Precast Brick Base	VCP	8"	2	pickholes in lid, brick riser crumbling TERMINAL MH found w/ smoke test
4/9/97	55	54	56		7'	Precast Brick Base	VCP	10"	3	pickholes in lid found w/ smoke test
4/10/97	74A	73	74		9'	Precast Brick Base	VCP	10"	4	pickholes in lid, extremely covered w/ brush found w/ smoke test

RATING
1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

CLIENT: Borough of Avondale SEWER AND MANHOLE INSPECTION SHEET INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
4/10/97	74	74A	75		10'	Precast Brick Base	VCP	10"	2	pickholes in lid, found w/ smoke test drop MH
4/16/97	12	11	13	0	9'	Precast Brick Base	VCP	10"	3	3.5' above ground, plastic insert, pickholes in lid
4/16/97	84	83 (meter)	85	3000 10000 (from lateral)	7'	Precast Brick Base	VCP	10"	2	Brick riser, signs of leaking, 6" lateral into MH 2.5' above ground
4/16/97	85	84	87	2000	8'	Precast Brick Base	VCP	10"	2	Lateral into MH, signs of leaking, 2.5' above ground
4/16/97	87	85			8'	Precast Brick Base	VCP	10"	1	2 visible leaks, other signs of leaking, 2.5' above ground, This MH was plugged
4/16/97	66	68	70	7000	14'	Precast Brick Base	VCP	10"	3	pickholes in lid, raised 1' above ground boltdown MH - missing bolts
4/16/97	68	69	66	15000	11'	Precast Brick Base	VCP	10"	2	signs of leaking, 5' above ground boltdown MH - missing bolts
4/16/97	69	3	68	30000	11'	Precast Brick Base	VCP	10"	2	signs of leaking, 5' above ground boltdown MH - missing bolts

RATING

1-Visible Leak
2-Signs of Leaking
3-Minor Deficiencies
4-No Deficiencies

[illegible]

CLIENT: Borough of Avondale

SEWER AND MANHOLE INSPECTION SHEET

INSPECTION CREW: Jerry Debalko, Art Auchenbach

WO#: 5685-004

Date	MH No.	Downstream MH	Upstream MH(s)	Measured Flow (gpd)	MH Depth	MH Type	Pipe Type(s)	Pipe Diameter (inches)	MH Rating (1)-Worst (4)-Best	Notes/Comments:
4/16/97	3	2	69 4A	37000	15'	Precast Brick Base	VCP	10"	2	Most flow is from 69, 6' above ground Flow is approximated due to depth of MH and oxygen level
4/16/97	36	35	8		8'	Precast Brick Base	VCP	10"	2	Signs of leaking, plastic insert, solids in channel
4/23/97	2	Plant Wet Well	1 3		17'	Precast	VCP	10" 10"	4	Good Condition, probably should have a plastic insert
4/23/97	8	36	9		11'	Precast Brick Base	VCP	10"	2	Signs of leaking, bolted cover 4' above ground

RATING

1-Visible Leak

2-Signs of Leaking

3-Minor Deficiencies

4-No Deficiencies

APPENDIX B

PLUGGING AND WEIRING RESULTS

Plug and Weir Results

Date	Plugged Manhole	Weired Manhole(s)	Measured Flow (gpd)
4/16/97	13	12	0
4/16/97		10	12000
4/16/97	87	85	2000
4/16/97		84	3000
			(10000 from lateral)
4/16/97		83 *	36000
4/16/97	75	74	0
4/16/97		74A	1000
4/16/97		73	2000
4/16/97	70	66	7000
4/16/97		68	15000
4/16/97		69	30000
4/16/97		3	37000

(*) Flow taken from ISCO open channel flow book.
Manhole 83 is a meter pit for New Garden Twp. flow.
Measured depth in flume was 1 3/8".

APPENDIX C

SMOKE TESTING RESULTS

Avondale Borough Smoke Testing Results

Inspectors: GAD & AWA

DATE	MH #	Findings
4/9/97	22	233 Church Rd. - Raised vent, no cap NE Corner Church Rd. & 3rd - No cap on vent, downspout into ground, no smoke Clean out CB
4/9/97	90	NE corner Henson & 3rd filled w/ smoke due to unfinished bathroom
4/9/97	19	321 Church St. - Vented cap
4/9/97	13	405 3rd Ave. - Roof leader into ground, no smoke
4/9/97	98B	207 New St. - No cap on vent, flush with ground
4/9/97	59B	Green house on Hoopes Alley - Pipe without cap
4/9/97	42	Found nothing of consequence
4/9/97	45	523 Pennsylvania Ave. - Downspouts into ground, no smoke 513 Pennsylvania Ave. - Downspouts into ground, no smoke
4/9/97	34	Car Wash at Sunoco Station - Vent, no lid, Possible discharge to system through car wash catch basins, could be significant I/I problem Fire House - Cleanout cap broke (on Morris St.)
4/9/97	53	Found MH 55 Smoke through Church roof vent
4/9/97	55	Vent at house north of MH55 uncovered and flush with ground
4/10/97	51	126 Pennsylvania Ave - Low lying vent, no cover
4/10/97	31	C.G. Furlong Law Office - Broken cleanout cap, flush w/ground Tractor Shop/B&C Tags - Downspouts into ground, no smoke Edlon Products - Downspouts into ground
4/10/97	26	231 State St. - Low vent cleanout, no cap (downspout <1' away from vent)
4/10/97	7AM	4 Cook St. Downspout into ground, no smoke 16 Miller St. Downspout into ground, no smoke 14 Miller St. Downspout into ground, no smoke 15 Miller St. Downspout into ground, no smoke 12 Miller St. Downspout into ground, no smoke 9 Miller St. Downspout into ground, no smoke
4/10/97	7-2AM	nothing of consequence
4/10/97	4AM	1 N. Williamson vent below grade

Avondale Borough Smoke Testing Results

Inspectors: GAD & AWA

DATE	MH #	Findings
4/10/97	6	nothing found
4/10/97	C	M. Cutone mushrooms needs lid on vents at conc. pad. Vents should be raised and capped Landhope Farms Market - Cleanout near MH 63A needs to be raised and capped
4/10/97	73	Found MH 74A
4/10/97	76	Found MH 74

APPENDIX D

PORTABLE FLOWMETERING DATA SUMMARY AND RAW DATA

METERED FLOWS AT MANHOLES 72, 13, 35

MH	DATE	TOTAL DAILY FLOW (mgd)		RAINFALL	
72	3/14/97		0.200		0.70
	3/15/97		0.170		0.00
	3/16/97		0.148		0.00
	3/17/97		0.159		0.00
	3/18/97		0.152		0.06
		AVERAGE	0.166	TOTAL	0.760
13	3/20/97		0.030		0.00
	3/21/97		0.010		0.00
	3/22/97		0.005		0.00
	3/23/97		0.013		0.00
	3/24/97		0.011		0.00
	3/25/97		0.007		0.00
	3/26/97		0.007		0.34
		AVERAGE	0.012	TOTAL	0.340
35	3/28/97		0.037		0.00
	3/29/97		0.010		0.21
	3/30/97		0.023		0.00
	3/31/97		0.052		0.54
	4/1/97		0.058		0.04
	4/2/97		0.054		0.00
		AVERAGE	0.039	TOTAL	0.790

DAILY TOTALS (GALLONS)

Date: 04/21/97 11:11 File: C080193A.73R

260 C80193
AVONDALE
MANHOLE #35
2ND AVE

Metering Period:
03/27/97 02:31 - 04/03/97 05:01

Report Period:
03/27/97 02:31 - 04/03/97 05:01

Date	Total	Date	Total
03/27/97	40.89K*	04/03/97	9.50K*
03/28/97	36.89K	04/04/97	-
03/29/97	10.46K	04/05/97	-
03/30/97	23.39K	04/06/97	-
03/31/97	52.44K	04/07/97	-
04/01/97	58.02K	04/08/97	-
04/02/97	53.65K	04/09/97	-
	275.73K*		9.50K*

Total for report period = 285,231.44 GALLONS

Codes:
- K Multiply data by 1,000
- M Multiply data by 1,000,000
- \- No data for period
- * Incomplete data for period
- < Data less than cutout value
- | Fill Data for period

DAILY MAXIMUMS and MINIMUMS for FLOW

Date: 04/21/97 11:11 File: C080193A.73R

260 C80193
AVONDALE
MANHOLE #35
2ND AVE

Metering Period:
03/27/97 02:31 - 04/03/97 05:01

Report Period:
03/27/97 02:31 - 04/03/97 05:01

Date	Time	FLO MGD	LEV in.	VEL FPS	Date	Time	FLO MGD	LEV in.	VEL FPS
03/27	10:16	0.06 *	2.30 *	1.87 *					
03/27	05:31	0.03 *	1.90 *	1.42 *					
03/28	18:31	0.06	2.60	1.68					
03/28	22:01	0.01	1.90	0.34					
03/29	13:01	0.02	2.80	0.55					
03/29	07:46	0.00	2.20	0.05					
03/30	18:46	0.06	2.40	1.83					
03/30	00:46	0.01	1.60	0.30					
03/31	12:31	0.08	2.70	1.93					
03/31	01:01	0.03	1.80	1.36					
04/01	20:46	0.09	2.70	2.16					
04/01	05:01	0.04	2.00	1.78					
04/02	09:01	0.08	2.60	2.05					
04/02	21:31	0.00	2.40	0.06					
04/03	04:46	0.06 *	2.40 *	1.75 *					
04/03	04:01	0.04 *	2.00 *	1.66 *					

Codes:

K	Multiply data by 1,000
M	Multiply data by 1,000,000
-	No data for period
*	Incomplete data for period
<	Data less than cutout value
^	Surcharge (level greater than pipe height)
|	Fill Data for period

1 HOUR AVERAGES

Date: 04/21/97 11:09 File: C080193A.73R

260 C80193
AVONDALE
MANHOLE #35
2ND AVE

Metering Period:
03/27/97 02:31 - 04/03/97 05:01

Report Period:
03/27/97 02:31 - 04/03/97 05:01

START Date	Time	FLO MGD	LEV in.	VEL FPS	START Date	Time	FLO MGD	LEV in.	VEL FPS
03/27	02:00	0.04 *	1.90 *	1.66 *	03/28	20:00	0.02	2.10	0.56
03/27	03:00	0.04	2.02	1.66	03/28	21:00	0.02	2.13	0.57
03/27	04:00	0.04	2.00	1.64	03/28	22:00	0.01	1.92	0.54
03/27	05:00	0.04	1.97	1.55	03/28	23:00	0.01	1.95	0.61
03/27	06:00	0.05	2.12	1.73	03/29	00:00	0.01	1.88	0.44
03/27	07:00	0.05	2.20	1.74	03/29	01:00	0.00	1.70	0.23
03/27	08:00	0.05	2.15	1.74	03/29	02:00	0.01	1.77	0.49
03/27	09:00	0.05	2.10	1.70	03/29	03:00	0.01	1.80	0.55
03/27	10:00	0.05	2.22	1.69	03/29	04:00	0.01	1.95	0.48
03/27	11:00	0.04	2.08	1.67	03/29	05:00	0.01	1.90	0.49
03/27	12:00	0.05	2.22	1.73	03/29	06:00	0.00	2.07	0.11
03/27	13:00	0.05	2.13	1.68	03/29	07:00	0.00	1.95	0.08
03/27	14:00	0.04	2.10	1.64	03/29	08:00	0.00	1.93	0.08
03/27	15:00	0.05	2.25	1.68	03/29	09:00	0.00	2.02	0.10
03/27	16:00	0.05	2.30	1.61	03/29	10:00	0.01	2.25	0.47
03/27	17:00	0.05	2.22	1.71	03/29	11:00	0.02	2.14	0.59
03/27	18:00	0.05	2.20	1.63	03/29	12:00	0.02	2.23	0.57
03/27	19:00	0.05	2.12	1.72	03/29	13:00	0.02	2.37	0.56
03/27	20:00	0.05	2.20	1.67	03/29	14:00	0.02	2.13	0.57
03/27	21:00	0.05	2.12	1.69	03/29	15:00	0.01	2.03	0.50
03/27	22:00	0.04	2.00	1.57	03/29	16:00	0.02	2.12	0.55
03/27	23:00	0.04	1.93	1.54	03/29	17:00	0.01	2.03	0.54
03/28	00:00	0.03	1.88	1.47	03/29	18:00	0.01	1.80	0.50
03/28	01:00	0.03	1.77	1.35	03/29	19:00	0.01	1.85	0.49
03/28	02:00	0.03	1.73	1.38	03/29	20:00	0.01	1.85	0.49
03/28	03:00	0.03	1.82	1.43	03/29	21:00	0.01	1.68	0.48
03/28	04:00	0.03	1.77	1.36	03/29	22:00	0.01	1.75	0.49
03/28	05:00	0.03	1.85	1.48	03/29	23:00	0.01	1.67	0.41
03/28	06:00	0.04	2.03	1.44	03/30	00:00	0.01	1.73	0.35
03/28	07:00	0.05	2.20	1.70	03/30	01:00	0.01	1.82	0.54
03/28	08:00	0.05	2.15	1.66	03/30	02:00	0.01	1.90	0.56
03/28	09:00	0.04	2.08	1.66	03/30	03:00	0.01	1.95	0.58
03/28	10:00	0.05	2.13	1.67	03/30	04:00	0.01	1.88	0.49
03/28	11:00	0.05	2.17	1.65	03/30	05:00	0.01	1.80	0.54
03/28	12:00	0.05	2.14	1.70	03/30	06:00	0.01	1.75	0.54
03/28	13:00	0.05	2.18	1.64	03/30	07:00	0.02	2.04	0.58
03/28	14:00	0.05	2.10	1.68	03/30	08:00	0.02	2.27	0.57
03/28	15:00	0.05	2.22	1.62	03/30	09:00	0.02	2.23	0.56
03/28	16:00	0.05	2.20	1.64	03/30	10:00	0.02	2.15	0.60
03/28	17:00	0.05	2.18	1.74	03/30	11:00	0.02	2.17	0.58
03/28	18:00	0.05	2.30	1.75	03/30	12:00	0.02	2.03	0.60
03/28	19:00	0.04	2.12	1.50	03/30	13:00	0.02	2.10	0.60

