Accomack County

23296 Courthouse Ave. • Suite 203
PO Box 388 • Accomack, Virginia 23301

Accomack County Regional Water Supply Plan

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Report Prepared By:

Malcolm Pirnie, Inc.

701 Town Center Dr
Suite 600
Newport News, VA 23606
(757) 757-8700

Accomack-Northampton PDC

PO Box 417
23372 Front Street
Accomac, Virginia 23301
(757) 787-2936

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Acronyms Used in the Report

A-N PDC	Accomack-Northampton Planning District Commission
BGS	below ground surface
CIL	commercial, industrial, and/or light industrial
CWS	community water systems
DACS	Department of Agriculture and Consumer Services
DCR	Department of Conservation and Recreation
DEQ	Department of Environmental Quality
DGIF	Department of Game and Inland Fisheries
DHR	Department of Historic Resources
DNH	Department of Natural Heritage
DOF	Department of Forestry
ESA	Endangered Species Act
ESGWMA	Eastern Shore Groundwater Management Area
FT	feet
JPA	Joint Permit Application
MG	million gallons
MGD	million gallons per day
MSL	mean sea level
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
TMDL	total maximum daily load
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VEC	Virginia Employment Commission
VLR	Virginia Landmarks Register
VMRC	Virginia Marine Resources Commission
VPA	Virginia Pollution Abatement
VPDES	Virginia Pollutant Discharge Elimination System
VWPP	Virginia Water Protection Permit
WWTP	Wastewater Treatment Plant

1. Introduction

This report comprises the Water Supply Plan for Accomack County and the Towns of Accomac, Belle Haven, Bloxom, Chincoteague, Eastville, Hallwood, Keller, Melfa, Onancock, Onley, Painter, Parksley, Saxis, Tangier, and Wachapreague. In 2003, the Virginia General Assembly amended the Code of Virginia to require the development of a comprehensive statewide water supply planning process that would (1) ensure that adequate and safe drinking water is available to all citizens of the Commonwealth, (2) encourage, promote, and protect all other beneficial uses of the Commonwealth's water resources, (3) encourage, promote and develop incentives for alternative water sources. In addition, the General Assembly required that local or regional water supply plans would be prepared and submitted to the Virginia Department of Environmental Quality (DEQ) in accordance with criteria and guidelines developed by the State Water Control Board. The DEQ subsequently develop Local and Regional Water Supply Planning Regulations (9 VAC 25-780) to implement the mandates of the Code. In addition to administering the requirements of 9 VAC 25-780, DEQ has provided assistance for preparing local and regional water supply plans (WSPs) in the form of grants, workshops, and guidance documents.

In 2009, Accomack County commissioned Malcolm Pirnie Inc. to prepare a WSP that meets the requirements of 9 VAC 25-780 with financial assistance from the Accomack-Northampton Planning District Commission (A-N PDC) and from DEQ in the form of a Regional WSP Competitive Grant. Fifteen Towns in the County also agreed to participate in the development of the Accomack Regional WSP: Accomac, Belle Haven, Bloxom, Chincoteague, Eastville, Hallwood, Keller, Melfa, Onancoke, Onley, Painter, Parksley, Saxis, Tangier, and Wachapreague.

The first phase of the planning process focused on the collection of water supply and water use information, identification of environmental resources affecting the use and potential development of water supplies, and a projection of future water demand by residential, commercial, industrial and agricultural users. The second phase of the planning process focused on demand management, drought contingency planning, identifying current or future water supply deficits or surpluses, and identifying existing or potential risks to ensuring that adequate water supplies are available for the Planning Region. Where the analysis identified current or future risks to ensuring adequate water supplies, the planning process evaluated alternatives for the enhancement of existing or the development of new water supplies.

1.1. Background

Accomack County is composed of the northern portion of the Eastern Shore of Virginia peninsula and its surrounding islands and is situated between the Atlantic Ocean to the East and the Chesapeake Bay to the West and South (Figure 1-1). Accomack County is bordered on the South by Northampton County and on the North by Maryland's Somerset and Worcester Counties.

1.1.1. Water Resources

Accomack County is surrounded on both eastern and western sides by saltwater and has no streams of any substantial size and therefore has no significant source of surface water and must depend on groundwater as its sole source of drinking water.

Fresh groundwater is present in a series of four major aquifers predominantly comprised of sand, gravel, and shell material. The four major aquifers are present in the majority of the County and are, in order of increasing depth below ground surface, the Columbia (unconfined), and the upper, middle, and lower Yorktown-Eastover (confined) aquifers. Aquifers deeper than the lower Yorktown-Eastover contain salty water and are currently not used as a source of water supply.

The four freshwater aquifers are generally separated by sedimentary confining units comprised largely of very fine sand, silt, and clay, with each confining unit being named after the underlying aquifer. The entirety of Accomack County (and therefore its aquifers) is located within the Eastern Shore Groundwater Management Area (ESGWMA) as defined by the Virginia Ground Water Management Act of 1992, which requires a permit from DEQ for any person or entity wishing to withdraw in excess of 300,000 gallons per month from a declared GWMA.

The majority of drinking water needs in the County are met through withdrawals from groundwater water wells screened in the (confined) Yorktown-Eastover aquifers, while the rest is met through withdrawals from groundwater wells screened in the (surficial) Columbia aquifer. Groundwater availability in the Columbia Aquifer is characterized by relatively large recharge rates, lower aquifer storage, and a higher susceptibility to contamination; conversely, groundwater availability in the Yorktown-Eastover Aquifers is characterized by relatively low recharge rate, higher aquifer storage and lower susceptibility to contamination.

There are a total of thirty tidal creeks in Accomack County, which are largely supplied from groundwater discharge (approximately 80%). Although surface water is not used as a source of drinking water in the County, it is an important resource for irrigation water and for shellfish, finfish, and other wildlife habitat.

Figure 1-1: Accomack Location Map

1.1.2. Water Supply and Demand

Water usage in the County can be categorized into four major groups with water usage as follows:

	2007 Usage	
Water Usage	**Mgd**	**%**
Agricultural	0.91	13.9
Domestic Self-Supplied	1.42	21.6
Commercial/Industrial	3.26	49.5
Public Water Supply	0.99	15.1
Total	**6.59**	**100.0**

According to Eastern Shore Agricultural Extension Agents, farm ponds supply 85% of the amount of water used for irrigation. Some of these ponds are used to store water that has been pumped from underground. Also, dams have been built in some tidal creeks to provide irrigation water.

1.2. Organization of the WSP

The organization of the Accomack County WSP follows the same structure as the WSP regulation (9 VAC 25-780) and is as follows:

Section one consists of the present introductory information.

Section two provides a summary of current information on existing water sources including community water supply systems and self-supplied agricultural and non-agricultural users according to the requirements of 9 VAC 25-780-70.

Section three provides a summary of current water usage in Accomack County for each of the community water supply systems and for agricultural and non-agricultural self-supplied users according to the requirements of 9 VAC 25-780-80.

Section four is divided into two major subsections. The first subsection provides descriptions the geologic, hydrologic, and meteorologic conditions pertaining to the existing water resources of Accomack County according to the requirements of 9 VAC 25-780-90A. The second subsection provides descriptions of the relevant environmental conditions that pertain to or may affect existing water supply sources in the County according to the requirements of 9 VAC 25-780-90B.

Section five provides a description of the methodology and results of future water use projections through to the 2030 planning horizon for community water supply systems and for agricultural and non-agricultural self-supplied users according to the requirements of 9 VAC 25-780-100

Section six provides a description of planned water demand management strategies according to the requirements of 9 VAC 25-780-110.

Section seven provides a summary of drought response and contingency plans including at least three graduated stages of response for community water supply systems and self-supplied users who withdraw more than an average of 300,000 gallons per month according to the requirements of 9 VAC 25-780-120.

Section eight provides a description of the adequacy of existing sources to meet current and projected water demands, a statement of need based information contained in the preceding sections, and a description of potential alternatives to bridge the gap between existing sources and future demands according to the requirements of 9 VAC 25-780-130.

Sections nine and ten provide a list of conclusions and references, respectively.

2. Existing Water Sources
(9 VAC 25-780-70)

This section summarizes water source information for Accomack County, and provides more detailed descriptions of water source information within each of the jurisdictions, in accordance with 9 VAC 25-780-70. The Eastern Shore peninsula contains no major streams or other surface water supplies capable of acting as a potable water supply; therefore, ground water is the primary resource for water needs in Accomack County. This section provides available well information for Community Water Systems and large self-supplied non-agricultural users, as well as a list of large agricultural users, and an estimate of the population served by individual wells using less than 300,000 gallons per month.

2.1. Community Water Systems

A Community Water System is defined as "a waterworks that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents, and is regulated by the Virginia Department of Health Waterworks Regulation (12 VAC 5-590)." In Accomack County, the following Community Water Systems utilize groundwater to supply their residents:

- Arcadia Nursing Center
- Captains Cove Subdivision
- Town of Chincoteague
- NASA Wallops Island Flight Center
- Town of Onancock
- Town of Parksley
- Rolling Acres Subdivision
- Shore Life Care at Parksley
- Town of Tangier
- Trails End Utility
- Triangle Enterprises Mobile Home Park

Groundwater well details (i.e. Well ID, depth, casing and screen depth) are provided in Appendix A. In some cases, specific well information was not readily available after reasonable search and is therefore listed as N/A in the tables in Appendix A. The locations of these Community Water Systems are shown on Figure 2-1. Table 2-1, below, summarizes the VDEQ permitted annual and maximum monthly withdrawals, as well as the VDH permitted capacities of the Community Water Systems in the County.