START Date	Time	FLO MGD	LEV in.	VEL FPS
03/30	14:00	0.02	2.12	0.61
03/30	15:00	0.02	2.20	0.64
03/30	16:00	0.02	2.22	0.57
03/30	17:00	0.04	2.03	1.65
03/30	18:00	0.05	2.32	1.74
03/30	19:00	0.05	2.28	1.78
03/30	20:00	0.05	2.23	1.75
03/30	21:00	0.03	1.93	1.43
03/30	22:00	0.04	2.10	1.64
03/30	23:00	0.04	1.92	1.52
03/31	00:00	0.03	1.93	1.45
03/31	01:00	0.03	1.87	1.43
03/31	02:00	0.04	2.02	1.52
03/31	03:00	0.04	2.05	1.51
03/31	04:00	0.04	2.00	1.54
03/31	05:00	0.04	2.00	1.56
03/31	06:00	0.05	2.30	1.65
03/31	07:00	0.05	2.33	1.73
03/31	08:00	0.06	2.30	1.80
03/31	09:00	0.06	2.37	1.85
03/31	10:00	0.06	2.35	1.86
03/31	11:00	0.06	2.40	1.80
03/31	12:00	0.06	2.42	1.91
03/31	13:00	0.06	2.35	1.88
03/31	14:00	0.06	2.32	1.85
03/31	15:00	0.06	2.33	1.77
03/31	16:00	0.06	2.40	1.82
03/31	17:00	0.06	2.33	1.81
03/31	18:00	0.06	2.34	1.82
03/31	19:00	0.06	2.26	1.87
03/31	20:00	0.06	2.28	1.84
03/31	21:00	0.06	2.35	1.90
03/31	22:00	0.05	2.18	1.86
03/31	23:00	0.05	2.17	1.89
04/01	00:00	0.05	2.05	1.82
04/01	01:00	0.05	2.10	1.75
04/01	02:00	0.05	2.12	1.80
04/01	03:00	0.05	2.17	1.83
04/01	04:00	0.05	2.15	1.76
04/01	05:00	0.05	2.12	1.83
04/01	06:00	0.06	2.30	1.88
04/01	07:00	0.06	2.28	1.80
04/01	08:00	0.06	2.27	1.95
04/01	09:00	0.06	2.30	1.87
04/01	10:00	0.06	2.47	1.87
04/01	11:00	0.06	2.38	1.90
04/01	12:00	0.06	2.28	1.90
04/01	13:00	0.06	2.30	1.94
04/01	14:00	0.06	2.42	1.92
04/01	15:00	0.06	2.27	1.96
04/01	16:00	0.07	2.47	1.92
04/01	17:00	0.06	2.40	1.95
04/01	18:00	0.07	2.47	2.02
04/01	19:00	0.07	2.38	2.03
04/01	20:00	0.07	2.44	2.08
04/01	21:00	0.06	2.31	1.90
04/01	22:00	0.05	2.18	1.73
04/01	23:00	0.05	2.15	1.75
04/02	00:00	0.05	2.12	1.79
04/02	01:00	0.05	2.13	1.74
04/02	02:00	0.05	2.10	1.69
04/02	03:00	0.05	2.15	1.67
04/02	04:00	0.05	2.10	1.68
04/02	05:00	0.05	2.22	1.76
04/02	06:00	0.05	2.21	1.67
04/02	07:00	0.06	2.42	1.89
04/02	08:00	0.06	2.42	1.81
04/02	09:00	0.06	2.38	1.86
04/02	10:00	0.06	2.30	1.84
04/02	11:00	0.05	2.18	1.85
04/02	12:00	0.05	2.15	1.88
04/02	13:00	0.06	2.24	1.86
04/02	14:00	0.05	2.11	1.87
04/02	15:00	0.06	2.37	1.83
04/02	16:00	0.06	2.35	1.87
04/02	17:00	0.06	2.40	1.82
04/02	18:00	0.06	2.35	1.86
04/02	19:00	0.06	2.37	1.86
04/02	20:00	0.06	2.28	1.82
04/02	21:00	0.04	2.33	1.41
04/02	22:00	0.05	2.15	1.81
04/02	23:00	0.05	2.10	1.81
04/03	00:00	0.05	2.08	1.79
04/03	01:00	0.04	2.00	1.72
04/03	02:00	0.04	2.03	1.72
04/03	03:00	0.05	2.07	1.75
04/03	04:00	0.05	2.12	1.71
04/03	05:00	0.06 *	2.40 *	1.75 *

Codes:

K	Multiply data by 1,000
M	Multiply data by 1,000,000
-	No data for period
*	Incomplete data for period
<	Data below cutout value
^	Surcharge (level greater than pipe height)
|	Fill Data for period

DAILY AVERAGES

Date: 04/01/97 16:12 File: C080193A.73J

260 C80193
AVONDALE
MANHOLE #13
OVER BRIDGE

Metering Period:
03/19/97 05:14 - 03/27/97 02:29

Report Period:
03/19/97 05:14 - 03/27/97 02:29

START Date	Time	FLO MGD		LEV in.		VEL FPS	
03/19	00:00	0.03	*	1.25	*	2.35	*
03/20	00:00	0.03		1.24		2.53	
03/21	00:00	0.01		1.21		0.93	
03/22	00:00	0.01		1.15		0.46	
03/23	00:00	0.01		1.28		1.11	
03/24	00:00	0.01		1.23		0.97	
03/25	00:00	0.01		1.25		0.60	
03/26	00:00	0.01		1.21		0.55	
03/27	00:00	0.00	*	0.72	*	-1.83	*

Codes:
- K Multiply data by 1,000
- M Multiply data by 1,000,000
- \- No data for period
- * Incomplete data for period
- < Data below cutout value
- ^ Surcharge (level greater than pipe height)
- | Fill Data for period

DAILY TOTALS (GALLONS)

Date: 04/01/97 16:12 File: C080193A.73J

260 C80193
AVONDALE
MANHOLE #13
OVER BRIDGE

Metering Period:
03/19/97 05:14 - 03/27/97 02:29

Report Period:
03/19/97 05:14 - 03/27/97 02:29

Date	Total	Date	Total
03/19/97	21.70K*	03/26/97	6.58K
03/20/97	29.54K	03/27/97	-305.92 *
03/21/97	9.53K	03/28/97	-
03/22/97	5.02K	03/29/97	-
03/23/97	13.08K	03/30/97	-
03/24/97	11.46K	03/31/97	-
03/25/97	6.94K	04/01/97	-
	97.27K*		6.28K*

Total for report period = 103,551.38 GALLONS

Codes:
- K Multiply data by 1,000
- M Multiply data by 1,000,000
- - No data for period
- * Incomplete data for period
- < Data less than cutout value
- | Fill Data for period

DAILY MAXIMUMS and MINIMUMS for FLOW

Date: 04/01/97 16:12 File: C080193A.73J

260 C80193
AVONDALE
MANHOLE #13
OVER BRIDGE

Metering Period:
03/19/97 05:14 - 03/27/97 02:29

Report Period:
03/19/97 05:14 - 03/27/97 02:29

Date	Time	FLO MGD	LEV in.	VEL FPS	Date	Time	FLO MGD	LEV in.	VEL FPS
03/19	17:59	0.04 *	1.40 *	2.69 *					
03/19	05:59	0.00 *	1.20 *	0.08 *					
03/20	19:44	0.05	1.50	3.16					
03/20	06:14	0.00	1.50	0.16					
03/21	00:29	0.03	1.20	2.69					
03/21	17:29	0.00	1.20	-0.04					
03/22	20:44	0.02	1.40	1.53					
03/22	00:14	0.00	1.00	0.00					
03/23	12:29	0.03	1.50	1.66					
03/23	17:59	0.00	1.50	0.02					
03/24	14:59	0.02	1.60	1.35					
03/24	04:59	0.00	1.10	0.07					
03/25	17:59	0.03	1.40	1.93					
03/25	18:59	0.00	1.60	-0.18					
03/26	10:14	0.02	1.20	2.11					
03/26	05:59	0.00	1.30	0.01					
03/27	00:44	0.00 *	0.90 *	0.43 *					
03/27	01:44	-0.03 *	0.40 *	-17.85 *					

Codes:

K	Multiply data by 1,000
M	Multiply data by 1,000,000
-	No data for period
*	Incomplete data for period
<	Data less than cutout value
^	Surcharge (level greater than pipe height)
|	Fill Data for period

1 HOUR AVERAGES

Date: 04/01/97 16:15 File: C080193A.73J

260 C80193
AVONDALE
MANHOLE #13
OVER BRIDGE

Metering Period:
03/19/97 05:14 - 03/27/97 02:29

Report Period:
03/19/97 05:14 - 03/27/97 02:29

START Date	Time	FLO MGD		LEV in.		VEL FPS		START Date	Time	FLO MGD	LEV in.	VEL FPS
03/19	05:00	0.02	*	1.10	*	1.89	*	03/20	23:00	0.03	1.25	2.52
03/19	06:00	0.00		1.32		0.18		03/21	00:00	0.03	1.20	2.53
03/19	07:00	0.03		1.15		2.56		03/21	01:00	0.03	1.20	2.55
03/19	08:00	0.03		1.20		2.59		03/21	02:00	0.03	1.15	2.43
03/19	09:00	0.03		1.15		2.58		03/21	03:00	0.03	1.17	2.53
03/19	10:00	0.03		1.23		2.48		03/21	04:00	0.03	1.18	2.43
03/19	11:00	0.03		1.20		2.66		03/21	05:00	0.01	1.50	0.55
03/19	12:00	0.03		1.22		2.62		03/21	06:00	0.00	1.67	0.35
03/19	13:00	0.03		1.27		2.43		03/21	07:00	0.01	1.17	1.27
03/19	14:00	0.03		1.30		2.49		03/21	08:00	0.01	1.02	1.13
03/19	15:00	0.03		1.30		2.17		03/21	09:00	0.01	1.08	1.00
03/19	16:00	0.03		1.32		2.64		03/21	10:00	0.01	1.10	1.00
03/19	17:00	0.03		1.38		2.31		03/21	11:00	0.01	1.10	0.81
03/19	18:00	0.03		1.32		2.62		03/21	12:00	0.01	1.05	0.92
03/19	19:00	0.03		1.25		2.27		03/21	13:00	0.01	1.10	0.92
03/19	20:00	0.03		1.27		2.49		03/21	14:00	0.01	1.12	0.89
03/19	21:00	0.03		1.28		2.54		03/21	15:00	0.01	1.03	1.04
03/19	22:00	0.03		1.25		2.53		03/21	16:00	0.00	1.17	0.07
03/19	23:00	0.03		1.25		2.53		03/21	17:00	0.00	1.17	-0.03
03/20	00:00	0.03		1.22		2.58		03/21	18:00	0.00	1.21	-0.02
03/20	01:00	0.03		1.17		2.74		03/21	19:00	0.00	1.43	0.00
03/20	02:00	0.03		1.20		2.68		03/21	20:00	0.00	1.55	0.00
03/20	03:00	0.03		1.20		2.66		03/21	21:00	0.00	1.30	0.01
03/20	04:00	0.03		1.20		2.69		03/21	22:00	0.00	1.22	0.00
03/20	05:00	0.03		1.25		2.60		03/21	23:00	0.00	1.10	0.01
03/20	06:00	0.03		1.35		2.10		03/22	00:00	0.00	1.00	0.00
03/20	07:00	0.03		1.20		2.49		03/22	01:00	0.00	1.05	0.01
03/20	08:00	0.03		1.20		2.71		03/22	02:00	0.00	1.02	0.01
03/20	09:00	0.02		1.23		1.52		03/22	03:00	0.00	1.10	0.00
03/20	10:00	0.02		1.15		1.91		03/22	04:00	0.00	1.02	0.01
03/20	11:00	0.02		1.08		2.31		03/22	05:00	0.00	1.05	0.01
03/20	12:00	0.03		1.25		2.95		03/22	06:00	0.00	1.15	0.01
03/20	13:00	0.03		1.23		2.82		03/22	07:00	0.00	1.18	0.01
03/20	14:00	0.03		1.30		2.79		03/22	08:00	0.00	1.18	0.28
03/20	15:00	0.03		1.28		2.48		03/22	09:00	0.00	1.22	0.43
03/20	16:00	0.03		1.30		2.48		03/22	10:00	0.00	1.33	0.31
03/20	17:00	0.03		1.25		2.67		03/22	11:00	0.00	1.12	0.31
03/20	18:00	0.03		1.27		2.51		03/22	12:00	0.00	1.17	0.31
03/20	19:00	0.04		1.38		2.83		03/22	13:00	0.00	1.17	0.36
03/20	20:00	0.03		1.32		2.68		03/22	14:00	0.00	1.15	0.35
03/20	21:00	0.03		1.27		2.57		03/22	15:00	0.00	1.10	0.33
03/20	22:00	0.03		1.27		2.39		03/22	16:00	0.00	1.27	0.18

START Date	Time	FLO MGD	LEV in.	VEL FPS
03/22	17:00	0.00	1.20	0.24
03/22	18:00	0.01	1.22	1.02
03/22	19:00	0.01	1.18	1.27
03/22	20:00	0.02	1.30	1.37
03/22	21:00	0.02	1.20	1.38
03/22	22:00	0.01	1.10	1.46
03/22	23:00	0.01	1.12	1.47
03/23	00:00	0.01	1.08	1.46
03/23	01:00	0.01	1.05	1.37
03/23	02:00	0.01	1.10	1.25
03/23	03:00	0.01	1.07	1.34
03/23	04:00	0.01	1.02	1.48
03/23	05:00	0.01	1.08	1.25
03/23	06:00	0.01	1.10	1.29
03/23	07:00	0.01	1.15	1.23
03/23	08:00	0.02	1.18	1.43
03/23	09:00	0.01	1.28	1.15
03/23	10:00	0.02	1.42	1.13
03/23	11:00	0.02	1.37	1.20
03/23	12:00	0.02	1.40	1.12
03/23	13:00	0.02	1.37	1.20
03/23	14:00	0.02	1.38	1.16
03/23	15:00	0.02	1.45	1.31
03/23	16:00	0.02	1.40	1.08
03/23	17:00	0.01	1.33	0.76
03/23	18:00	0.00	1.62	0.19
03/23	19:00	0.01	1.33	0.81
03/23	20:00	0.01	1.38	0.90
03/23	21:00	0.01	1.40	0.87
03/23	22:00	0.01	1.39	0.65
03/23	23:00	0.01	1.25	0.96
03/24	00:00	0.01	1.10	0.90
03/24	01:00	0.01	1.10	0.87
03/24	02:00	0.01	1.10	1.02
03/24	03:00	0.01	1.08	1.15
03/24	04:00	0.01	1.10	0.85
03/24	05:00	0.01	1.12	1.05
03/24	06:00	0.01	1.23	0.81
03/24	07:00	0.00	1.22	0.25
03/24	08:00	0.00	1.10	0.37
03/24	09:00	0.00	1.23	0.29
03/24	10:00	0.01	1.25	0.94
03/24	11:00	0.02	1.27	1.38
03/24	12:00	0.01	1.15	0.84
03/24	13:00	0.01	1.32	1.09
03/24	14:00	0.01	1.30	1.13
03/24	15:00	0.01	1.47	0.94
03/24	16:00	0.02	1.23	1.31
03/24	17:00	0.01	1.36	1.10
03/24	18:00	0.02	1.42	1.03
03/24	19:00	0.02	1.33	1.23
03/24	20:00	0.02	1.32	1.26
03/24	21:00	0.02	1.38	1.12
03/24	22:00	0.02	1.32	1.24
03/24	23:00	0.01	1.10	1.18
03/25	00:00	0.00	1.13	0.21
03/25	01:00	0.00	1.10	0.00
03/25	02:00	0.00	1.35	0.00
03/25	03:00	0.00	1.25	0.00
03/25	04:00	0.00	1.20	0.02
03/25	05:00	0.01	1.08	1.17
03/25	06:00	0.01	1.35	1.06
03/25	07:00	0.00	1.23	0.32
03/25	08:00	0.00	1.12	0.06
03/25	09:00	0.01	1.20	0.46
03/25	10:00	0.01	1.18	1.18
03/25	11:00	0.01	1.15	1.32
03/25	12:00	0.01	1.42	0.49
03/25	13:00	0.01	1.17	0.94
03/25	14:00	0.01	1.25	0.71
03/25	15:00	0.01	1.25	0.85
03/25	16:00	0.01	1.12	0.84
03/25	17:00	0.01	1.15	1.31
03/25	18:00	0.01	1.40	0.67
03/25	19:00	0.00	1.42	-0.03
03/25	20:00	0.02	1.30	1.22
03/25	21:00	0.02	1.37	1.24
03/25	22:00	0.00	1.38	0.39
03/25	23:00	0.00	1.37	0.01
03/26	00:00	0.00	1.25	0.02
03/26	01:00	0.00	1.20	0.02
03/26	02:00	0.00	1.10	0.03
03/26	03:00	0.00	1.10	0.04
03/26	04:00	0.00	1.17	0.05
03/26	05:00	0.00	1.13	0.08
03/26	06:00	0.00	1.45	0.03
03/26	07:00	0.01	1.40	0.66
03/26	08:00	0.02	1.25	1.46
03/26	09:00	0.02	1.27	1.66
03/26	10:00	0.02	1.25	1.33
03/26	11:00	0.01	1.28	1.08
03/26	12:00	0.01	1.30	0.80
03/26	13:00	0.01	1.35	0.99
03/26	14:00	0.01	1.30	0.74
03/26	15:00	0.00	1.12	0.26
03/26	16:00	0.00	1.13	0.38
03/26	17:00	0.01	1.33	0.96
03/26	18:00	0.02	1.38	1.12
03/26	19:00	0.00	1.22	0.40
03/26	20:00	0.00	1.08	0.25
03/26	21:00	0.00	1.00	0.24
03/26	22:00	0.00	1.00	0.31
03/26	23:00	0.00	0.95	0.34
03/27	00:00	0.00	0.88	0.26
03/27	01:00	0.00	0.64	-4.32
03/27	02:00	0.00 *	0.55 *	-1.01 *

Codes:

K	Multiply data by 1,000
M	Multiply data by 1,000,000
-	No data for period
*	Incomplete data for period
<	Data below cutout value
^	Surcharge (level greater than pipe height)
|	Fill Data for period

DAILY AVERAGES

Date: 04/01/97 16:10 File: C080193A.73E

260 C80193
AVONDALE
MANHOLE #72
RT. 41

Metering Period:
03/14/97 00:29 - 03/19/97 04:59

Report Period:
03/14/97 00:29 - 03/19/97 04:59

START Date	Time	FLO MGD		LEV in.		VEL FPS	
03/14	00:00	0.20	*	4.16	*	1.83	*
03/15	00:00	0.17		3.63		1.86	
03/16	00:00	0.15		3.50		1.72	
03/17	00:00	0.16		3.64		1.74	
03/18	00:00	0.15		3.42		1.82	
03/19	00:00	0.13	*	3.17	*	1.76	*

Codes:
- K Multiply data by 1,000
- M Multiply data by 1,000,000
- \- No data for period
- * Incomplete data for period
- < Data below cutout value
- ^ Surcharge (level greater than pipe height)
- | Fill Data for period

DAILY TOTALS (GALLONS)

Date: 04/01/97 16:11 File: C080193A.73E

260 C80193
AVONDALE
MANHOLE #72
RT. 41

Metering Period:
03/14/97 00:29 - 03/19/97 04:59

Report Period:
03/14/97 00:29 - 03/19/97 04:59

Date	Total
03/14/97	199.66K*
03/15/97	169.75K
03/16/97	148.10K
03/17/97	159.44K
03/18/97	151.59K
03/19/97	27.79K*
03/20/97	
	856.32K*

Total for report period = 856,322.31 GALLONS

Codes:
K Multiply data by 1,000
M Multiply data by 1,000,000
- No data for period
* Incomplete data for period
< Data less than cutout value
| Fill Data for period

DAILY MAXIMUMS and MINIMUMS for FLOW

Date: 04/01/97 16:11 File: C080193A.73E

260 C80193
AVONDALE
MANHOLE #72
RT. 41

Metering Period:
03/14/97 00:29 - 03/19/97 04:59

Report Period:
03/14/97 00:29 - 03/19/97 04:59

Date	Time	FLO MGD	LEV in.	VEL FPS	Date	Time	FLO MGD	LEV in.	VEL FPS
03/14	20:59	0.31 *	5.50 *	1.91 *					
03/14	00:44	0.12 *	2.80 *	1.90 *					
03/15	12:29	0.27	4.80	1.96					
03/15	22:59	0.10	2.80	1.64					
03/16	15:29	0.24	4.60	1.87					
03/16	19:29	0.10	2.90	1.51					
03/17	16:44	0.24	4.70	1.82					
03/17	06:59	0.10	2.90	1.49					
03/18	16:59	0.25	4.60	1.95					
03/18	19:59	0.10	2.70	1.71					
03/19	01:14	0.17 *	3.60 *	1.95 *					
03/19	04:44	0.00 *	2.10 *	-0.07 *					

Codes:

K	Multiply data by 1,000
M	Multiply data by 1,000,000
-	No data for period
*	Incomplete data for period
<	Data less than cutout value
^	Surcharge (level greater than pipe height)
|	Fill Data for period

1 HOUR AVERAGES

Date: 04/01/97 16:10 File: C080193A.73E

260 C80193
AVONDALE
MANHOLE #72
RT. 41

Metering Period:
03/14/97 00:29 - 03/19/97 04:59

Report Period:
03/14/97 00:29 - 03/19/97 04:59

START Date Time	FLO MGD	LEV in.	VEL FPS	START Date Time	FLO MGD	LEV in.	VEL FPS
03/14 00:00	0.13 *	2.99 *	1.91 *	03/15 18:00	0.17	3.76	1.73
03/14 01:00	0.16	3.51	1.82	03/15 19:00	0.19	4.01	1.77
03/14 02:00	0.14	3.25	1.78	03/15 20:00	0.19	4.14	1.72
03/14 03:00	0.14	3.30	1.79	03/15 21:00	0.12	2.99	1.76
03/14 04:00	0.14	3.28	1.80	03/15 22:00	0.15	3.56	1.71
03/14 05:00	0.15	3.47	1.78	03/15 23:00	0.13	3.24	1.72
03/14 06:00	0.14	3.33	1.73	03/16 00:00	0.14	3.27	1.77
03/14 07:00	0.18	3.99	1.74	03/16 01:00	0.14	3.38	1.77
03/14 08:00	0.19	4.02	1.77	03/16 02:00	0.13	3.28	1.72
03/14 09:00	0.18	3.88	1.83	03/16 03:00	0.14	3.35	1.74
03/14 10:00	0.21	4.30	1.82	03/16 04:00	0.14	3.38	1.78
03/14 11:00	0.20	4.19	1.83	03/16 05:00	0.14	3.35	1.74
03/14 12:00	0.22	4.60	1.72	03/16 06:00	0.13	3.22	1.76
03/14 13:00	0.23	4.53	1.80	03/16 07:00	0.14	3.33	1.71
03/14 14:00	0.23	4.68	1.76	03/16 08:00	0.14	3.26	1.74
03/14 15:00	0.25	5.10	1.66	03/16 09:00	0.15	3.61	1.61
03/14 16:00	0.24	4.73	1.81	03/16 10:00	0.18	4.02	1.75
03/14 17:00	0.26	4.89	1.87	03/16 11:00	0.14	3.41	1.67
03/14 18:00	0.24	4.47	1.92	03/16 12:00	0.18	4.00	1.68
03/14 19:00	0.24	4.42	1.95	03/16 13:00	0.16	3.78	1.71
03/14 20:00	0.25	4.80	1.80	03/16 14:00	0.16	3.77	1.65
03/14 21:00	0.29	5.01	2.02	03/16 15:00	0.20	4.26	1.71
03/14 22:00	0.24	4.42	2.01	03/16 16:00	0.16	3.61	1.77
03/14 23:00	0.22	4.04	2.03	03/16 17:00	0.16	3.74	1.72
03/15 00:00	0.16	3.37	2.02	03/16 18:00	0.12	3.18	1.67
03/15 01:00	0.13	2.89	2.01	03/16 19:00	0.13	3.20	1.67
03/15 02:00	0.12	2.86	1.93	03/16 20:00	0.14	3.37	1.65
03/15 03:00	0.14	3.18	1.91	03/16 21:00	0.15	3.60	1.70
03/15 04:00	0.15	3.22	2.01	03/16 22:00	0.13	3.25	1.75
03/15 05:00	0.15	3.20	1.96	03/16 23:00	0.15	3.42	1.78
03/15 06:00	0.13	2.97	1.94	03/17 00:00	0.14	3.33	1.71
03/15 07:00	0.14	3.21	1.84	03/17 01:00	0.13	3.25	1.73
03/15 08:00	0.20	3.94	1.94	03/17 02:00	0.13	3.25	1.74
03/15 09:00	0.20	4.17	1.79	03/17 03:00	0.13	3.20	1.69
03/15 10:00	0.21	4.30	1.82	03/17 04:00	0.13	3.20	1.73
03/15 11:00	0.22	4.20	1.92	03/17 05:00	0.14	3.37	1.72
03/15 12:00	0.22	4.38	1.85	03/17 06:00	0.12	3.27	1.60
03/15 13:00	0.20	3.99	1.94	03/17 07:00	0.12	3.17	1.59
03/15 14:00	0.18	3.87	1.84	03/17 08:00	0.17	4.12	1.59
03/15 15:00	0.16	3.50	1.89	03/17 09:00	0.18	4.02	1.73
03/15 16:00	0.22	4.18	1.96	03/17 10:00	0.20	4.17	1.84
03/15 17:00	0.19	4.04	1.80	03/17 11:00	0.18	3.88	1.84