Table 2-1:
Accomack County CWS: Permitted Withdrawals

	VDEQ Permitted Withdrawals		VDH Design Capacity (GPD)
Water System Name	Total Annual Withdrawal (MG)	Max. Monthly Withdrawal (MG)	
ARCADIA NURSING CENTER			10,052
CAPTAINS COVE SUBDIVISION	65.00 [1]	12.00 [1]	226,080
CHINCOTEAGUE, TOWN OF	219.40 [1]	34.1 [1]	1,000,000
NASA WALLOPS FLIGHT CENTER	13.30	3.94	700,000
ONANCOCK, TOWN OF	80.62	8.08	377,600
PARKSLEY, TOWN OF	32.80 [1]	4.00 [1]	182,000
ROLLING ACRES SUBDIVISION			17,333
SHORE LIFE CARE AT PARKSLEY	6.80	0.80	29,315
TANGIER, TOWN OF			130,000
TRAILS END	15.70	2.60	122,800
TRIANGLE ENTERPRISES MHP	9.70	1.20	17,400

[1] Permit amounts are based on amounts requested in Permit Application

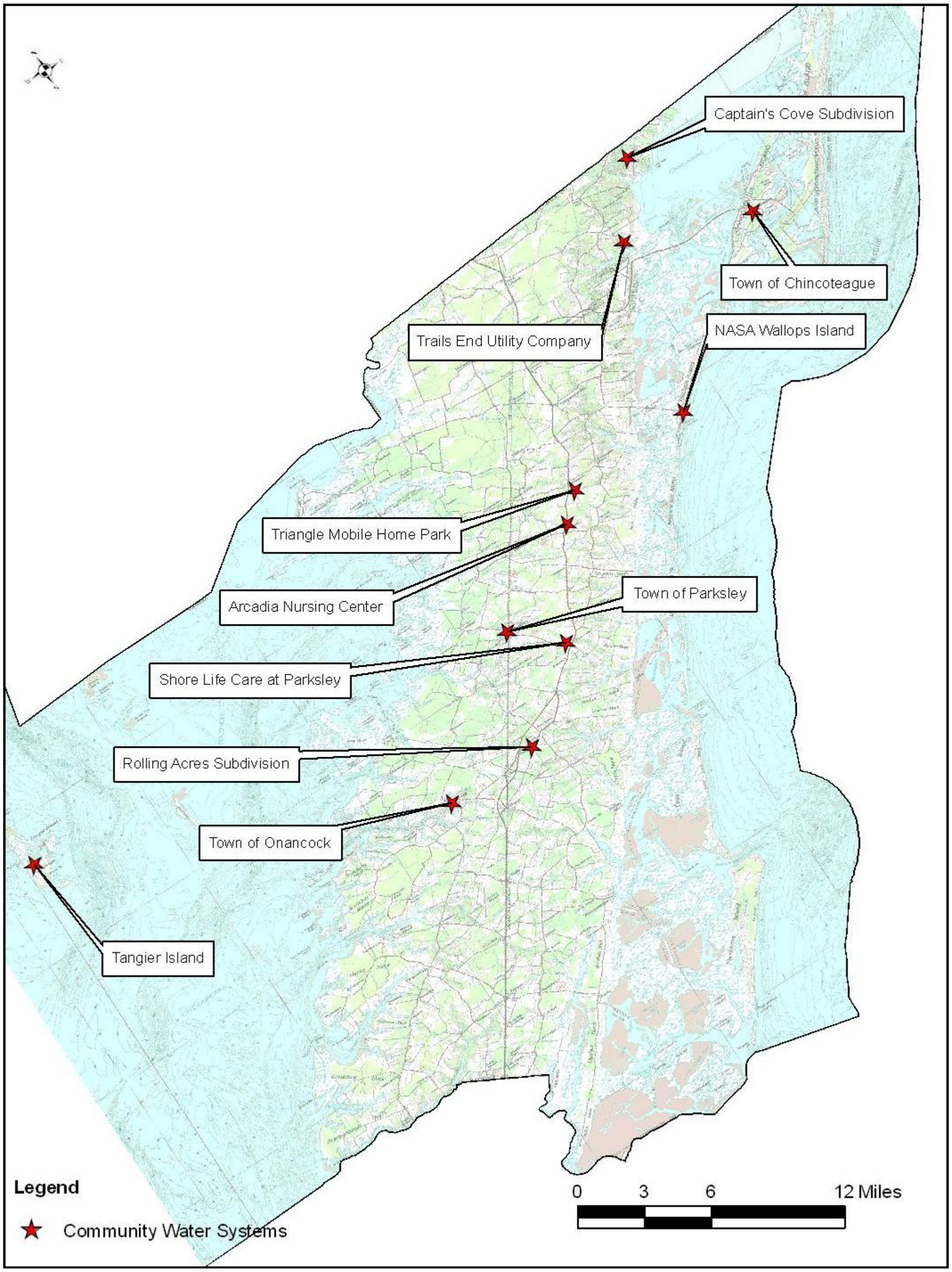
2.2. Purchased Water Source

No community water systems in Accomack County purchase water from outside of the County. Availability of water for community purchase outside of the County region was not evaluated as part of this water supply plan because the primary source of water in the County is groundwater, which typically serves the population in the immediate area.

2.3. Large Self-Supplied Users

Non-community water systems, or self-supplied users, of greater than 300,000 gallons per month are categorized into non-agricultural and agricultural users. The following sections provide information regarding the large self-supplied users in Accomack County. The majority of large self-supplied users in the County use groundwater as their primary source, however some agricultural users utilize surface water sources.

Figure 2-1: Community Water Systems in Accomack County



2.3.1. Non-Agricultural Large Self-Supplied Users

All non-agricultural large self-supplied users in Accomack County utilize groundwater as their primary source. The six large non-agricultural self supplied users of more than 300,000 gallons of groundwater per month that were identified in the County are as follows:

- Commonwealth Chesapeake Power Station
- Eastern Shore Yacht and Country Club
- Integrated Fisheries International Limited
- KMX Chemical Corporation
- Perdue
- Tyson Foods Incorporated

Groundwater well details (i.e. Well ID, depth, casing and screen depth) are provided in Appendix B. In some cases, specific well information was not readily available after reasonable search and is therefore listed as N/A in the tables in Appendix B. Table 2-2 summarizes the VDEQ permitted annual and maximum monthly withdrawals, as well as the VDH permitted capacities for the large, non-agricultural self-supplied users of groundwater in the County.

Table 2-2:
Non-Agricultural Large Self-Supplied Users: Permitted Withdrawals

	VDEQ Permitted Withdrawals		VDH Design Capacity (GPD)
Water System and Well Name	Total Annual Withdrawal (MG)	Max. Monthly Withdrawal (MG)	
Commonwealth Chesapeake Power Station	61.40	10.80	
Eastern Shore Yacht and Country Club	25.00	6.50	
Integrated Fisheries International Limited	95.00	10.50	
KMX Chemical Corporation	76.44	8.77	
Perdue*	700.00	78.33	
Tyson Foods Incorporated*	675.00	46.00	1,584,000

*Annual and monthly amounts are requested, final permits pending

2.3.2. Agricultural Large Self Supplied Users

Agriculture is the dominant land use in Accomack County, and groundwater is the primary source of irrigation for crops, nurseries and livestock operations. In some cases, groundwater is used to refill irrigation ponds. Some agricultural users utilize surface water for irrigation purposes, and both use types will be discussed in the following sections.

2.3.2.1. Groundwater Sources

A total of 43 large agricultural self-supplied users were identified in the County that use more than 300,000 gallons per month of groundwater for irrigation. Table 2-3 lists the large agricultural groundwater users in the County, as well as the annual and monthly permitted withdrawal amounts for each user. As shown in this table, the total permitted agricultural groundwater use in the County is 1.4 billion gallons (BG) per year.

Table 2-3.
Large Self-Supplied Agricultural Users of Groundwater

	Annual Permitted Withdrawal (gallons)	Monthly Permitted Withdrawal (gallons)
FACILITY/SYSTEM NAME		
AL Mathews	41,904,000	14,142,000
Ames Farm	65,000,000	16,250,000
Bethel Church	32,400,000	16,200,000
Bobtown Nursery	10,900,000	4,000,000
Bowen Farm	42,620,000	16,000,000
Broadleaf Farms	3,700,000	1,000,000
Byrd Farm	22,650,000	9,910,000
Christian/Ames Farm	56,091,000	21,034,125
David Van Dessel Farm	4,500,000	1,200,000
Dennis Azaleas	2,700,000	500,000
Dennis Nursery	5,000,000	900,000
Drummond Farm	31,000,000	11,000,000
East Coast Brokers and Packers	13,500,000	2,400,000
Ed Goin	34,320,000	11,583,000
Evans or Oaks Farm	120,072,000	26,568,000
Gillespe Farm	28,000,000	12,500,000
Gunter Farm	12,500,000	6,300,000
Hagan Farm	17,000,000	5,700,000
Hickory Hill	34,560,000	17,280,000
Hogneck Farm	13,000,000	5,500,000
Home Farm	8,400,000	6,500,000
James Farm	54,000,000	7,900,000
Kelley Farm	30,124,000	14,300,000
Lang	51,840,000	12,960,000
Lewis Farm	24,300,000	11,500,000
Liberty Hall Farm	4,400,000	1,000,000
Mathews Farm	10,900,000	3,114,290
Melfa Farm	30,360,000	11,400,000
Middleton Farm	185,000,000	37,000,000
Mutton Hunk Fen Natural Area Preserve	40,340,000	19,100,000
Northam Somers	37,800,000	11,812,500
Painter Farm	18,400,000	8,520,000
Peach Orchard	42,600,000	8,520,000

Rew Farm	49,000,000	16,300,000
Robert Van Dessel Farm	3,400,000	900,000
Simpson Farm	21,517,000	10,193,000
Sommers Farm	24,300,000	11,500,000
Sterling	93,060,000	44,080,000
Tidewater Growers	1,800,000	600,000
Weaver Farm	32,900,000	11,000,000
Wes Powers	20,160,000	5,040,000
Wessells Farm	21,517,000	10,193,000
Wessells/ Watkinson Farm	13,500,000	3,375,000
Total Permitted Withdrawals (MG)	**1,411.04**	**466.77**

2.3.2.2. Surface Water Sources

A number of farms and nurseries in the County utilize surface water sources such as ponds for irrigation. While these withdrawals are not permitted by the state, they are required to report their surface water withdrawals. Table 2-4 lists the large agricultural self-supplied users of surface water in the County, as well as the average annual reported use between 2001 and 2006.

Table 2-4.
Large Self-Supplied Agricultural Users of Surface Water

	Average Annual Use (MG)
User Name	
AL WESSELLS\BOB WATKINSON	14.01
BOBTOWN NURSERY	41.48
DUBLIN FARMS INC	506.00
EASTERN SHORE AGR. EXP. STN.	0.91
ED GOIN	32.04
F.A. HOLLAND & SONS	40.88
GODWIN'S NURSERY/PENINSULA PRO	0.35
GREEN ACRES FARMS	9.50
JOHN H DUER III	151.20
KELLEY FARM	21.98
KLUIS' NURSERIES	8.11
MATTHEWS FARM	21.74
NOCK FARM	5.47
PEACH ORCHARD FARM	12.50
STURGIS FARM	56.19
VAN KESTEREN FARMS INC	139.85
W.T. HOLLAND SONS INC	33.56
WEAVER FARM	28.12
WESSELLS FARM	11.59

2.4. Small Self-Supplied Users

The Water Supply Planning regulations require that "a water plan shall include an estimate of the number of residents and business that are self-supplied by individual wells withdrawing less than 300,000 gallons per month and an estimate of the population served by individual wells" (9 VAC 25-780-70.J).

The estimate of small self-supplied residential users is 30,006 persons. This estimate was developed by subtracting total population served by the Community Water Systems (see Section 3.0 below) from the estimated 2010 population in Accomack County (as reported in the Accomack County Comprehensive Plan, Page 3-7, forecast based on "trend plus" rate):

County Population – CWS Population Served = Population served by individual wells
(39,630 – 9,624 = 30,006 persons)

For planning purposes, it was assumed than an average of 2.5 persons occupy a residence (Accomack County Comprehensive Plan, page 3-20); therefore, based on a population served of 9,189 persons, there are an estimated 12,002 small, self supplied residential wells.

Estimating the number of businesses that are self-supplied by groundwater in the County is a bit more difficult. A review of the VDH groundwater permit holders in the County showed that a total of 25 non-transient, non-community small users and 53 transient non-community small users rely on groundwater as their primary water source. Tables 2-5 and 2-6 contain a list of the transient and non-transient small self-supplied businesses, respectively, along with the population served and the water system ID number.

Table 2-5:
Small Self-Supplied Groundwater Users and Population Served
(Transient, Non-Community)

	No. of Service Connections	Service Area Population
WATER SYSTEM NAME		
ACCOMAC AREA HEADQUARTERS	40	VA3001001
ACCOMAC RESIDENCY OFFICE	36	VA3001030
AMERICA`S BEST VALUE INN (ONLEY)	103	VA3001034
BURGER KING (ONLEY)	300	VA3001059
CAPTAIN`S QUARTERS	50	VA3001103
CLINTON SUMMER MLC	28	VA3001075
COMFORT INN	175	VA3001178
EAST COAST BROKERS & PACKERS	296	VA3001551
EASTERN SHORE MOTEL	30	VA3001631
EASTERN SHORE PUBLIC LIBRARY	300	VA3001211

	No. of Service Connections	Service Area Population
WATER SYSTEM NAME		
ECBP PACKING HOUSE MLC	120	VA3001651
ELKS LODGE #1766	400	VA3001043
EXMORE MOOSE #683	360	VA3001432
FRED HALL MLC	45	VA3001077
ISLAND HOUSE RESTAURANT	200	VA3001892
KELLY MLC	160	VA3001074
KUZZENS (AMES FARM COMPLEX QUAD 1)	80	VA3001400
KUZZENS (AMES FARM COMPLEX QUAD 2)	80	VA3001401
KUZZENS (AMES FARM COMPLEX QUAD 3)	28	VA3001402
KUZZENS (AMES FARM COMPLEX QUAD 4)	28	VA3001403
KUZZENS PACKING INC	150	VA3001796
LAKEVIEW MLC	70	VA3001702
LITTLE ACRES CAMPGROUND	25	VA3001040
MAPPSVILLE MLC	100	VA3001078
MCDONALDS (ONLEY)	500	VA3001430
NEW CHURCH INFORMATION CENTER	504	VA3001550
OCCOHANNOCK ON THE BAY	100	VA3001588
OCEANWAY MARKET	500	VA3001611
PARKSLEY FAMILY RESTAURANT	50	VA3001776
PEERLESS VIRGINIA (SOMERS FARM MLC)	60	VA3001789
PIZZA HUT (OAK HALL)	350	VA3001715
RAYS SHANTY	96	VA3001010
RICK HALL (JUDGE GUNTER HOUSE MLC)	40	VA3001731
SAGE DINER	184	VA3001720
SHORE SEAFOOD	30	VA3001054
SHUCKER`S ROADHOUSE	250	VA3001880
STUCKEYS (MAPPSVILLE)	50	VA3001810
SUBWAY (OAK HALL)	50	VA3001053
SUNRISE BAR & GRILL	100	VA3001717
TALL PINES CAMPGROUND	100	VA3001820
TAMMY & JOHNNYS	54	VA3001830
TAYLOR & FULTON (PACKING HOUSE)	250	VA3001837
TAYLOR & FULTON (TASLEY MLC)	70	VA3001862
TEMPERANCEVILLE AREA HQ	40	VA3001850
T`S CORNER	500	VA3001885
VIRGINIA LANDING	630	VA3001600
WACHAPREAGUE MOTEL	35	VA3001894
WATKINSON EAST MLC	104	VA3001081
WATKINSON WEST MLC	38	VA3001082
WATTSVILLE MALONE MLC	50	VA3001076
WENDY`S (ONLEY)	88	VA3001895
WHISPERING PINES MOTEL	100	VA3001970
WRIGHTS SEAFOOD RESTAURANT	325	VA3001980

Table 2-6:
Small Self-Supplied Groundwater Users and Population Served
(Non-Transient, Non-Community)

	No. of Service Connections	Service Area Population
WATER SYSTEM NAME		
ACCAWMACKE ELEMENTARY SCHOOL	634	VA3001791
ACCOMACK COUNTY HEALTH DEPT	95	VA3001003
ACCOMACK COUNTY INDUSTRIAL PK	92	VA3001006
ACCOMACK COUNTY OFFICE BUILDINGS	400	VA3001004
ACCOMACK NORTHAMPTON ELECTRIC COOPERATIVE	35	VA3001014
ACCOMACK SOCIAL SERVICES	170	VA3001018
ARCADIA SCHOOLS	1600	VA3001015
ATLANTIC COMMUNITY HEALTH CENTER	40	VA3001036
BOJANGLE`S (ONLEY)	38	VA3001065
CHESAPEAKE SQUARE	60	VA3001150
EASTERN SHORE COMM COLLEGE	890	VA3001212
EASTERN SHORE FAMILY YMCA	385	VA3001982
FOUR CORNERS PLAZA NORTH	50	VA3001739
FOUR CORNERS PLAZA SOUTH	100	VA3001650
FRESH PRIDE	25	VA3001290
HEAD START - ACCOMAC	350	VA3001331
KEGOTANK ELEMENTARY SCHOOL	635	VA3001560
NANDUA SCHOOLS	1500	VA3001488
OAK HALL SHOPPING CENTER	90	VA3001575
ONLEY COMMUNITY HEALTH CENTER	75	VA3001625
ONLEY PRESCHOOL	53	VA3001428
PARKSLEY MIGRANT HEAD START	200	VA3001658
PEEBLES DEPT STORE	35	VA3001690
PUNGOTEAGUE ELEMENTARY SCHOOL	610	VA3001790
ST PAUL`S DAY CARE CENTER	120	VA3001210

2.5. Source Water Assessment Plans or Wellhead Protection Programs

The Eastern Shore of Virginia was designated a Ground Water Management Area in 1976 and any withdrawal of 300,000 gallons per month or more in this area requires a ground water withdrawal permit from DEQ. At the local level, the Eastern Shore of Virginia Ground Water Committee was formed in 1990 to assist local governments and residents in understanding, protecting and managing the ground water resource. The Ground Water Supply Protection and Management Plan for the Eastern Shore of Virginia

(1992) provides the basis and guidelines for protecting the ground water resource. In addition to the Ground Water Committee, the two counties have adopted provisions in their ordinances that provide protection to the ground water resource. In November 1998, Accomack County passed an ordinance that includes provisions specific to ground water resource protection. In June 2003, Accomack County passed an ordinance requiring that certain new developments implement specific measures designed to protect and preserve the water resource (Source: http://www.a-npdc.org/groundwater).

3. Existing Water Use
(9 VAC 25-780-80)

This section will describe the existing water use in Accomack County, in accordance with the provisions of 9 VAC 25-780-80. Water use is broken down into the following user categories:

- Community Water Systems – including residential use, commercial institutional and light industrial use, heavy industrial use, military use, water production, unaccounted for water losses, and sales to other community water systems.
- Self-Supplied Non-Agricultural Users of more than 300,000 gallons per month
- Self-Supplied Agricultural Users of more than 300,000 gallons per month
- Self-Supplied Users of less than 300,000 gallons per month

Information contained in this section was derived from a number of sources including 2009 VDH waterworks permit/water use reports, individual groundwater permit applications and VDEQ data.

3.1. Community Water Systems

The following information is required for all Community Water Systems (CWS), as stated in 9 VAC 25-780-80.B:

- Population within CWS service area
- Number of connections within CWS service area
- Average and maximum daily withdrawal for each CWS
- The amount of water used within the CWS service area on an average annual basis and on an average monthly basis
- The peak daily use by month
- Disaggregated estimates of water use by different user types (i.e. residential, commercial institutional and light industrial, heavy industrial, etc).

Table 3-1 contains the population and current number of service connections within the service area of each CWS, as reported by VDH. The total population served by

Community Water Systems in Accomack County is 9,624 across 8,468 service connections.

Table 3-1.
Community Water System Service Area Connections and Population

WATER SYSTEM NAME	No. of Service Connections	Service Area Population
ARCADIA NURSING CENTER	2	92
CAPTAINS COVE SUBDIVISION	635	720
CHINCOTEAGUE, TOWN OF	3255	3500
NASA WALLOPS FLIGHT CENTER	250	1625
ONANCOCK, TOWN OF	720	1525
PARKSLEY, TOWN OF	483	925
ROLLING ACRES SUBDIVISION	38	170
SHORE LIFE CARE AT PARKSLEY	1	150
TANGIER, TOWN OF	324	650
TRAILS END	2680	115
TRIANGLE ENTERPRISES MHP	80	152
Total:	**8468**	**9624**

Historical use for Community Water Systems was extracted from several sources. Total annual use (MG), average daily use and average monthly use was calculated for use reported to the VDEQ between 2003 and 2009 for the following CWS:

- NASA Wallops Island Flight Center
- Town of Onancock
- Trails End Utility Company

Tables 3-2, 3-3 and 3-4 present the total annual use, average daily use, and average monthly use, respectively.

Table 3-2:
VDEQ-Reported Total Annual Use (MG): CWS

Community Water Systems	2003	2004	2005	2006	2007	2008	2009
NASA Wallops Island Flight Center	45.39	13.03	14.41	9.97	9.11	8.33	8.58
Onancock, Town of	62.54	59.11	50.42	47.04	50.44	44.33	34.18
Trails End	15.70	16.45	18.59	19.88	21.17	21.77	18.36

Table 3-3:
VDEQ-Reported Average Daily Use (MGD): CWS

	2003	2004	2005	2006	2007	2008	2009
Community Water Systems							
NASA Wallops Island Flight Center	0.124	0.036	0.039	0.027	0.025	0.023	0.023
Onancock, Town of	0.171	0.162	0.138	0.129	0.138	0.121	0.094
Trails End	0.043	0.045	0.051	0.054	0.058	0.060	0.050

Table 3-4:
VDEQ-Reported Average Monthly Use (MG): CWS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Community Water Systems												
NASA Wallops Island Flight Center	1.58	1.43	1.33	1.31	1.49	1.63	1.62	1.83	1.29	1.56	1.64	1.77
Onancock, Town of	1.15	0.98	1.10	1.07	1.21	1.17	1.37	1.28	1.16	1.11	1.02	1.07
Trails End	0.28	0.31	0.36	0.46	0.63	0.76	0.88	0.71	0.71	0.51	0.38	0.28

Recent VDEQ water use records were not available for the following Community Water Systems in Accomack County:

- Arcadia Nursing Center
- Captain's Cove Subdivision
- Town of Chincoteague
- Town of Parksley
- Shore Life Care at Parksley
- Triangle Enterprises Mobile Home Park

Historic VDH water use records were available for these systems, and were used to calculate total annual use, average daily use and average monthly use (see Tables 3-5 though 3-16).

3.1.1. Arcadia Nursing Center

VDH monthly water use records were available for 2000 – 2002. The total average annual use over this time period was 3.22 MG per year, with an average daily withdrawal of 0.009 MGD (Table 3-5). The average monthly use is presented in Table 3-6, which shows a maximum monthly withdrawal of 0.524 MG in the month of July.

Table 3-5:
VDH-Reported Total Annual and Average Daily Use: Arcadia Nursing Center

	2000	2001	2002	Average
Total Annual Use (MG)	3.36	3.37	2.95	**3.22**
Average Daily Use (MGD)	0.009	0.009	0.008	**0.009**

Table 3-6:
VDH-Reported Average Monthly Use (MG): Arcadia Nursing Center

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Monthly Use (MG)	0.273	0.266	0.214	0.252	0.237	0.134	0.524	0.318	0.233	0.201	0.312	0.261

3.1.2. Captain’s Cove Subdivision

VDH monthly water use records were available for 1995 - 2002. The total average annual use over this time period was 20.83 MG per year, with an average daily withdrawal of 0.057 MGD (Table 3-7). The average monthly use is presented in Table 3-8, which shows a maximum monthly withdrawal of 2.989 MG in the month of July.