START Date	Time	FLO MGD	LEV in.	VEL FPS
03/17	12:00	0.20	4.27	1.77
03/17	13:00	0.19	3.95	1.84
03/17	14:00	0.15	3.57	1.73
03/17	15:00	0.16	3.61	1.74
03/17	16:00	0.20	4.11	1.86
03/17	17:00	0.20	4.16	1.78
03/17	18:00	0.15	3.52	1.68
03/17	19:00	0.16	3.78	1.64
03/17	20:00	0.14	3.48	1.70
03/17	21:00	0.20	4.09	1.85
03/17	22:00	0.15	3.40	1.78
03/17	23:00	0.15	3.28	1.87
03/18	00:00	0.15	3.45	1.83
03/18	01:00	0.14	3.30	1.83
03/18	02:00	0.14	3.15	1.85
03/18	03:00	0.14	3.32	1.80
03/18	04:00	0.14	3.25	1.81
03/18	05:00	0.14	3.25	1.81
03/18	06:00	0.13	3.30	1.71
03/18	07:00	0.13	3.34	1.68
03/18	08:00	0.14	3.36	1.68
03/18	09:00	0.15	3.52	1.70
03/18	10:00	0.17	3.65	1.88
03/18	11:00	0.15	3.35	1.87
03/18	12:00	0.16	3.65	1.79
03/18	13:00	0.15	3.31	1.84
03/18	14:00	0.16	3.40	1.89
03/18	15:00	0.18	3.71	1.94
03/18	16:00	0.20	4.05	1.91
03/18	17:00	0.20	4.03	1.89
03/18	18:00	0.17	3.63	1.85
03/18	19:00	0.15	3.44	1.79
03/18	20:00	0.13	3.08	1.85
03/18	21:00	0.12	2.91	1.78
03/18	22:00	0.15	3.37	1.86
03/18	23:00	0.14	3.19	1.87
03/19	00:00	0.14	3.32	1.82
03/19	01:00	0.15	3.35	1.86
03/19	02:00	0.14	3.22	1.86
03/19	03:00	0.13	3.13	1.86
03/19	04:00	0.10 *	2.84 *	1.40 *

Codes:

- K Multiply data by 1,000
- M Multiply data by 1,000,000
- \- No data for period
- * Incomplete data for period
- < Data below cutout value
- ^ Surcharge (level greater than pipe height)
- | Fill Data for period

APPENDIX 12

NEW GARDEN TOWNSHIP
INFLOW/INFILTRATION REPORT

New Garden Township, Chester County, PA

EVALUATION OF INFILTRATION/INFLOW (I & I) OCCURRENCE AND MAGNITUDE, EMANATING FROM NEW GARDEN TOWNSHIP, AND ITS EFFECT ON THE HYDRAULIC LOAD IN THE AVONDALE WWTF

August, 1998

Prepared for the New Garden Township Sewer Authority

By

GTS Technologies, Inc.
of Harrisburg & Exton, PA

EVALUATION OF INFILTRATION/INFLOW (I & I) OCCURRENCE AND MAGNITUDE, EMANATING FROM NEW GARDEN TOWNSHIP, AND ITS EFFECT ON THE HYDRAULIC LOAD IN THE AVONDALE WWTF

Introduction

As a result of a meeting held with the representatives of the Avondale Borough at the DEP Regional Office, the Township took upon itself to conduct an I & I study. Comments made by DEP representatives in that meeting indicate that although the sewage flow from the Township appears to be within its allocation in the Avondale Plant, the total flow from both municipalities into the WWTF exceeds the permitted capacity. Therefore, since the moratorium on new sewer connections is in effect, the present excess flow is attributable to I & I.

Sewage flow from New Garden Township enters the Borough of Avondale at two locations, namely,

(i) the extension of the 4470 feet long, 10 inch diameter interceptor Sewer, fed by collector sewers in Toughkenamon, as well as by an 8 inch diameter sewer along Baltimore Pike.

(ii) the extension of the 3500 feet long, 10 inch diameter gravity sewer, along RTE 41 fed by a 6 inch diameter force main, located along the West shoulder of the Highway. The force main extends from the property known as Hewlett Packard and serves a narrow corridor along RTE 41.

Infiltration can be expected along stretches of sewer that are located below the groundwater table. In New Garden Township, such stretches are limited to the following locations:

- A short distance of an 8 inch diameter collector sewer along Baltimore Pike, both East and West of Penn Green Road (serving Kramme and a Mushroom operation East of Kramme). The East part of this collector crosses below a tributary to Trout Run.
- A short segment of an 8 inch collector sewer along the East end of Willow Street, where the sewer runs below an encased stream, a tributary to the Red Clay Creek.
- Some 2000 feet of 10 inch Interceptor Sewer along the Railroad tracks, West of Penn Green Road. This stretch of sewer parallels Trout Run and is at a close proximity to the stream. The invert of the sewer is below the groundwater table.

Evaluation of I & I, Emanating from New Garden Township into Avondale

Based on the above assumptions, infiltration along the RTE 41 interceptor sewer is not expected to occur and therefore, high priority was given to the analysis of sewage flow along the Railroad interceptor sewer, including the flow from Toughkenamon.

Methodology

The procedure adopted for the evaluation of I & I is as follows:

(1) Determine sewage flow at key locations within the selected study areas using measurement devices, such as weirs and orifices.

(2) Record sewage flow at peak hours, as well as at expected low flow periods.

(3) Plug sections of interceptor and record flow at various manholes, as well as at the Meter Pit.

(4) Estimate the groundwater table with reference to the sewer invert elevations.

Preparations

The Flow Poke, a measuring device that can be installed in manholes directly from the top of ground, was selected for the I & I study. The device is lowered into the inflow (upstream) end of the sewer in selected manholes. An inflatable seal secures the round insert that includes the measuring device (a triangular weir, or an orifice) into the incoming sewer pipe. The flow rate is being read by means of a manometer.

Although the Flow Poke is calibrated, a volumetric check was made at low flow (1 to 5 GPM), using a calibrated bucket.

Selected manholes were pried loose ahead of the scheduled flow measurements, this was particularly necessary for manholes within street cartways.

Since the original plans do not show the elevation of manhole tops along the railroad interceptor sewer, these elevations were obtained by measuring from the mid channel to the rim of selected manholes with given invert elevations. It should also be noted that all manholes along the railroad interceptor are elevated by approximately three feet above the ground surface. Pertinent manhole data are presented in TABLE I.

A training session was held on July 7 with the measuring crew, conducted by Robert Klinger,

Evaluation of I & I, Emanating from
New Garden Township into Avondale

GTS inspector of sewer construction (including construction inspection in new subdivisions).

Observations

On July 7, 1998 manhole 509, at the intersection of Center and Willow streets in Toughkenamon was examined. This is the last manhole before the ejector station, pumping all sewage flow into the first manhole on Willow street (MH 707), from which gravity flow prevails (along Newark Road to the 10 inch interceptor sewer). Due to the channel configuration in this manhole, only the flow from Willow Street could be measured. At 11:45 AM the estimated flow from each direction was 1.5 GPM. The flow of 15 GPM from Willow street (minor number of connections) was at first attributable to possible infiltration. Subsequent examination at 12:05 PM indicated a significant reduction in the Willow Street sewage flow. Further examination indicated that the flow may have originated from a laundry on Willow street, having a milky color.

Flow measurements with the Flow Poke indicated 5 GPM and subsequently additional measurements did not exceed 7 GPM flow from Willow Street collector sewer. Observations made before noon on July 14 revealed standing water in Manhole 509, suggesting that flow rate at peak flow periods exceed the capacity of the ejector station (50 GAL.). Review of the 1966 construction plans reveals that Manhole 509 is partially submerged by design, allowing High Water Level switch to activate at elevation 307.50', resulting in submerging the Manhole outlet by approximately 3.5 feet. Records of all measurements made during the period of July 7 thru July 23, 1998 are presented in APPENDIX "A". Pertinent data on the interceptor sewer along the Railroad Tracks is presented in TABLE I and the location of public sewers flowing into the Avondale WWTF is presented in the attached map (Fig. 1).

Flow Measurements indicate the following pattern of sewerage related activities:

(1) There is round the clock sewage flow as depicted by discharges from Modern Mushroom Farms and the ejector station. The average daily flow from the former source is 10,000 Gallons Per Day (GPD), or the equivalent of 7 GPM. The minimum daily flow from the latter is 4 GPM, derived from the frequency of the ejector station activation, between 5 and 6 AM (on August 6, 1998, recorded by William O'Conner). Additionally, sewage flow from the Baltimore Pike 8 inch collector (both East and West of Penn Green Road) ranges between 5 to 15 GPM during the day time, and lower flows observed after midnight.

(2) There are very few sewer connections to the 10 inch sewer interceptor along the Reynolds' Farm, East of Penn Green Road (between Manhole 805 and 808).

(3) A small quarry is located on the Reynolds Farm, immediately South of Manhole 806. The bedrock formation along the 10 inch interceptor, in both municipalities is Cockeysville Marble, a carbonate rock. Due to the existence of crevices and sinkholes in this formation, the permeability (or, hydraulic conductivity) is high, resulting in a relatively high rate of groundwater flow in the bedrock. Consequently, the slope of the groundwater table (the gradient) is expected to be flat. Based on the above, the water surface in the quarry represents the level of the groundwater table within its proximity. A survey conducted on July 21, 1998 indicates the water table to be more than 4 feet below the sewer invert in Manhole 806.

Flow of sewage in selected manholes, both East and West of Penn Green Road (MH 206 and MH 207), is presented in TABLE II.

Although the major emphasis was placed on evaluation of I & I along the Railroad interceptor sewer, few readings were obtained from RTE 41 interceptor. On July 22, at 3:15 AM, flow meter reading at the RTE 41 Meter Pit was 8000 GPD (5.6 GPM). A similar flow was recorded at 1:30 AM on July 23rd. Using the "TOP WIDTH" measurement in Manhole 207 on July 22, at 3:00 PM and "Critical Flow" condition in the manhole channel, the calculated flow is 16 GPM (or 23,000 GPD).

Flow records of the Avondale WWTF, showing the contribution of each municipality, are presented in APPENDIX B. These records represent the average daily flow for the period of May through August 7, 1998 and include the July 7 through 23 I & I evaluation period.

Evaluation

Flow measurements in the 10 inch interceptor sewer along the railroad tracks include "after midnight" flow records (see TABLE-II). MH 808 is located East of Penn Green Road, reflecting all sewage flows from Toughkenamon, excluding the flow from Baltimore Pike, both East and West of Penn Green Road. Plugging this manhole isolates the main sewage flow from Toughkenamon. Therefore, flow measurements taken in manholes West of Penn Green Road represent sewage flow from Baltimore Pike into Manhole 809, as well as the flow from laterals into the 10 inch interceptor, West of Penn Green Road.

On July 15, the measured flow after midnight was 18.2 GPM in the Meter Pit and 7 GPM in MH 813. Thus the flow rate between these two manholes is 18.2 GPM - 7 GPM = 11.2 GPM. There are no known lateral connections into the Interceptor Sewer, between MH 815 and the Meter Pit. Therefore, after plugging Manhole 815 at 1:00 AM the measured 6.3 GPM sewage flow in the Meter Pit, suggests an infiltration rate of 6.3 GPM. The measured flow in Manhole

Evaluation of I & I, Emanating from New Garden Township into Avondale

811 through Manhole 815 depicts flow from Baltimore Pike (into MH 809) and any other lateral flow, as well as possible infiltration. Consequently, the range of possible infiltration rate is between 6.3 GPM (8,900 GPD) and 11.2 GPM (16,000 GPD). Observations made during the study period, strongly suggest that the 5 GPM measured in MH 811 represents sewage flow from Baltimore Pike (into MH 809). Additionally, an estimated flow from at least two laterals (below MH 813) indicates sewage flow of at least 3 GPM, at all times. Accordingly, the upper range of inferred infiltration is 11.2 GPM - 3 GPM = 8.3 GPM (12,000 GPD).