Table 3-7:
VDH-Reported Total Annual and Average Daily Use: Captain's Cove Subdivision

	1995	1996	1997	1998	1999	2000	2001	2002	Average
Total Annual Use (MG)	24.75	19.73	18.17	16.60	19.22	21.83	21.46	24.86	**20.83**
Average Daily Use (MGD)	0.068	0.054	0.050	0.045	0.053	0.060	0.059	0.068	**0.057**

Table 3-8:
VDH-Reported Average Monthly Use (MG): Captain's Cove Subdivision

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Monthly Use (MG)	1.420	1.252	1.446	1.719	1.909	2.188	2.989	2.365	1.625	1.422	1.289	1.206

3.1.3. Town of Chincoteague

VDH monthly water use records were available for 1995 - 2002. The total average annual use over this time period was 193.94 MG per year, with an average daily withdrawal of 0.531 MGD (Table 3-9). The average monthly use is presented in Table 3-10, which shows a maximum monthly withdrawal of 28.34 MG in the month of July.

Table 3-9:
VDH-Reported Total Annual and Average Daily Use: Town of Chincoteague

	1995	1996	1997	1998	1999	2000	2001	2002	Average
Total Annual Use (MG)	196.71	200.29	195.32	195.08	198.82	188.88	180.06	196.40	**193.94**
Average Daily Use (MGD)	0.539	0.549	0.535	0.534	0.545	0.517	0.493	0.538	**0.531**

Table 3-10:
VDH-Reported Average Monthly Use (MG): Town of Chincoteague

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Monthly Use (MG)	10.74	9.95	11.77	13.69	17.06	20.39	28.34	26.39	17.40	15.31	12.87	10.04

3.1.4. Town of Parksley

VDH monthly water use records were available for 1995 - 2002. The total average annual use over this time period was 26.96 MG per year, with an average daily withdrawal of 0.074 MGD (Table 3-11). The average monthly use is presented in Table 3-12, which shows a maximum monthly withdrawal of 2.59 MG in the month of July.

Table 3-11:
VDH-Reported Total Annual and Average Daily Use: Town of Parksley

	1995	1996	1997	1998	1999	2000	2001	2002	Average
Total Annual Use (MG)	24.49	22.83	24.44	25.34	30.51	29.50	27.99	30.61	**26.96**
Average Daily Use (MGD)	0.067	0.063	0.067	0.069	0.084	0.081	0.077	0.084	**0.074**

Table 3-12:
VDH-Reported Average Monthly Use (MG): Town of Parksley

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Monthly Use (MG)	2.15	1.98	2.14	2.19	2.34	2.43	2.59	2.58	2.25	2.10	2.12	2.09

3.1.5. Shore Life Care of Parksley *(formerly Accomack County Nursing Home)*

VDH monthly water use records were available for 1995 - 2002. The total average annual use over this time period was 5.16 MG per year, with an average daily withdrawal of 0.014 MGD (Table 3-13). The average monthly use is presented in Table 3-14, which shows a maximum monthly withdrawal of 0.457 MG in the month of December.

Table 3-13:
VDH-Reported Total Annual and Average Daily Use: Shore Life Care at Parksley

	1995	1996	1997	1998	1999	2000	2001	2002	Average
Total Annual Use (MG)	4.46	4.39	4.97	5.22	5.21	6.26	5.52	5.24	**5.16**
Average Daily Use (MGD)	0.012	0.012	0.014	0.014	0.014	0.017	0.015	0.014	**0.014**

Table 3-14:
VDH-Reported Average Monthly Use (MG): Shore Life Care at Parksley

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Monthly Use (MG)	0.433	0.388	0.426	0.393	0.432	0.416	0.444	0.443	0.441	0.443	0.444	0.457

3.1.6. Triangle Enterprises Mobile Home Park

VDH monthly water use records were available for 1989 - 1997. The total average annual use over this time period was 10.28 MG per year, with an average daily withdrawal of 0.028 MGD (Table 3-15). The average monthly use is presented in Table 3-16, which shows a maximum monthly withdrawal of 1.254 MG in the month of September. According to documentation contained in the June 2005 Application for Groundwater Withdrawal Permit, withdrawal data collected prior to January 2004 is known to be inaccurate. Withdrawal data collected during 2006 shows a total annual withdrawal of 8.21 MG, with an average daily withdrawal of 0.022 MGD. During 2006, the maximum monthly withdrawal was 1.047 MG, which occurred during the month of September (consistent with maximum month presented in Table 3-16).

Table 3-15:
VDH-Reported Total Annual and Average Daily Use:
Triangle Enterprises Mobile Home Park

	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average
Total Annual Use (MG)	7.25	10.05	9.79	10.29	28.89	7.23	9.96	5.03	4.05	**10.28**
Average Daily Use (MGD)	0.020	0.028	0.027	0.028	0.079	0.020	0.027	0.014	0.011	**0.028**

Table 3-16:
VDH-Reported Average Monthly Use (MG):
Triangle Enterprises Mobile Home Park

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Monthly Use (MG)	0.759	1.051	0.593	0.666	0.649	0.162	1.123	0.876	1.254	0.613	0.982	0.739

Water use records were not available for the following Community Water Systems in Accomack County:

- Rolling Acres Subdivision
- Town of Tangier

Maximum day and peak day water use by month data were not available for any of the Community Water Systems in the County. Water use records are reported to the VDEQ and VDH on a monthly basis, so peak day use is not able to be calculated using existing records.

There are no large, self-supplied non-agricultural or agricultural users of groundwater or surface water within the service areas of the Community Water Systems. All users within the service area boundaries rely on water supplied by the CWS.

According to information available through VDEQ groundwater withdrawal permits, the primary use type for Community Water Systems in the County is residential use, with the exception of the following:

- Town of Onancock: 93% Residential Use, 1% Fire Protection and 6% WWTP Process Water

It is assumed that Unaccounted for Water Losses are present in each CWS; however, precise estimates of this use were not readily available.

3.2. Large Self-Supplied Non-Agricultural Users

In accordance with 9 VAC 25-780-80.C, this section provides an estimate of the water used on an average annual basis by all self-supplied non-agricultural users (outside of the Community Water System service areas) of more than 300,000 gallons per month of surface water and groundwater. As discussed earlier, all large self-supplied non-agricultural users in Accomack County rely on groundwater for their water supply needs. Based on VDEQ reported withdrawals, the three of the six large-self supplied groundwater users in the County used a total of 14.89 MG in 2009, which was down substantially from the previous six years of use. Table 3-17 presents the total annual use (in MG) reported to the VDEQ between 2003 and 2009.

Table 3-17:
Total Annual Use by Large-Self Supplied Non-Agricultural Groundwater Users

	2003	2004	2005	2006	2007	2008	2009
Self-Supplied Non-Agricultural Users							
Commonwealth Chesapeake Power Station	13.91	9.64	6.55	3.28	3.80	3.10	2.10
Eastern Shore Yacht and Country Club	6.13	5.38	9.30	9.15	17.87	8.48	12.70
Integrated Fisheries International Limited	58.99	55.81	43.85	11.37	12.93	4.83	0.09
Total (MG)	**79.03**	**70.83**	**59.71**	**23.80**	**34.60**	**16.41**	**14.89**

Recent VDEQ water use records were not available for the following Large Self-Supplied Non-Agricultural Users:

- KMX Chemical Corporation
- Perdue
- Tyson Foods

3.2.1. Tyson Foods

The 2005 Application for a Groundwater Withdrawal Permit contains annual reports of water withdrawals for Tyson Foods wells between 1998 and 2002, which are presented in Table 3-18. Newer data were also available for the period between 2001 and 2005 through the VDEQ water use database. Over this period of time, the average total annual withdrawal was 422.3 MG, which is approximately 62.6 percent of the amount requested in their VDEQ Permit Application.

Table 3-18:
Average Annual Groundwater Use: Tyson Foods, Inc.

	2000	2001	2002	2003	2004	2005	2006	2007	Average
Total Annual Use (MG)	347.6	345.6	368.9	338.2	345.1	313.6	330.9	337.3	**340.9**

3.2.2. Perdue

Water usage data for Perdue was obtained from the VDEQ Water Use Database, shown in Table 3-19. The average total annual usage between 2001 and 2005 was 674 MG, which is approximately 96 percent of the amount requested in their 2007 VDEQ Permit Application.

Table 3-19:
Average Annual Groundwater Use: Perdue

	2001	2002	2003	2004	2005	2006	2007	Average
Total Annual Use (MG)	674.61	679.55	661.97	657.10	680.40	683.00	597.11	**662.0**

3.2.3. KMX Chemical Corporation

No withdrawal information was available for this user.

3.3. Large Self-Supplied Agricultural Users

In accordance with 9 VAC 25-780-80.D, this section provides an estimate of the water used on an average annual basis by all self-supplied agricultural users (outside of the Community Water System service areas) of more than 300,000 gallons per month of surface water and groundwater. Average annual surface water use by agricultural large self-supplied users was presented previously in Table 2-4. These use estimates were calculated as the average annual use between 2001 and 2006, based on withdrawals reported to the VDEQ.

Table 3-19 presents the total annual groundwater withdrawals that were reported to the VDEQ between 2003 and 2008 by large, self-supplied agricultural users in the County.

Table 3-20:
Total Annual Use by Large-Self Supplied Agricultural Groundwater Users

	2003	2004	2005	2006	2007	2008
Agricultural User						
AL Mathews Farm			2,604,000	39,477,000	31,800,259	10,773,301
Ames	13,937,000		256,217	15,805,459	26,809,221	892,089
Bobtown Nursery	8,437,004	7,048,765	10,485,399	9,559,211	9,461,384	
Bowen Farm					37,578,995	1,060,000
Broadleaf Farms	3,112,600	4,622,400	5,623,200	3,181,680	3,110,160	1,739,040
Byrd Farm					9,632,000	
Christian/Ames Farm				77,132	35,677,387	93,000
Dennis Nursery	3,385,100	4,213,300	4,017,090	4,681,350	4,975,080	1,634,060
Drummond Farm	9,226,300	12,904,800	10,039,700	14,267,600	22,744,400	
Ed Goin Farm				9,222,000		
Gunter Farm	12,373,000	7,305,000	17,000	6,000	64,000	24,000
Hogneck Farm	10,752,800	1,690,500	13,094,000		36,935	
Home Farm					450,283	
Lang Farm					10,864,799	1,444,069
Lewis Farm	6,490,600	1,557,600	1,276,100	2,900,500	5,857,100	
Machipongo Farm					15,209,000	
Melfa Farm				85,700	7,397,753	1,874,000
Mutton Hunk Fen Natural Area Preserve			10,495,890	6,235,510	10,914,800	
Northam Somers Farm			2,274,000	33,264,000	12,436,513	292,557
Painter Farm				7,863,600	25,956,674	3,793,000
Rew Farm	8,933,400	2,843,500	7,748,500	22,000	3,920,100	820,000
Sommers Farm	7,728,300	4,975,600	12,230,200	4,258,900	7,966,500	
Taylor & Fulton Gillespe Farm	4,757,600	3,451,600	8,699,500	11,195,900	6,862,400	
Wessells Farm			12,236,100	6,638,100	9,984,500	
Wessells Watkinson Farm				8,733,000		
Total Use (MG)	**89.13**	**50.61**	**101.10**	**177.47**	**329.71**	**24.44**

3.4. Small Self-Supplied Use Outside of the Community Service Areas

In accordance with 90 VAC 25-780-80.E, this section contains an estimate of water use by small self-supplied users of groundwater that are outside of the Community Service Areas. This use includes residential and business use and is calculated as follows:

- Residential Use: Estimate of Population Served by Individual Wells * Average Per Capita Use Rate of 75 gpcd
  - 30,006 persons * 75 gpcd = 2.25 MGD

- Business Use: Estimate of Total Population Served (as presented in Tables 2-5 and 2-6) * Average Per Capita Use Rate
  - 16,734 persons served * 50 gpcd = 0.84 MGD

- Total Small Self-Supplied Use: Residential Use plus Business Use
  - 2.25 MGD + 0.84 MGD = 3.09 MGD

4. Existing Water Resource Conditions
(9 VAC 25-780-90)

This section is divided into two parts, which contain: 1) a description of the physical environment pertaining to the geologic, hydrology, and meteorological conditions in Accomack County and 2) a description of existing environmental conditions that pertain to, or may affect sources that provide the current supply in fulfillment of requirements of 9 VAC 25-780-90. Potential environmental resource issues pertaining to new water supplies are discussed Section **Error! Reference source not found.**. Special attention is iven to the potential effects of water usage on current environmental conditions and to mitigating strategies and which reduce or avoid such potential effects.

4.1. Physical Environment

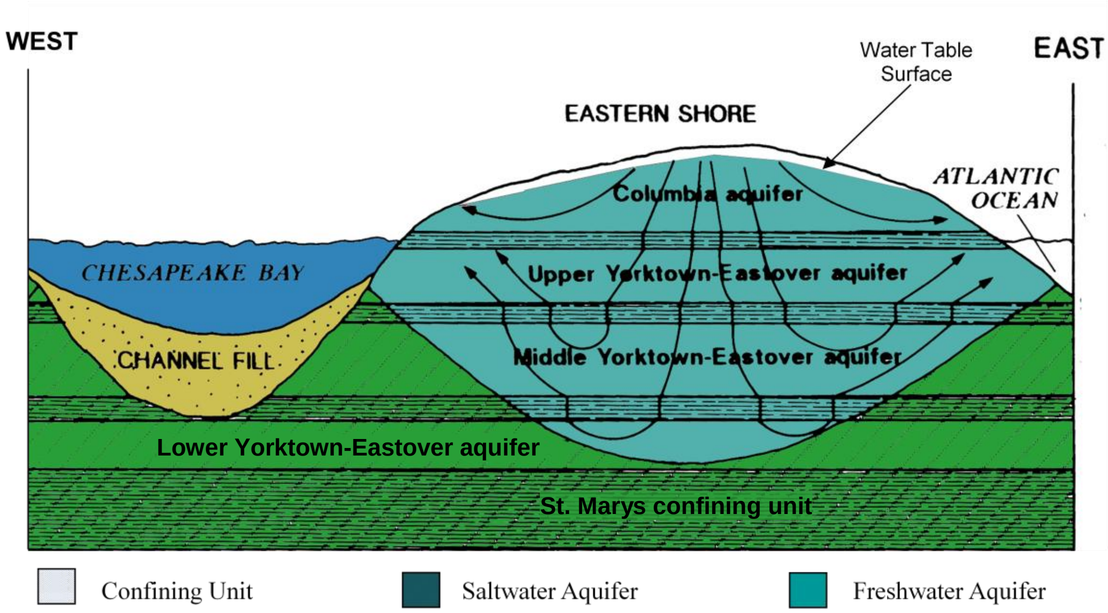
4.1.1. Geologic/Hydrogeologic Setting

There have been a substantial number of local and regional studies on the geologic and hydrologic characteristics of the sediments on the Eastern Shore of Virginia and adjacent areas of Maryland. Many of these studies have dealt principally with geologic descriptions of the formational units. The geology of the Eastern Shore consists of unconsolidated deposits of interbedded clay, silt, sand, and gravel, with variable amounts of shell material. These deposits thicken and slope eastward, and form a system of layered aquifers and confining units. The total sediment thickness ranges from approximately 2,000 feet in the western areas to as much as 7,000 feet to the east[1]. These sediments generally overlie a bedrock basement that also dips northeastward.

The aquifers are comprised of sand, gravel, and shell material, and confining units are comprised of clay and silt and are divided into the unconfined Columbia aquifer (water table aquifer), and a series of confined aquifers and intervening semi-confining units (Figure 4-1). The low permeability confining units restrict downward ground water movement. The confined aquifers, in order of increasing depth, are: Yorktown-Eastover (includes upper, middle, and lower Yorktown aquifers), St. Marys Choptank aquifer, Brighteast aquifer, and upper, middle, and lower Potomac aquifers. Fresh ground water generally occurs only in the upper 300 feet of sediments and at shallower depths along the coastlines of the Eastern Shore and is limited to the Columbia and Yorktown aquifers. These aquifers have been designated by the EPA as the sole source aquifers for the Eastern Shore, excluding Tangier and Chincoteague Islands. The water supply of

Tangier Island consists of groundwater wells screened in the Potomac aquifer since the interface between freshwater from the mainland and saltwater occurs to the east of Tangier Island but west of the Eastern Shore.

Figure 4-1: Conceptual Groundwater Flow System of the Virginia Eastern Shore



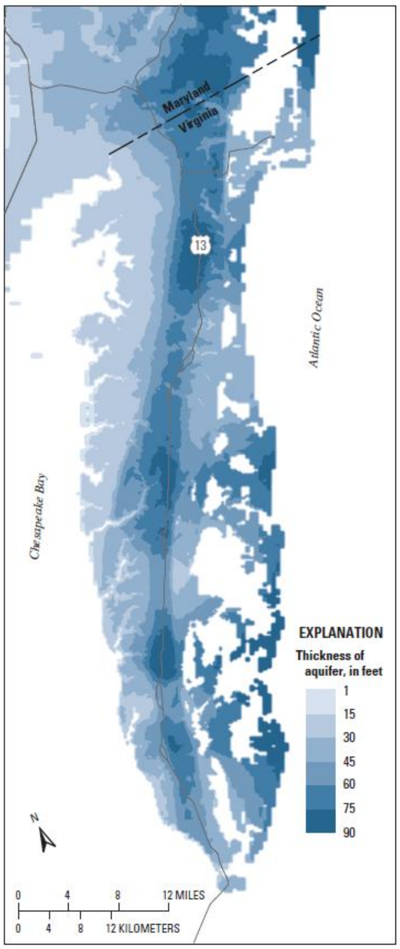
Source: Richardson, 1992[2].

The Columbia and Yorktown aquifers consist of a sequence of sandy units separated by fine-grained facies, which are predominately fine sandy silts and clayey fine sands. The confining units separating the aquifers are leaky, and there is significant ground water flow through these layers. Flow through the confining units is the sole source of recharge for the Yorktown aquifer in the Eastern Shore of Virginia. Within the individual aquifers there commonly exist discontinuous silty and clayey layers that locally serve to restrict vertical flow.

4.1.1.1. Columbia Aquifer

The Columbia aquifer is the uppermost aquifer and is unconfined over most of the area. Sediments comprising this aquifer unconformably overlie the Yorktown aquifers, and are in turn, unconformably overlain by Holocene sediments. Aquifer properties are primarily dependent on lithology and thickness of the water producing sands, gravels and shell materials. Thickness of the Columbia aquifer and depth to water vary with topography.

Figure 4-2: Thickness of the (surficial) Columbia Aquifer



Source: Sanford, et al, 2009[1]

Beneath most of the Eastern Shore of Virginia, thickness of the Columbia aquifer generally ranges from 20 feet near the coast to 60 feet inland (Figure 4-2). Thickness near the central corridor of the Eastern Shore can exceed 100 feet in some areas, and depth to ground water is typically within 10 feet of the surface. To the northwest, the Columbia aquifer generally does not exceed 20 feet in thickness, and to the south and east, the aquifer thickness typically ranges from 40 to 140 feet.

The principal water-bearing unit for the Columbia aquifer on the Eastern Shore of Virginia is generally comprised of Beaverdam Sand. The thickness of the Beaverdam Sand typically ranges between 15 and 30 feet on the Eastern Shore, and in some local areas is has been eroded and replaced by younger channel deposits.

Overlying the Beaverdam Sands are generally discontinuous sand and silt units interbedded with silty and clayey units that serve as local sources of ground water. These sediments include the Walston Silt, the Omar Formation, the Ironshire Formation, the Parsonburg Sand, and the Sinepuxent Formation.

Transmissivities reported for the Columbia aquifer range from 100 to 50,000 ft^2/day. On the Eastern Shore of Virginia, transmissivities are somewhat lower, typically ranging between 1,000 and 4,000 ft^2/day. The general increase in transmissivity to the north appears to be a function of both increasing thickness and increasing hydraulic conductivity.

Water levels in the Columbia aquifer on the Eastern Shore are generally subparallel to surface topography. The highest elevations on the Eastern Shore are along the central ridge, with maximum elevations of +30 to +45 feet (ft) above mean sea level (msl) in the central portion of the peninsula decreasing toward the coastline to approximately +10 ft msl near the tidal marshes. Overall, it appears that depth to ground water is between 10 and 20 ft below ground surface (bgs) for the upland areas and 5 to 10 ft bgs beneath the lower terrace deposits. Ground water from the Columbia aquifer is not used for any single large withdrawals on the Eastern Shore, therefore there are not any mappable cones of depression in this aquifer. However, the Columbia aquifer is extensively used as a supply source for self-supplied domestic and smaller non-domestic water demands.