At 2:00 AM on July 22, after plugging MH 811, the flow at the meter pit was 17 GPM, representing the flow along an 1,800 feet of the interceptor sewer, including all lateral connections, West of Penn Green Road. The latter rate of flow is similar to that recorded on July 7th (18.2 GPM). *NOTE: For velocities as high as 1 foot/second along 1,800 feet of plugged interceptor, wait at least 30 minutes before measuring flow in the Meter Pit.*

Based on the flow measurements and the observations made during the period of July 7 thru July 23, 1998, the following conclusions have been reached:

(1) Sewage outflow from New Garden Township into Avondale WWTF is a 24-hour occurrence, having a minimum flow of 14 GPM (20,000 GPD).

(2) Infiltration is limited to the 10 Inch Interceptor Sewer, located between Penn Green Road and the Meter Pit. During the study period, the rate of flow the can be attributable to infiltration, is 9,000 to 12,000 GPD.

(3) During the period of July 7 through July 23 the average total sewage outflow from New Garden Township into the Borough of Avondale was 120,250 GPD, representing 40 percent of the WWTF permitted capacity. This outflow is 52,550 GPD (30 %) lower than the Township's allocation in the treatment plant.

(4) There is no detectable infiltration into the 10 inch interceptor sewer along RTE 41. The 5 GPM flow recorded in the Meter Pit at 3:00 AM, is attributable to night time activities from the Turkey Hill store and other normal operations.

Recommendations

The above conclusions were reached from records obtained during the dry period of July 7 through 23, 1998. The infiltration rates into sewers are subject to fluctuation of the ground water Table. The estimated 12,000 GPD infiltration rate emanating from New Garden Township does not affect the Township allocation into the plant. Whereas, mitigating infiltration of 12,000

Evaluation of I & I, Emanating from New Garden Township into Avondale

GPD from the Township without mitigating the infiltration in the Borough will not significantly alter the present hydraulic loading. The township is able, by means of diversion, to periodically reduce sewage flow into the Avondale WWTF. This will provide additional flow information and records for verification of the results obtained to date. Based on the above, the following recommendations are made:

(1) Install observation wells along the interceptor sewers at selected locations. As a minimum, install three (3) observation wells, having a minimum depth of 18 feet, between Penn Green Road and the Meter Pit and two (2) observation wells along RTE 41, between Penn Green Road and the Meter Pit. Monitor groundwater fluctuation in the observation well, by weekly measurements, to coincide with meter pit flow readings, in general, and after a rainy period, in particular. *Estimated cost for the installation of five observation wells is $ 3,750.*

(2) When a rise in the groundwater table is recorded in the observation wells, repeat night measurements, at similar locations indicated in this report.

(3) The ability to divert temporarily large part of Toughkenamon sewage flow, away from the Avondale WWTF, will facilitate evaluation of the reduced flow on the hydraulic loading of the plant.

(4) Should observations during high groundwater table indicate larger flow that can be attributable to infiltration, conduct a TV camera survey of the Interceptor Sewer, in sections located West of Penn Green Road. If the source of infiltration is located, mitigate by grouting leaky joints, or repairing detected broken pipe.

Acknowledgment

The assistance given by **Hugo Abondi** of **Miller Environmental**, greatly facilitated the gathering of records, in general, and having access to the meter pits, in particular.

Respectfully submitted

GTS Technologies, Inc.

Gideon Yachin, P.E.
Principal Engineer

cc Spencer Andress

TABLE - I PERTINENT DATA
10 INCH INTERCEPTOR SEWER ALONG RAILROAD TRACK IN NEW GARDEN TOWNSHIP

MANHOLE NO.	DISTANCE FEET	INVERT ELEV. (Ft.) OUT	IN	RIM ELEV. (Feet)	SLOPE Ft/Foot	COMMENTS
Meter Pit		273.18	273.28			
	338.0				0.0040	
MH 815		274.62	274.72	283.25		No visible laterals
	400.0				0.0040	
MH 814		276.32	276.42	285.33		lateral from South (Leo)
	400.0				0.0092	
MH 813		280.10	280.20	290.15		Lateral from North
	400.0				0.0095	
MH 812		284.00	284.10	292.76		
	200.0				0.0208	
MH 811		288.26	288.36	298.02		
	200.0				0.0200	
MH 810		292.36	292.46	301.91		
	100.0				0.0230	
MH 809		294.79	294.89	302.51		at Penn Green Rd
	310.0				0.0230	
MH 808		301.82	301.92	308.25		
	350.0				0.0090	
MH 807		305.07	305.17	313.33		
	350.0				0.0049	
MH 806		306.90	307.00	315.53		
	200.0				0.0115	
MH 805		309.30	309.40	318.31		
	350.0				0.0035	
MH 804		310.63	310.74			
	230.0				0.0033	
MH 803		311.50	311.60			
	149.0				0.0034	
MH 802		312.12	312.22			
	395.0				0.0036	
MH 801		313.60	313.70			
	97.0				0.0036	
MH 800		314.05	314.15			

TABLE - II RECORDED FLOW IN 10-INCH RAILROAD INTERCEPTOR
AT THE INDICATED MANHOLES; FROM METER PIT TO MANHOLE 805

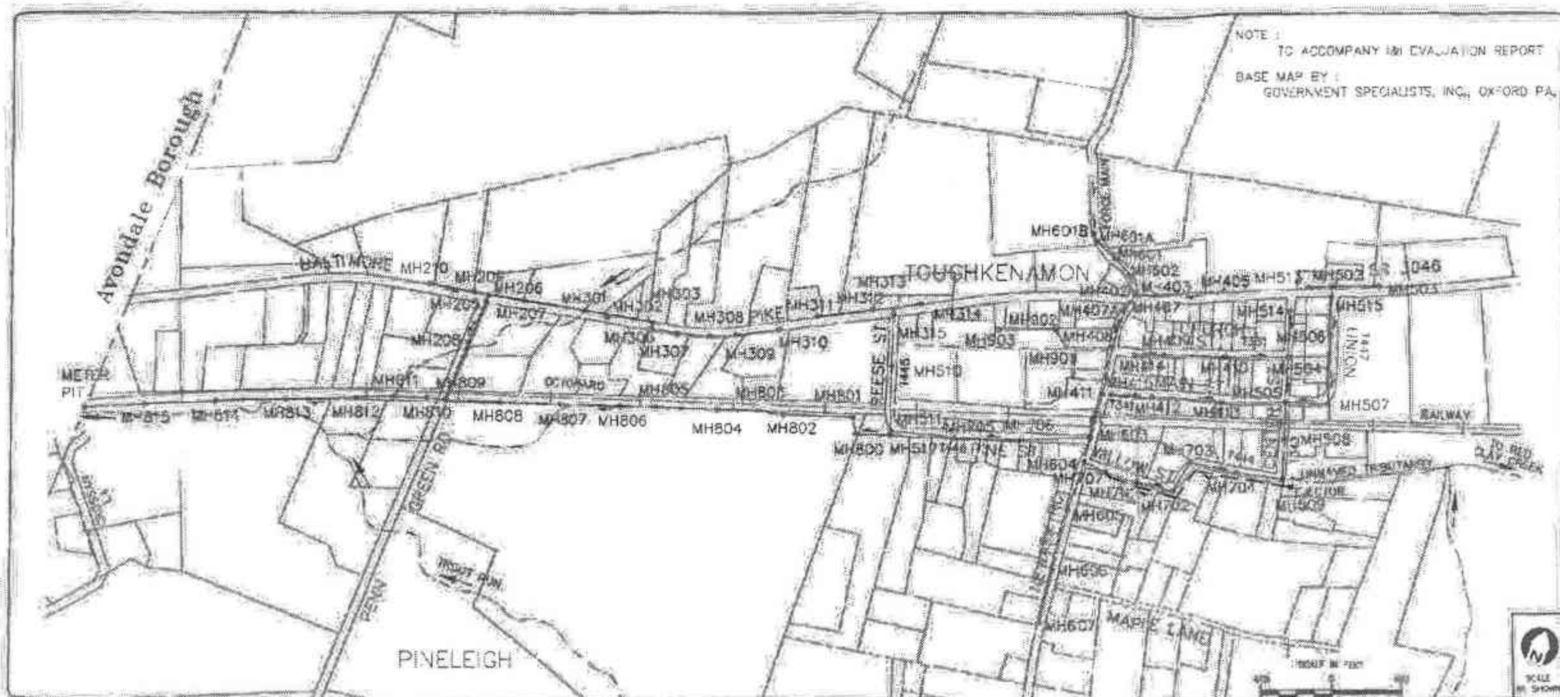
DATE	TIME	FLOW IN GPM								REMARKS
		METER PIT	MH 815	MH 813	MH 812	MH 811	MH 809	MH 808	MH 805	
7/07/98	01:45 PM				44.0					
	02:15 PM					22.0				
7/13/98	11:40 AM									10.5 GPM from Balt. Pike
	02:05 PM					54.0				
7/14/98	10:35 AM					41.0				
	10:39 AM							14.0		
	10:55 PM					22.0				
	11:07 PM				28.0					
7/15/98	12:02 AM							0.0		Plugged MH 808
	12:18 AM					5.0				Plugged MH 808
	12:32 AM			7.0						Plugged MH 808
	12:50 AM	18.2								Plugged MH 808
										Plugged MH 808
	01:00 AM		0.0							Plugged MH 815 (& 808)
	01:09 AM	6.3								
7/21/98	11:30 AM		64.0							
	11:42 AM					65.0				
	02:35 PM								30.0	
	10:12 PM	75.0								
	10:32 PM							22.0		
	10:52 PM					56.0				
	11:25 PM									15GPM E. of Kramme 8" *
	11:35 PM	60.0								

* *8" collector sewer from Baltimore Pike to Manhole 809*

TABLE II CONTINUED

DATE	TIME	FLOW IN GPM								REMARKS
		METER PIT	MH 815	MH 813	MH 812	MH 811	MH 809	MH 808	MH 805	
	11:45 PM									Plugged MH 814
7/22/98	12:14 AM	10.0								Plugged MH 813
	12:33 AM	20.0								
	12:38 AM									Unplugged MH 813
	12:45 AM									Plugged MH 812
	01:05 AM	16.0								
	01:12 AM									Unplugged MH 812
	01:40 AM	30.0								
	01:47 AM									Plugged MH 811
	02:00 AM	17.0								
	02:06 AM									Unplugged MH 811
	02:14 AM									Plugged MH 808
	02:27 AM	24.0								
	02:42 AM									Unplugged MH 808 *
7/22/98	01:05 PM					62.0				
	01:20 PM							30.0		
	01:40 PM									8 GPM W. of Kramme
	02:17 PM								18.0	
	02:30 PM							22.0		
	02:35 PM					75.0				White Sudsy water (Dove?)
	10.24 PM	86.0								
	10:45 PM							66.0		
	10:58 PM					62.0				No flow W. of Kramme
7/23/98	12:13 AM	30.0								
	12:20 AM									Plugged MH 811
	12:35 AM	20.0								
	12:40 AM									Unplugged MH 811
	12:45 AM	7.0								
	01:15 AM	30.0								

* *8" collector sewer from Baltimore Pike to Manhole 809*



AUG. 1998

GTS Technologies, Inc

SANITARY SEWER SYSTEM
FLOWING TO THE AVONDALE
WATER TREATMENT FACILITY
NEW GARDEN TWP., CHESTER CO., PENN.