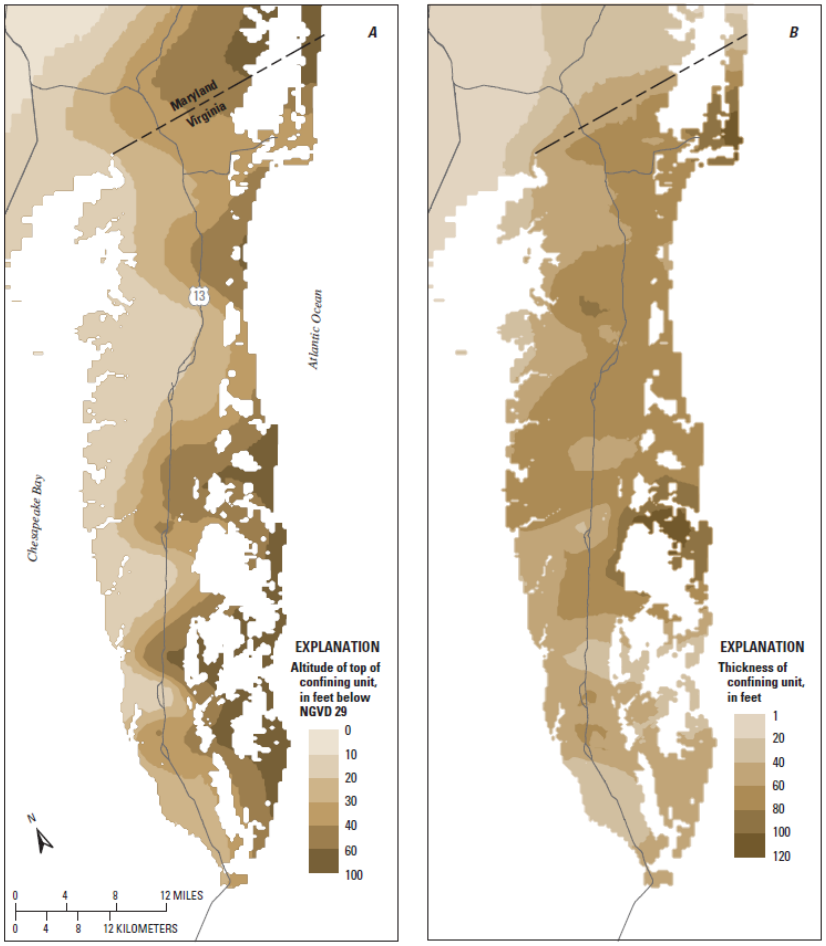
The Columbia aquifer on the Eastern Shore subcrops into the Chesapeake Bay to the west and Atlantic Ocean to the east. Where it subcrops, freshwater discharges directly from the aquifer into the estuarine and ocean water, respectively.

4.1.1.2. Upper Yorktown Confining Unit

The upper Yorktown confining unit consists predominately of marine fine sandy silt with some clay and averages 15 to 30 ft thick (Figure 4-3). Maximum thickness of this confining unit exceeds 100 ft beneath Assateague Island and Chincoteague Islands. These sediments are for the most part reworked sediments from the upper Yorktown Formation and may locally contain fluvial silts and clays. The upper Yorktown confining unit typically consists of a sequence of lenticular interbedded silts, clays, and fine sands and is not massive. In some locations, sandy channel deposit shave breached the confining unit and cut into the underlying upper Yorktown aquifer. There are two such paleochannels on the Eastern Shore of Virginia located near Exmore and Eastville. While this unit is aerially extensive, and only locally absent, it serves to restrict vertical movement of ground water and not effectively preclude it, as evidenced by the fact that the principal source of freshwater recharge and discharge for the Yorktown aquifers on the Eastern Shore is through the confining units. Recharge is discussed in Section 4.1.3 below.

The top of the upper Yorktown confining unit in the Eastern Shore is approximately -10 ft msl along the western margin (Chesapeake Bay) to -60 ft msl along the eastern margin (ocean side). Dip of this unit is 2 to 3 feet per mile and strikes northeast, parallel with the orientation of the peninsula.

Figure 4-3: Top elevation (a) and thickness (b) of the Upper Yorktown Confining Unit



Source: Sandford, et al, 2009[1].

4.1.1.3. Upper Yorktown Aquifer

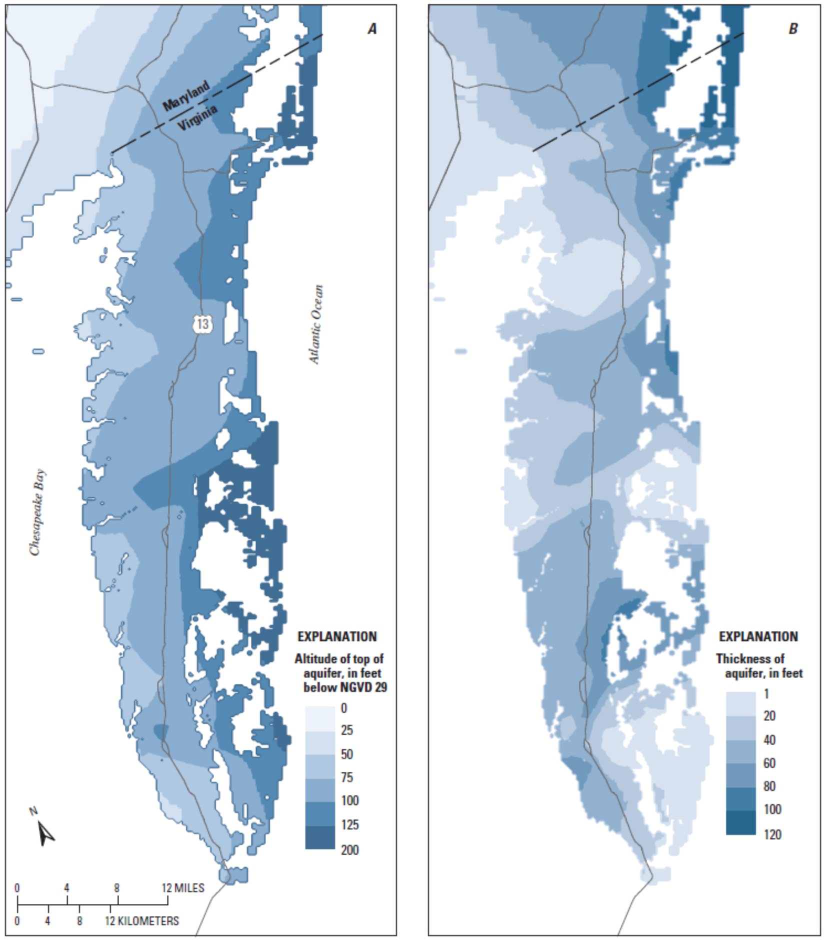
The upper Yorktown aquifer is the uppermost unit of the Yorktown-Eastover aquifer system, and is generally defined as the first significant sand unit occurring below the unconformity separating the basal Columbia Group sediments from the Chesapeake Group sediments. Sediments deposited in channel fills which incised into the Yorktown Formation have also been identified as the upper Yorktown aquifer, even though it is not clear if there is a good hydraulic connection between the channel fill sediments and the Yorktown Formation sediments. These channel fill deposits have been identified in the Eastern Shore near Exmore and Eastville. Over most of its extent, the Upper Yorktown aquifer consists of gray fine to medium sand with shell fragments commonly present. Locally, discontinuous coarse sand and gravel layers and thin lenses of blue clayey silt are often present.

Surficial recharge to the upper Yorktown aquifer occurs along a northeast striking belt, called the "recharge spine", approximately 1.5 to 4 miles wide. This recharge area is present along the length of the Eastern Shore and provides freshwater recharge through the overlying confining unit (Figure 4-4).

Figure 4-4: Recharge Spine of Accomack County

Source: Accomack County Comprehensive Plan, 2008.

Figure 4-5: Top elevation (a) and thickness (b) of the Upper Yorktown Aquifer



Source: Sanford, et al, 2009[1]

The top of the aquifer in the Eastern Shore is approximately -75 feet msl along the western edge to -125 ft msl to the east (Figure 4-5). Dip of the upper Yorktown aquifer is approximately 3 feet per mile and strike is northeast, parallel to the peninsula. The upper Yorktown aquifer is typically thinner to the west, where more of the sediments were eroded, and thickens to the east. On the Eastern Shore, the thickness of the upper Yorktown ranges between 15 feet in southwest Northampton County to greater than 100 feet near Assateague Island and is typically between 30 and 60 feet thick (Figure 4-5).

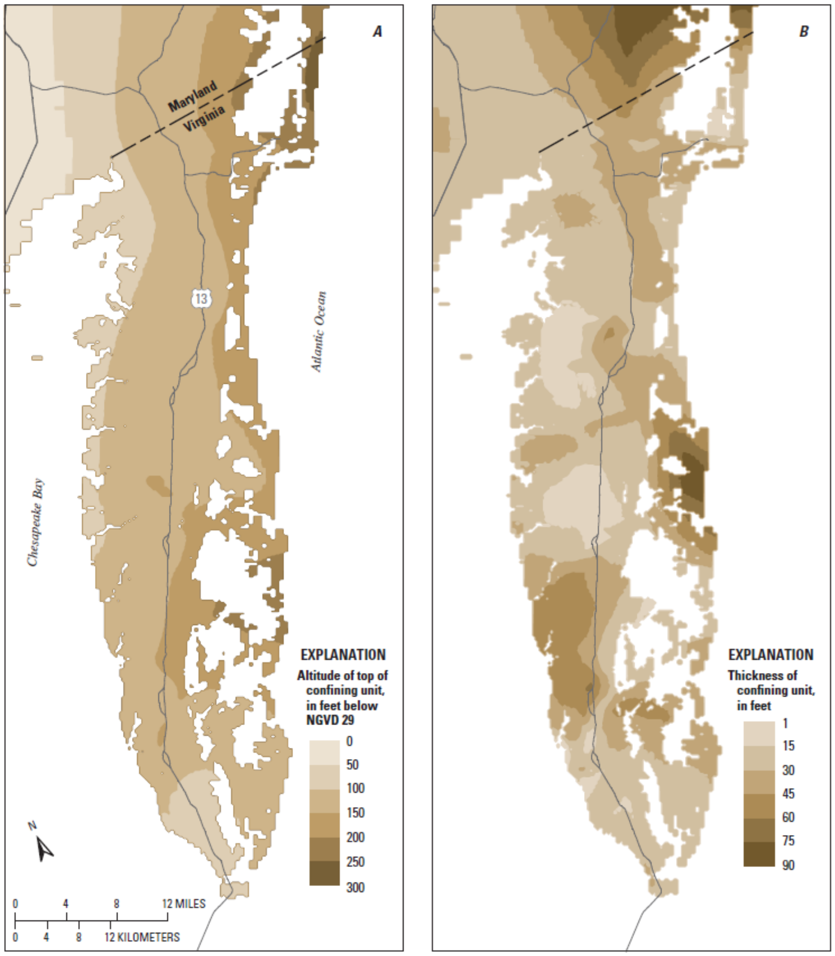
Transmissivity for the upper Yorktown aquifer is generally lower than the Columbia aquifer, and has a lower variability. Transmissivity for this aquifer typically ranges between 1,000 to 5,000 ft^2/day.

Ground water levels on the Eastern Shore follows the same general pattern as the overlying Columbia aquifer, since recharge to this aquifer is from the Columbia. Because the confining unit separating the two aquifers is consistently present over most of the area, there is significant head loss between the two aquifers. A maximum ground water level of +25 ft msl occurs in south central Accomack County, decreasing radially from this point. In Northampton County, ground water level is between +5 and +10 ft , and in central Accomack County, ground water level is +15 to +20 feet MSL, decreasing to +8 to +12 ft msl near the state boundary with Maryland. At the eastern and western coastline, ground water level decreases to approximately +5 ft msl. A short distance offshore, vertical ground water flow direction is expected to reverse, with fresh ground water flow from the upper Yorktown aquifer into the overlying Columbia aquifer. There are several prominent cones of depression resulting from significant ground water withdrawals centered around Temperanceville (Tyson Food), Accomack (Perdue), Exmore, and Cape Charles.

4.1.1.4. Middle Yorktown Confining Unit

The middle Yorktown confining unit is not as continuous or impermeable as the upper Yorktown confining unit, and has been described as allowing substantial leakage between the upper and middle Yorktown aquifers. In some areas this confining unit is absent, and over most of the Eastern Shore, it consists of a zone of interbedded silts and clays with numerous fine sand layers. Thickness of the middle Yorktown confining unit ranges between 15 and 100 ft, and tends to be thinner to the west and south (Figure 4-6).