1

APPENDIX "A"

FLOW RECORDS JULY 7 THROUGH 23, 1998

INFILTRATION INFLOW EVALUATION, NEW GARDEN TOWNSHIP
Sewage Flow Measurenents into Avondale WWTF

DATE	TIME	MH	FLOW GPM	NOTES
07/07/98	10:30: AM	*	5.6	At Ejector on Center St. Volumetric measurement at the Willow Street outfall
	12:05 PM		7.0	Using Flow Poke
	01:45 PM	812	44.0	Using Flow Poke
	02:00 PM	810		Unable to measure flow
	02:15 PM	809	22.0	Using Flow Poke
07/13/98	11:22 AM	**	5.0	Baltimore Pikw, E. of Kramme
	11:40 AM	**	10.5	Baltimore Pikw, W. of Kramme
	02:05 PM	811	54.0	Using Flow Poke
07/14/98	10:35 AM	811	41.0	Using Flow Poke
	10:39 PM	808	14.0	Using Flow Poke
	10:55 PM	811	22.0	Using Flow Poke
	11:07 PM	812	28.0	Using Flow Poke
	11:50 PM	Meter Pit		Meter Manhole 2" in Channel
07/15/98	12:02 AM	808	0.0	Plugged Manhole 808
	12:18 AM	811	5.0	Manhole 808 is Plugged
	12:32 AM	813	7.0	Manhole 808 is Plugged
	12:50 AM	Meter Pit	18.2	10 Gal in 33 Seconds Manhole 808 remains Plugged
	01:00 AM	815	0.0	Plugged MH 815 (also 808)
	01:09 AM	Meter Pit	6.3	10 Gal in 1min 36 secs Manhole 808 is plugged
		807		Measured rise of sewage in feet below top of Manhole Rim
	01:26 AM	807		7.24'
	02:02 AM	807		6.88'
	02:23 AM	807		6.50'

* 8 Inch Diameter Sewer Collector along Willow and Center Streets in Toughkenamon

** 8" Diameter Sewer Collector along Baltimore Pike, East & West of Penn Green Road

INFILTRATION INFLOW EVALUATION, NEW GARDEN TOWNSHIP
Sewage Flow Measurenents into Avondale WWTF

DATE	TIME	MH	FLOW GPM	NOTES
07/21/98	11:30 AM	815	64.0	Using Flow Poke
	11:42 AM	811	65.0	Using Flow Poke
	11:50 AM	809		Could not insert Flow Poke
	02:35 PM	805	30.0	Using Flow Poke
	10:12 PM	Meter Pit	75.0	10 Gal in 8 seconds
	10:32 PM	808	22.0	
	10:52 PM	811	56.0	
	11:25 PM		15.0	East of Kramme, Baltimore Pike
	11:35 PM	Meter Pit	60.0	10 Gal in 10 seconds
	11:45 PM			Plugged MH 814 at midnight
07/22/98	12:14 AM			Plugged MH 813
	12:33 AM	Meter Pit	20.0	
	12:38 AM			Unplugged MH 813
	12:45 AM			Plugged MH 812
	01:05 AM	Meter Pit	16.0	
	01:12 AM			Unplugged MH 812
	01:40 AM	Meter Pit	30.0	
	01:47 AM			Plugged MH 811
	02:00 AM	Meter Pit	17.0	
	02:06 AM			Unplugged MH 811
	02:14 AM			Plugged MH 808
	02:37 AM	Meter Pit	24.0	
	02:42 AM			Unplugged MH 808
	03:15 AM	RTE 41	5.6	RTE 41 Meter Pit 8000 GPD
07/22/98	01:05 PM	811	62.0	Using Flow Poke
	01:20 PM	808	30.0	
	01:40 PM	**	8.0	W. of Kramme, Balt. Pike
	02:17 PM	805	18.0	
	02:30 PM	808	22.0	
	02:35 PM	811	75.0	White sudsy water (Dove ?)
	03:00 PM	RTE 41		1st MH off Penn Green Rd. depth 1.75" Top Width 5.75"
	10:24 PM	Meter Pit	86.0	
	10:45 PM	808	66.0	
	10:58 PM	811	62.0	
07/22/98	10:58 PM	**	0.0	No flow, W. of Kramme

** 8 Inch Diameter Collector along Baltimore Pike, East & West of Penn Green Road

INFILTRATION INFLOW EVALUATION, NEW GARDEN TOWNSHIP
Sewage Flow Measurenents into Avondale WWTF

DATE	TIME	MH	FLOW GPM	NOTES
07/23/98	12:05 AM	RTE 41	13.0	In Meter Pit
	12:13 AM	Meter Pit	30.0	Railroad Interceptor Sewer
	12:20 AM			Plugged MH 811
	12:35 AM	Meter Pit	20.0	
	12:40 AM			Unplugged MH 811
	12:45 AM	Meter Pit	7.0	
	01:15 AM	Meter Pit	30.0	
	01:30 AM	RTE 41		Recorded by Hugo

APPENDIX "B"

AVERAGE DAILY RATE OF INFLUENT AND EFFLUENT
INTO AND OUT OF AVONDALE WWTF (5/01/-8/07/1998)

AVERAGE DAILY RATE OF INFLOW & EFFLUENT DISCHARGES

INTO AND OUT OF AVONDALE WWTF (5/01-8/07/1998)

WEEK ENDING	NEW GARDEN TWP. FLOW GPD	% OF CAPACITY	AVONDALE FLOW GPD	% OF CAPACITY	WWTF EFFLUENT DISCHARGE	% OF CAPACITY	NO. OF EDUs TOTAL	NEW GARDEN	AVONDALE
05/01/98	127617	42.54	247526	82.51	375143	125.05	1072	365	707
05/08/98	135986	45.33	244300	81.43	380286	126.76	1087	389	698
05/15/98	171439	57.15	322990	107.66	494429	164.81	1413	490	923
05/22/98									
05/29/98	138784	46.26	211359	70.45	350143	116.71	1000	397	604
06/05/98	124150	41.38	205136	68.38	329286	109.76	941	355	586
06/12/98	132239	44.08	205332	68.44	337571	112.52	964	378	587
06/19/98	134296	44.77	251847	83.95	386143	128.71	1103	384	720
06/26/98	126337	42.11	218520	72.84	344857	114.95	985	361	624
07/03/98	127206	42.40	211937	70.65	339143	113.05	969	363	606
07/10/98	*121064*	*40.35*	*210365*	*70.12*	*331429*	*110.48*	*947*	*346*	*601*
07/17/98	*118213*	*39.40*	*207930*	*69.31*	*326143*	*108.71*	*932*	*338*	*594*
07/24/98	*121461*	*40.49*	*202110*	*67.37*	*323571*	*107.86*	*924*	*347*	*577*
07/31/98	123818	41.27	189468	63.16	313286	104.43	895	354	541
08/07/98	109331	36.44	188526	62.84	297857	99.29	851	312	539

NOTE: Records in italics coinside with the period of I & I evaluation in New Garden Township

COMPARISON BETWEEN TOWNSHIP AND BOROUGH SEWAGE FLOW
INTO THE AVONDALE WWTF

NEW GARDEN TWP		ABOVE/BELOW ALLOCATION		AVONDALE	ABOVE/BELOW ALLOCATION	
WEEK ENDING	FLOW GPD	GPD	%	FLOW GPD	GPD	%
05/01/98	127617	45183	26.15	247526	120326	94.60
05/08/98	135986	36814	21.30	244300	117100	92.06
05/15/98	171439	1361	0.79	322090	195790	153.92
05/22/98						
05/29/98	138784	34016	19.69	211359	84159	66.16
06/05/98	124150	48650	28.15	205136	77936	61.27
06/12/98	132239	40561	22.28	205332	78132	61.42
06/19/98	134296	38504	22.28	251847	124647	97.99
06/26/98	126337	46463	26.89	218520	91320	71.79
07/03/98	127206	45594	26.39	211937	84737	66.62
07/10/98	*121064*	51736	29.94	210365	83165	65.38
07/17/98	*118213*	54587	31.59	207930	80730	63.47
07/24/98	*121461*	51339	29.71	202110	74910	58.89
07/31/98	123818	48982	28.35	189468	62268	48.95
08/07/98	109331	63469	36.73	188526	61326	48.21

NOTE: Records in Italics coinside with the period of I & I evaluation in New Garden Township

NOTE: Out of the 300,000 GPD Avondale WWTF Capacity, New Garden Township Allocation is 172,800 GPD and the Borough Allocation is 127,200 GPD

AVONDALE WASTEWATER TREATMENT FACILITY
Gallons Per Week and Gallons Per Day

WEEK ENDING	NEW GARDEN TOWNSHIP RTE 41	RAILROAD	TOTAL	EFFL. DISCH.	AVONDALE INFLOW
05/01/98	201670	691650	893320	2626000	1732680
	28810	**98807**	**127617**	**375143**	**247526**
05/08/98	236170	715730	951900	2662000	1710100
	33739	**102247**	**135986**	**380286**	**244300**
05/15/98	244530	955540	1200070	3461000	2260930
	34933	**136506**	**171439**	**494429**	**322990**
05/22/98					
05/29/98	191290	780200	971490	2451000	1479510
	27327	**111457**	**138784**	**350143**	**211359**
06/05/98	195830	673220	869050	2305000	1435950
	27976	**96174**	**124150**	**329286**	**205136**
06/12/98	221500	704170	925670	2363000	1437330
	31643	**100596**	**132239**	**337571**	**205333**
06/19/98	208940	731130	940070	2703000	1762930
	29849	**104447**	**134296**	**386143**	**251847**
06/26/98	220970	663390	884360	2414000	1529640
	31567	**94770**	**126337**	**344857**	**218520**
07/03/98	217860	672580	890440	2374000	1483560
	31123	**96083**	**127206**	**339143**	**211937**

AVONDALE WASTEWATER TREATMENT FACILITY

WEEK ENDING	NEW GARDEN TWP. FLOW GPD	% OF CAPACITY	AVONDALE FLOW GPD	% OF CAPACIT	WWTF EFFLUENT DISCH. GPD	% OF CAPACITY	NO. OF EDUs TOTAL	NEW GARDEN	AVONDALE
05/01/98	127617	42.54	247526	82.51	376143	125.05	1072	365	707
05/08/98	135986	45.33	244300	81.43	380286	126.76	1087	389	698
05/15/98	171439	57.15	322990	107.66	494429	164.81	1413	490	923
05/22/98									
05/29/98	138784	46.26	211359	70.45	350143	116.71	1000	397	604
06/05/98	124150	41.38	205136	68.38	329286	109.76	941	355	586
06/12/98	132239	44.08	205333	68.44	337571	112.52	964	378	587
06/19/98	134296	44.77	251847	83.95	386143	128.71	1103	384	720
06/26/98	126337	42.11	218520	72.84	344857	114.95	985	361	624
07/03/98	127206	42.40	211937	70.65	339143	113.05	969	363	606

COMPARISON BETWEEN TOWNSHIP AND BOROUGH SEWAGE FLOW INTO THE AVONDALE WWTF

NEW GARDEN TWP		ABOVE/BELOW ALLOCATION		AVONDALE	ABOVE/BELOW ALLOCATION	
WEEK ENDING	FLOW GPD	GPD	%	FLOW GPD	GPD	%
05/01/98	127617	45183	26.15	247526	120326	94.60
05/08/98	135986	36814	21.30	244300	117100	92.06
05/15/98	171439	1361	0.79	322990	195790	153.92
05/22/98						
05/29/98	138784	34016	19.69	211359	84159	66.16
06/05/98	124150	48650	28.15	205136	77936	61.27
06/12/98	132239	40561	22.28	205332	78132	61.42
06/19/98	134296	38504	22.28	251847	124647	97.99
06/26/98	126337	46463	26.89	218520	91320	71.79
07/03/98	127206	45594	26.39	211937	84737	66.62

NOTE: Out of the 300,000 GPD Avondale WWTF Capacity, New Garden Township Allocation is 172,800 GPD and the Borough Allocation is 127,200 GPD

AVERAGE DAILY RATE OF INFLOW & EFFLUENT DISCHARGES

INTO AND OUT OF AVONDALE WWTF (5/01-7/03/1998)

WEEK ENDING	NEW GARDEN TWP.		AVONDALE		WWTF		NO. OF EDUs		
	FLOW GPD	% OF CAPACITY	FLOW GPD	% OF CAPACITY	EFFLUENT DISCHARGE	% OF CAPACITY	TOTAL	NEW GARDEN	AVONDALE
05/01/98	127617	42.54	247526	82.51	375143	125.05	1072	365	707
05/08/98	135986	45.33	244300	81.43	380286	126.76	1087	389	698
05/15/98	171439	57.15	322990	107.66	494429	164.81	1413	490	923
05/22/98									
05/29/98	138784	46.26	211359	70.45	350143	116.71	1000	397	604
06/05/98	124150	41.38	205136	68.38	329286	109.76	941	355	586
06/12/98	132239	44.08	205332	68.44	337571	112.52	964	378	587
06/19/98	134296	44.77	251847	83.95	386143	128.71	1103	384	720
06/26/98	126337	42.11	210520	72.84	344857	114.95	985	361	624
07/03/98	127206	42.40	211937	70.65	339143	113.05	969	363	606

7/14 ~~8/15/98~~

MH

810 9'-6"

811 9'-8½" ← 41 GPM 10:35AM

54.6 GPM 2:05 PM

812 8'-8½"

813 10'-0"

814 8'-11½"

815 8'-7"

Meter

808 76½"

807 98½" = 8.2'

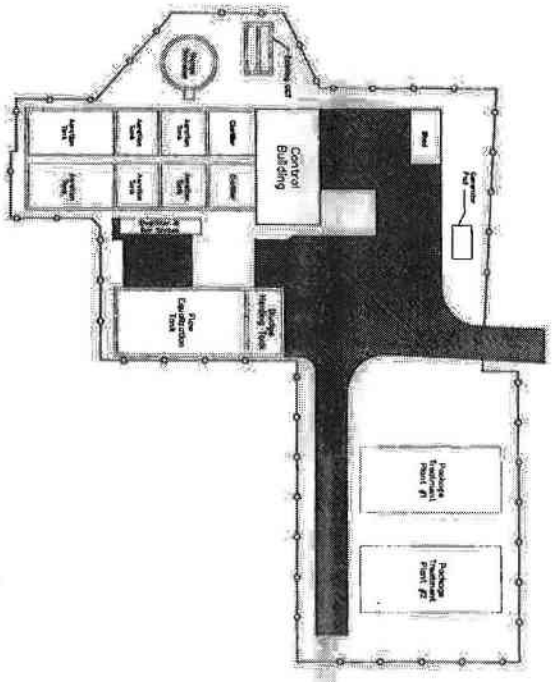
806 103"