Figure 4-6: Top elevation (a) and thickness (b) of the Middle Yorktown Confining Unit



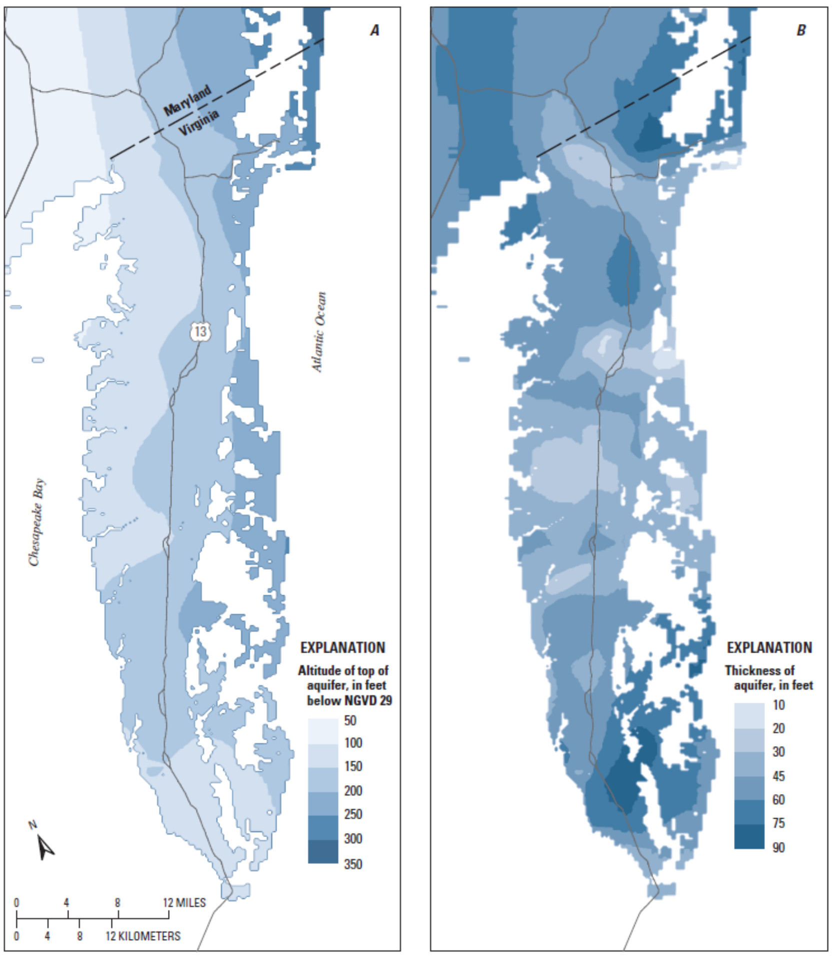
Source: Sanford, et al, 2009[1]

4.1.1.5. Middle Yorktown Aquifer

The middle Yorktown aquifer is an aerially extensive hydrologic unit of the Yorktown-Eastover aquifer system. The middle Yorktown aquifer, over most of its extent in the Eastern Shore is a gray fine sand to silty fine sand with shell fragments prevalent. In some areas, such as near the southern tip of the Eastern Shore, the middle Yorktown aquifer is coarser, consisting of gray medium to fine sand. This unit fines toward central Northampton County to a silty fine sand. Thickness of the middle Yorktown aquifer typically ranges between 30 ft and 60 ft, although locally is can be absent or up to 100 feet thick. The top of the aquifer in the Eastern Shore is between -125 ft msl to -150 ft msl along the western coast increasing to -225 to -250 ft msl to the east (Figure 4-7). The dip of the middle Yorktown is approximately 6 feet per mile, or roughly twice the dip as the overlying Upper Yorktown aquifer beds. As with the other units, strike is northeast, parallel with the peninsula. Transmissivities for the middle Yorktown in the Eastern Shore range between 1,000 and 3,000 ft^2/day.

Ground water levels for the middle Yorktown aquifer on the Eastern Shore are only slightly lower in the central portion than the upper Yorktown, with a maximum ground water elevation between +20 and +25 ft msl near Accomac. At the coast and a short distance offshore, the ground water level in the middle Yorktown is expected to be slightly higher than the upper Yorktown, with the vertical ground water flow reversed to an upward direction. In Northampton County, ground water level typically ranges between +10 and +5 ft msl.

Figure 4-7: Top elevation (a) and thickness (b) of the Middle Yorktown Aquifer

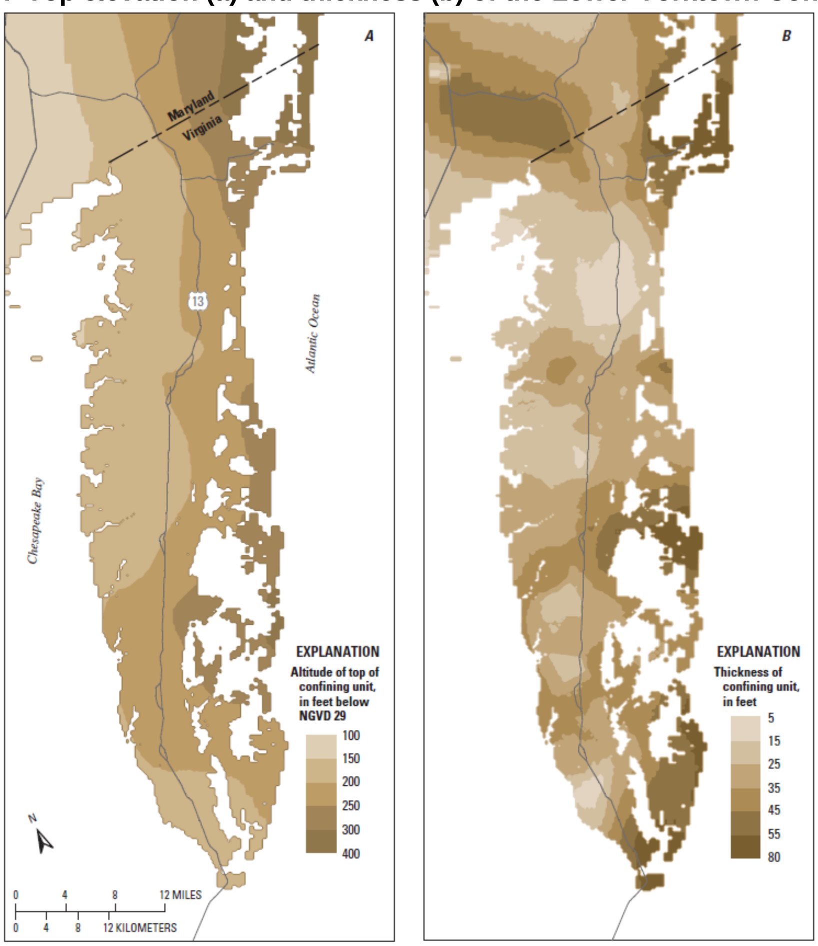


Source: Sanford, et al, 2009[1]

4.1.1.6. Lower Yorktown Confining Unit

The lower Yorktown confining unit has been described only in the Eastern Shore and has not been identified to the north in Maryland. A confining layer separating the "Manokin aquifer" into two layers in the vicinity of Assateague Island has been described by some Maryland researchers. This confining layer is the lower Yorktown confining unit. Because it has not been identified further north in Maryland, is assumed to pinch out completely between Chincoteague and Snow Hill. The confining unit is thickest in central and northern Accomack County, thinning to the south and pinching out to the north in Maryland (Figure 4-8). Over the Eastern Shore area, the sediments comprising lower Yorktown confining unit tend to be finer grained than sediments from the middle Yorktown confining unit. As such, the lower Yorktown confining unit appears to restrict vertical flow more than the middle Yorktown confining unit.

Figure 4-8: Top elevation (a) and thickness (b) of the Lower Yorktown Confining Unit

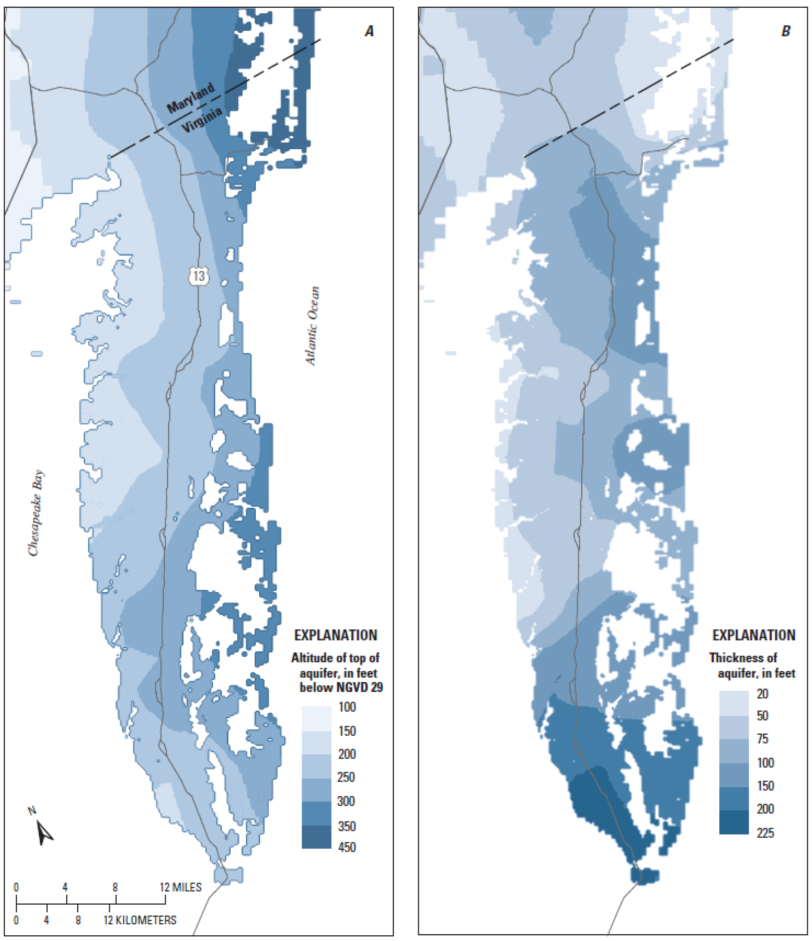


Source: Sanford, et al, 2009[1]

4.1.1.7. Lower Yorktown Aquifer

The lower Yorktown aquifer in the Eastern Shore typically consists of a fining upward sequence of gray fine sand to silty fine sand with shell fragments. In the Eastern Shore, the lower Yorktown aquifer is usually slightly thicker than the overlying middle Yorktown aquifer, and is generally between 60 and 80 feet thick throughout the area. The top of the lower Yorktown ranges between -175 and -225 ft msl along the western coast to -300 to -350 ft msl along the eastern coast. The dip of the lower Yorktown aquifer is approximately 8 feet per mile, continuing the progressive increase in bed dip with depth exhibited by the overlying units.