805 107½"

~~804~~ 13 GPM . 18,720

APPENDIX 13

OPTION 1 – SITE DRAWING



BOROUGH OF AVONDALE

ACTIVITY PLAN

OPTION WASTE 1

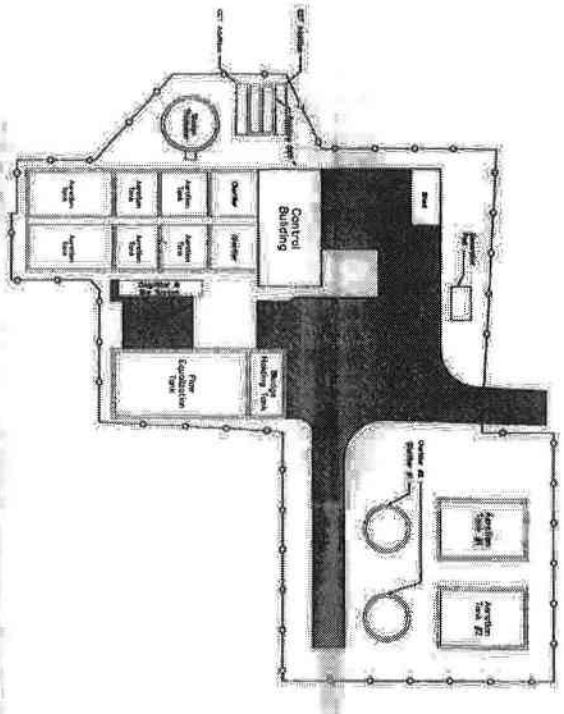
SSM

5685-005

D-001

APPENDIX 14

OPTION 2 – SITE DRAWING



BOROUGH OF AVONDALE

NOT FOR BID

OPTION NUMBER 2

SSM

5685-005

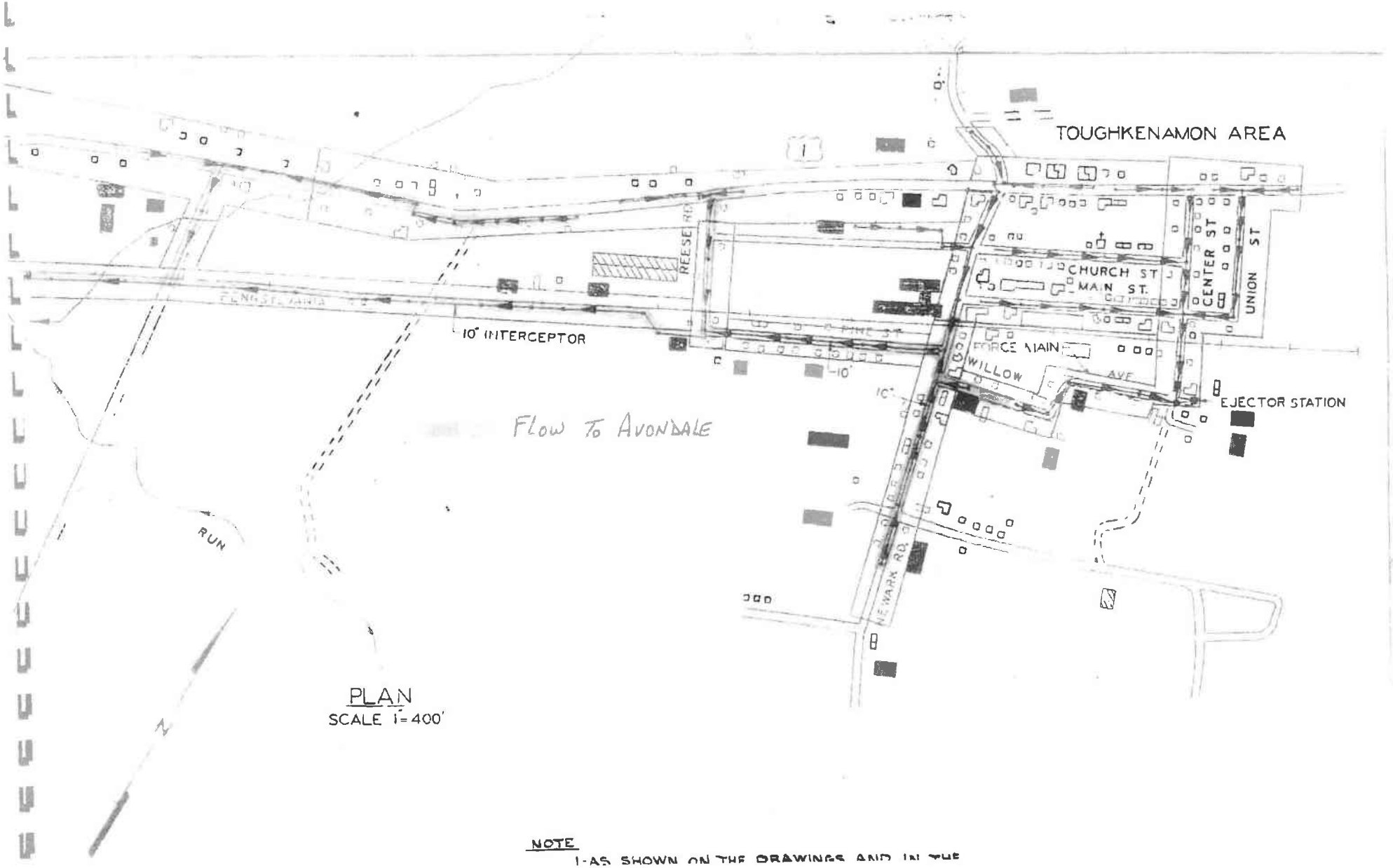
D-002

APPENDIX 15

PNDI SEARCH RESPONSE

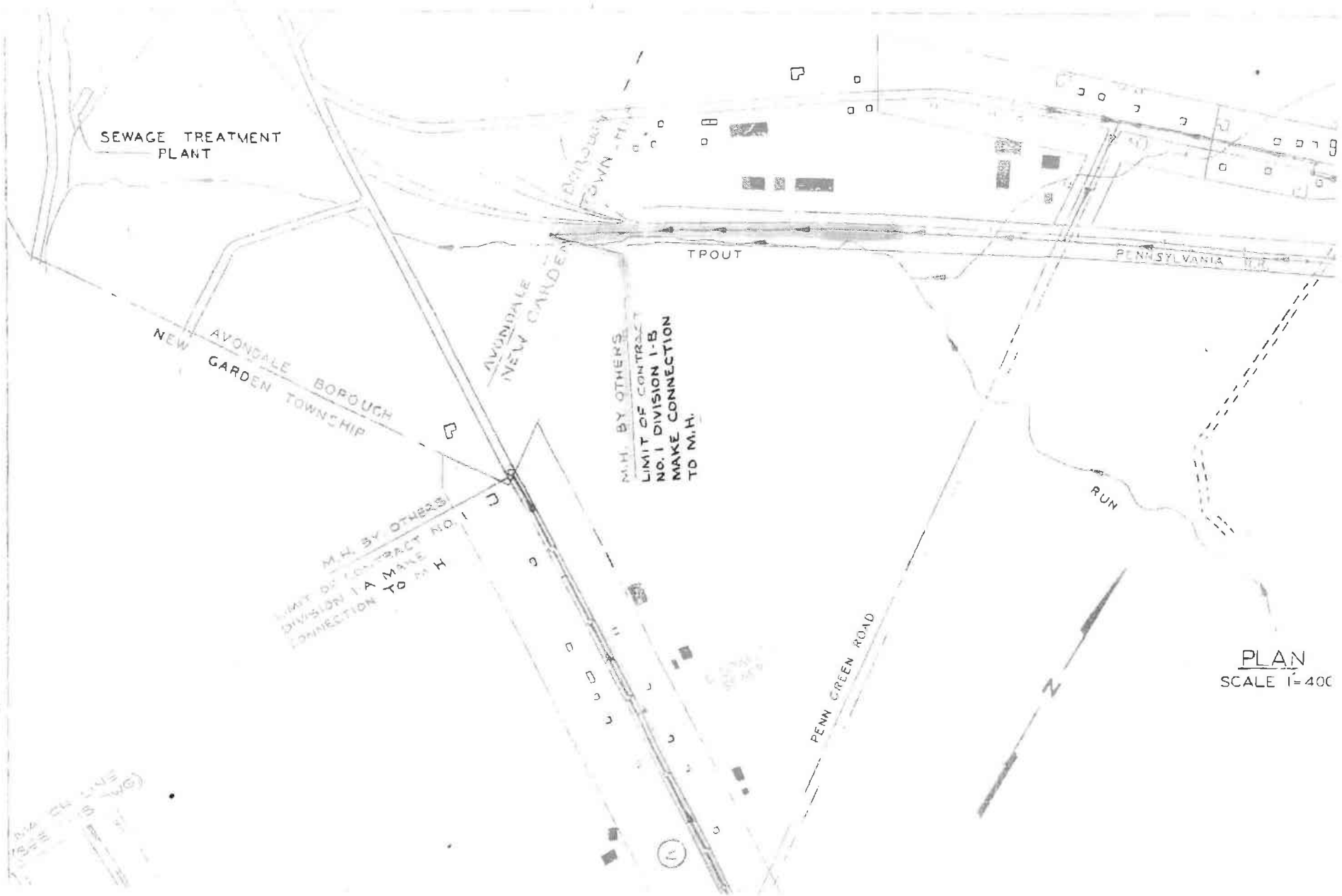
APPENDIX 16

NEW GARDEN TOWNSHIP
SEWAGE COLLECTION SYSTEM MAP



PLAN
SCALE 1"=400'

NOTE
1-AS SHOWN ON THE DRAWINGS AND IN THE



PLAN
SCALE 1=400


M.H. BY OTHERS
LIMIT OF CONTRACT NO. 1
DIVISION 1-A MAKE
CONNECTION TO M.H.
PENN GREEN ROAD
RUN
N
PLA
SCALE 1=
6" A.C. FORCE MAIN
RT. 41
ROUTE 41
1-A
MATCH LINE

APPENDIX 17

NEW GARDEN TOWNSHIP FLOW DATA

FLOW CALCULATIONS
[based on actual Avondale meter readings through 12/25/98]

DATE	RAIL ROAD LINE		ROUTE 41 LINE	
8/21/98	40,737,900	(meter reading)	60,011,150	(meter reading)
1/2/98	17,486,150	(meter reading)	52,785,790	(meter reading)
	23,251,750	(gallons processed) (33 weeks)	7,225,360	(gallons processed) (33 weeks)
	704,598	(gallons per week)	218,950	(gallons per week)
	99,793	(gallons per day)(233 days)	31,010	(gallons per day)(233 days)

Note: From 1/2/98 through 8/21/98 all flow went to Avondale.

12/25/98	43,604,760	(meter reading)	63,741,250	(meter reading)
8/21/98	40,737,900	(meter reading)	60,011,150	(meter reading)
	2,866,860	(gallons processed) (18 weeks)	3,730,100	(gallons processed) (18 weeks)
	159,270	(gallons per week)	207,228	(gallons per week)
	22,753	(gallons per day)(126 days)	29,604	(gallons per day)(126 days)

Note: Flow had been diverted to the NGTWWTF during this period and continuing.

Summary: Rail Road line before diversion = 99,793 gallons per day average.
Rail Road line after diversion = 22,753 gallons per day average.
Decrease in flow to Avondale = 77,040 gallons per day average (77.2% decrease).

Route 41 line before diversion = 31,010 gallons per day average.
Route 41 line after diversion = 29,604 gallons per day average.
Decrease in flow to Avondale = 1,406 gallons per day average (4.5% decrease).

NOTE: There was no flow diverted from the Route 41 line. The difference is not statistically significant.

COMPARISON CHECK
[based on actual Avondale meter readings through 12/25/98]

Main meter reading on 1/2/98 = 411,394,000

Main meter reading on 8/21/98 = 502,175,000

Total gallons processed during 33 weeks = 90,781,000

Average gallons processed per week total = 2,750,939

Average gallons processed per day total = 389,618 (100%) (233 days)

Average gallons processed per day total for New Garden Township = 130,803 (33.6%)

Average gallons processed per day for Avondale = 258,815 (66.4%)

Note: From 1/2/98 through 8/21/98 all flow went to Avondale.

Main meter reading on 12/25/98 = 529,722,000

Main meter reading on 8/21/98 = 502,175,000

Total gallons processed during 18 weeks = 27,547,000

Average gallons processed per week total = 1,530,389

Average gallons processed per day total = 218,627 (100%) (126 days)

Average gallons processed per day total for New Garden Township = 52,357 (24.0%)

Capacity purchased by New Garden Township = 173,250
Present use = 30.2% of purchased capacity

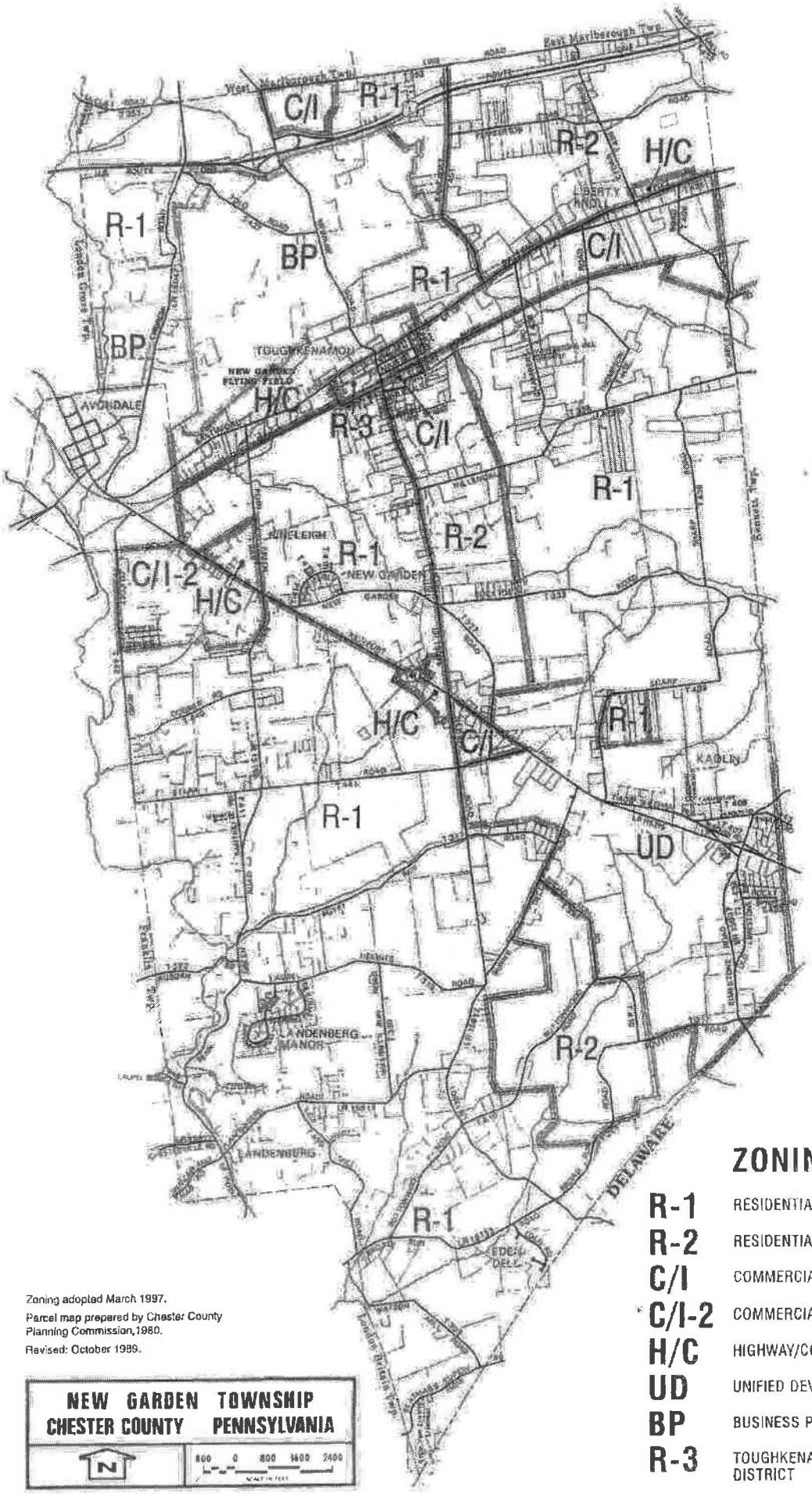
Average gallons processed per day for Avondale = 166,270 (76.0%)

Capacity purchased by Avondale = 126,750
Present use = 131.2%

Note: Flow had been diverted to the NGTWWTF during this period and continuing

APPENDIX 18

NEW GARDEN TOWNSHIP ZONING MAP



Zoning adopted March 1997.

Parcel map prepared by Chester County Planning Commission, 1980.

Revised: October 1989.

NEW GARDEN TOWNSHIP
CHESTER COUNTY PENNSYLVANIA

N

800 0 800 1600 2400

SCALE IN FEET

ZONING MAP

R-1	RESIDENTIAL DISTRICT
R-2	RESIDENTIAL DISTRICT
C/I	COMMERCIAL/INDUSTRIAL
C/I-2	COMMERCIAL/INDUSTRIAL LTD
H/C	HIGHWAY/COMMERCIAL
UD	UNIFIED DEVELOPMENT
BP	BUSINESS PARK
R-3	TOUGHKENAMON RESIDENTIAL DISTRICT

TABLE 1

Borough of Avondale
ACT 537 Sewage Facilities Plan
Option 1 Cost Estimate

Item	Description	unit	Unit Cost	Quantity	Extended Cost	Installation	Total
1	**Package Treatment Units**						
	Site Preparation	CY	$ 25	583	$ 14,583	$ -	$ 14,583
	Clearing	SY	$ 0.81	1,111	$ 900	$ -	$ 900
	Crushed Stone	CY	$ 14	100	$ 1,350	$ -	$ 1,350
	Concrete	CY	$ 400	96	$ 38,519	$ -	$ 38,519
	Aluminum Stairs	trd.	$ 240	30	$ 7,200	$ -	$ 7,200
	Site Lighting	SF	$ 1,500	9	$ 13,500	$ -	$ 13,500
	Piping	LF	$ 55	750	$ 41,250	$ -	$ 41,250
	Concrete Splitter Box	LS	$ 12,000	1	$ 12,000	$ -	$ 12,000
	Package Treatment Units	LS	$ 245,000	1	$ 245,000	$ -	$ 245,000
	Erection	LS	$ 145,000	1	$ 145,000	$ -	$ 145,000

Construction Sub-Total	$	**519,302**
Site Paving	$	4,436
Site Fencing	$	12,240
Plumbing and HVAC	$	10,386
Site Electrical and Controls	$	62,316
General Conditions	$	35,000
Insurance and Bonds	$	10,386
Mobilization	$	15,579
Construction Total	$	**669,645**
Legal and Engineering Fees	$	160,715
Contingency (27%)	$	180,804
Project Total	$	**1,011,164**

TABLE 2

Borough of Avondale
ACT 537 Sewage Facilities Plan
Option 2 Cost Estimate

Item	Description	unit	Unit Cost	Quantity	Extended Cost	Installation	Total
1	**Clarifiers**						
	Site Preparation	CY	$ 25	170	$ 4,250	$	$ 4,250
	Clearing	SY	$ 0.81	333	$ 270	$	$ 270
	Crushed Stone	CY	$ 14	15	$ 203	$	$ 203
	15' Clarifier Mechanism	ea.	$ 19,000	2	$ 38,000	$ 34,200	$ 72,200
	Clarifier Concrete Tank	CY	$ 400	75	$ 30,000	$	$ 30,000
	Aluminum Stairs	trd.	$ 240	50	$ 12,000	$	$ 12,000
	Grating	SF	$ 60	55	$ 3,300	$	$ 3,300
	Piping	LF	$ 55	300	$ 16,500	$	$ 16,500
	Site Lighting Lamps	ea.	$ 1,500	4	$ 6,000	$	$ 6,000
	Concrete Splitter Box	l.s.	$ 12,000	1	$ 12,000	$	$ 12,000
						Sub-Total	**$ 156,723**
2	**Aeration Tanks**						
	Site Preparation	CY	$ 25	389	$ 9,722	$	$ 9,722
	Clearing	SY	$ 26	778	$ 20,222	$	$ 20,222
	Crushed Stone	CY	$ 14	55	$ 743	$	$ 743
	Surface Aerators	ea.	$ 13,500	4	$ 54,000	$ 48,600	$ 102,600
	Concrete Aeration Tanks	CY	$ 400	250	$ 100,000	$	$ 100,000
	Bridging	LF	$ 90	110	$ 9,900	$	$ 9,900
	Aluminum Stairs	trd.	$ 240	100	$ 24,000	$	$ 24,000
	RAS Pumps	ea.	$ 9,500	2	$ 19,000	$ 17,100	$ 36,100
	WAS Pump	ea.	$ 7,500	1	$ 7,500	$ 6,750	$ 14,250
	Grating	SF	$ 60	375	$ 22,500	$	$ 22,500
	Site Lighting Lamps	ea.	$ 1,500	6	$ 9,000	$	$ 9,000
	Piping	LF	$ 55	600	$ 33,000	$	$ 33,000
						Sub-Total	**$ 382,037**
3	CCT						
	Demolition	l.s.	$ 7,500	1	$ 7,500	$	$ 7,500
	Site Preparation	CY	$ 25	78	$ 1,944	$	$ 1,944
	Crushed Stone	CY	$ 14	15	$ 203	$	$ 203
	Concrete CCT	CY	$ 400	50	$ 20,000	$	$ 20,000
	Effluent TRC Monitor	ea.	$ 11,200	1	$ 11,200	$ 10,080	$ 21,280
	Dechlorination Chemical Feed	ea.	$ 1,800	1	$ 1,800	$ 1,620	$ 3,420
	Piping	LF	$ 55	25	$ 1,375	$	$ 1,375
						Sub-Total	**$ 55,722**
						Construction Sub-Total	**$ 594,481**
						Site Paving	$ 4,400
						Site Fencing	$ 10,620
						Plumbing and HVAC	$ 11,890
						Site Electrical and Controls	$ 71,338
						General Conditions	$ 35,000
						Insurance and Bonds	$ 11,890
						Mobilization	$ 17,834
						Construction Total	**$ 757,453**
						Legal and Engineering Fees	$ 181,789
						Contingency (27%)	$ 204,512
						Project Total	**$ 1,143,754**

TABLE 3

Borough of Avondale
ACT 537 Sewage Facilities Plan
Option 1 Operating and Maintenance Cost Estimate

Power (based on $0.08 per kilowatt hour)

Equipment	Power Rating (hp)	Daily Service Time (hrs.)	kW*hrs	Yearly Operating Cost
Aeration Blower	7.5	24	134.2	$ 3,919
Aeration Blower	7.5	24	134.2	$ 3,919
Digester Blower	3	24	53.7	$ 1,568
Digester Blower	3	24	53.7	$ 1,568
WAS Pump	3.0	8	17.9	$ 523
RAS Pump	5.0	24	89.5	$ 2,613
RAS Pump	5.0	24	89.5	$ 2,613
			Total Power Costs	$ 16,723

Sludge Disposal

Sludge Generated (lbs./day)	Gallons Disposed	$/Gallon	Yearly Disposal Cost
108	648	0.09	$ 21,290

Maintenance

	Yearly Maintenance Cost
Based on 6% of Capital Equipment Purchase Price	$ 14,700

Yearly Operating and Maintenance Cost	$	52,713
Contingency (15%)	$	7,907
Total Yearly Operating and Maintenance Cost	$	60,620

TABLE 4

Borough of Avondale
ACT 537 Sewage Facilities Plan
Option 2 Operating and Maintenance Cost Estimate

Power (based on $0.08 per kilowatt hour)

Equipment	Power Rating (hp)	Daily Service Time (hrs.)	kW*hrs	Yearly Operating Cost
Clarifier Drive	1	24	17.9	$ 523
Clarifier Drive	1	24	17.9	$ 523
Surface Aerator	3.3	24	59.1	$ 1,725
Surface Aerator	3.3	24	59.1	$ 1,725
Surface Aerator	3.3	24	59.1	$ 1,725
Surface Aerator	3.3	24	59.1	$ 1,725
WAS Pump	3.0	8	17.9	$ 523
RAS Pump	5.0	24	89.5	$ 2,613
RAS Pump	5.0	24	89.5	$ 2,613
		Total Power Costs		$ 13,692

Sludge Disposal

Sludge Generated (lbs./day)	Gallons Disposed	$/Gallon	Yearly Disposal Cost
108	648	0.09	$ 21,290

Maintenance

	Yearly Maintenance Cost
Based on 6% of Capital Equipment Purchase Price	$ 7,890

Yearly Operating and Maintenance Cost	$	42,872
Contingency (15%)	$	6,431
Total Yearly Operating and Maintenance Cost	$	49,302

TABLE 5

Borough of Avondale
ACT 537 Sewage Facilities Plan
Present Worth Analysis

Option	Construction and Project Costs	Yearly Operating and Maintenance Costs	5 year Present Worth	10 Year Present Worth
Upgrade using Above-Ground Steel Package Plants	$ 1,011,164	$ 60,620	$ 1,253,201	$ 1,417,926
Upgrade using Above-Ground Concrete Aeration Tanks, Clarifiers and CCT Expansion	$ 1,143,754	$ 49,302	$ 1,340,604	$ 1,474,577