Figure 4-9: Top elevation (a) and thickness (b) of the Lower Yorktown Aquifer



Source: Sanford, et al, 2009[1]

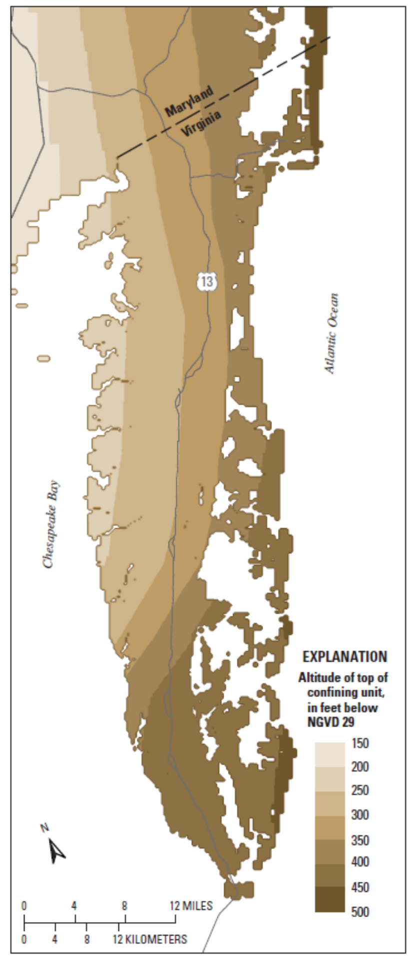
Transmissivity for this aquifer in the Eastern Shore is roughly the same or slightly lower than the middle Yorktown, averaging around 1,200 ft^2/day in areas where the sediments are productive. There are only a few pumping tests conducted in the lower Yorktown of the Eastern Shore and the lower and middle Yorktown aquifer are not differentiated in Maryland. Therefore, there is not a great deal of information on areal variability in transmissivity of the Lower Yorktown.

4.1.1.8. St. Marys Confining Unit

The St. Marys confining unit is defined by the top of the St. Marys Formation and is the most correlative stratigraphic horizon for the sediments in the Eastern Shore and Maryland. The St. Marys confining unit consists of offshore marine very fine sandy silts and clays with abundant shells. This unit comprises sediments from the St. Marys Formation, and separates the lower Yorktown aquifer from the underlying Choptank aquifer. Thickness of the St. Marys confining unit is greater than 100 feet across the entire area, and in most locations exceeds 150 feet. Owing largely to the thickness of this unit, the St. Marys forms an effective confining layer restricting flow between the two aquifers.

In the vicinity of the Virginia Eastern Shore, with the exclusion of Tangier Island, water bearing aquifers below the St. Mary's confining unit are considered too brackish or saline for use as a source of water supply.

Figure 4-10: Tope elevation of the St Marys Confining Unit



Source: Sanford, et al, 2009[1]

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There are two major concerns regarding groundwater in Accomack County, quantity and quality. Groundwater quantity is limited by the nature of the aquifers and must be carefully managed to prevent overuse that can result in saltwater intrusion. Groundwater quality depends on proper management of land use activities that can contaminate aquifers. In recognition of the limited groundwater supply and the potential for contamination, the U.S. Environmental Protection Agency designated the Eastern Shore of Virginia a Sole Source Aquifer in 1997. The designation provides protection to the Shore's water supply by requiring the EPA to review proposed projects on the Shore that are receiving federal financial assistance to ensure they do not endanger the water supply. The EPA Sole Source Aquifer designation excludes Tangier Island and Chincoteague Island.

4.1.2. Hydrologic Setting

Surface features characteristic of the Coastal Plain of the Eastern Shore include terraces, stream channels, drowned valleys, Carolina bays, swamps and marshes, remnant dunes, and bar-like features formed during the Pleistocene time. The central portion of the Eastern Shore peninsula forms a broad, low ridge which trends northeast-southwest and stands at an elevation ranging from about +25 to +50 ft msl. This central highland area is the principal fresh ground water recharge area for the peninsula and is referred to as the "recharge spine" of the Eastern Shore (Figure 4-4). The terrace has maintained the same strand line for almost the entire length of the Atlantic Coastal Plain and is divided into a lower and upper terrace which directs the drainage of the Eastern Shore[3].

The lower terrace, generally located west of Route 13, consists of broad flats broken by large meandering tidal creeks and bordered by tidal marshes[4]. The upper terrace ranges in elevation from +25 to +45 ft msl. The topography of the upper terrace, more complex than the lower terrace, is characterized by shallow sand-rimmed depressions known as Carolina bays. The bays, predominantly oval in shape, exert an important influence on the infiltration, retardation of runoff, and movement of ground water. Between the mainland and the barrier islands are extensive tidal marshes flooded regularly by saltwater and drained by an extensive system of creeks[4]. These systems accept ground water discharge.

The Eastern Shore is drained by a total thirty small creeks flowing bayward or seaward from the drainage divide which passes the length of the peninsula. The lower reaches of the creeks form tidal estuaries fed by narrow, meandering branches. Because of the low topography and low inflow of freshwater, the creeks are brackish to saline everywhere except for the upper reaches. The estuaries are more pronounced on the Chesapeake Bay side and receive more of the surface and ground water drainage than the smaller creeks on the ocean side[5].

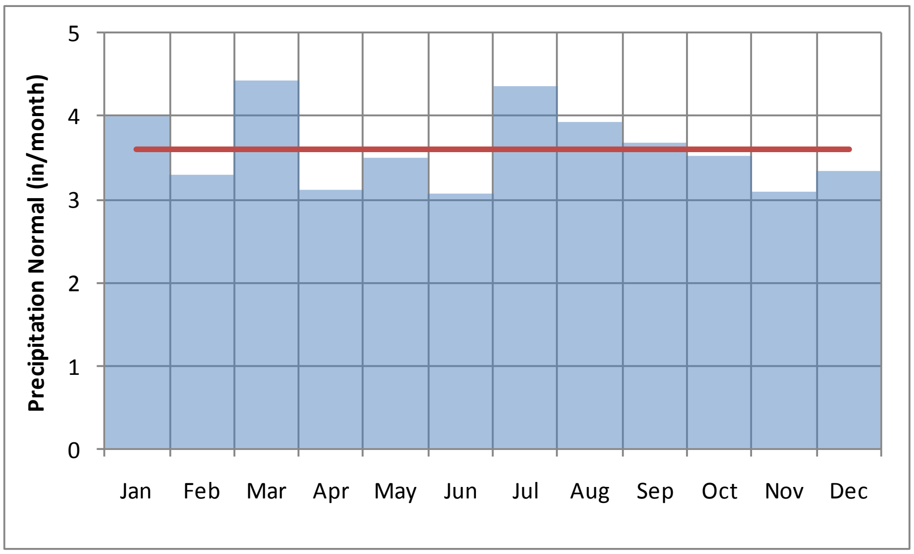
Numerous drainage basins exist on the shore ranging in size from approximately four to six square miles. These basins consist of several small creeks and interconnected ditches. Primary drainage basins of the Eastern Shore of Virginia are Gargathy Creek, Folloy Creek, Finney Creek, Occohannock Creek, and Pungoteague Creek basins in Accomack County; and Mattawoman Creek and Nassawadox Creek basins in Northampton County[6].

The Pocomoke River basin borders Worcester County, Maryland and Accomack County, Virginia and serves as a major drainage divide for this area.

4.1.3. Meteorologic Setting

The average annual precipitation on the Eastern Shore is approximately 44 inches. The precipitation normals vary seasonally between 3.0 and 4.5 inches; with the highest months being March and July and the lowest being June and November (). Aquifers of the Eastern Shore are recharged by precipitation; however the majority of the precipitation is lost to runoff and evapotranspiration.

Figure 4-11: Precipitation Normals for the Eastern Shore of Virginia



Source: NOAA, 2002[7].

Ground water recharge can be divided into a number of components. Total ground water recharge is the amount of precipitation which is not lost as runoff or evaporation (and evapotranspiration in the unsaturated zone). Of the total ground water recharge to the saturated zone, the principal losses are through evapotranspiration or discharge to surface waters. Loss through evapotranspiration and surface water discharge is most significant in the low lying areas where the water table aquifer is near the surface. The remaining recharge water goes into storage (in the water table aquifer) or recharges the underlying confined aquifers.

There have been a number of ground water recharge values previously estimated for the Eastern Shore. Holme[3] conducted a detailed two year study of ground water recharge from monthly ground water budgets in the Beaverdam Creek basin in Maryland, near the border with Accomack. From his work a recharge value of 12 inches/year was determined, after subtracting ground water loss through evapotranspiration. The 12 inches/year estimate includes recharge which is later lost through discharge to surface waters. Harsh and Laczniak conducted a study of the regional aquifer system of the Northern Atlantic coastal Plain[8]. In this study they estimated that ground water recharge to the water table aquifer is approximately 15 inches/year. A digital-flow-model study in the Coastal Plain of central and southern Delaware[9] used 14 inches/year as an estimate of ground water recharge for the area. More recent studies on the Eastern Shore have estimated that recharge to the unconfined aquifer ranges between 8.5 and 15 inches/year[2] and 12 and 26 inches/year[10].

Fresh groundwater recharge to the underlying confined Yorktown aquifer is generally restricted to the central "spine recharge" area of the peninsula (Figure 4-4). Some of the water that recharges near the center of the peninsula flows vertically through the water table aquifer and underlying confining units to recharge the confined aquifers. This downward flow component decreases with distance from the central recharge area. Ground water flow in the confined aquifers is also primarily horizontal, with some downward flow in the central peninsula and upward flow in coastal discharge areas.

4.2. Existing Environmental Conditions

4.2.1. Threatened and Endangered Species

Accomack County supports populations of a wide variety of flora, and fauna, some of which are of significant economic, recreational, or cultural importance to the county, and several of which are listed as rare, threatened or endangered.

The Virginia Department of Conservation and Recreation (DCR), with authority from the Code of Virginia, established a program to protect habitats of rare, threatened, and endangered plant and animal species; exemplary natural communities, habitats, and ecosystems; and others natural features of the Commonwealth. Resources protected under this program are called "Natural Heritage Resources" under this program. DCR maintains a list of Natural Heritage Resource species believed to be sufficiently uncommon to merit an inventory of their status for each county in the Commonwealth. In all DCR has listed thirty-eight plant species and twenty-six animal species as Natural Heritage Resources in Accomack County (**Table 4-1**).

Ranking systems have been developed to designate a species' rarity based on its range-wide status. A species' global rank is based on its level of occurrence world-wide, whereas its state rank is based on its occurrence within the boundaries of the state of Virginia. Species which are fairly common in other parts of the country but seldom found in Virginia will have different global and state ranks.

The U.S. Fish and Wildlife Service and the National Marine Fisheries Service identify species which receive protection under the Federal Endangered Species Act. Federal status lists a species as endangered, threatened, or as proposed or candidates for listing.

The Endangered Species Act (ESA) of 1973 (7 USC 136; 16 USC 1535 et seq.) was designed to conserve and protect imperiled plant and animal species and the ecosystems on which they depend from extinction. Programs under the ESA are administered individually and jointly by the US Fish and Wildlife Service and by the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service. The law prohibits the "taking" of a listed species or adversely impacting relevant habitat through real or administrative actions. In accordance with the ESA, any future water supply project would be required to consider and avoid potential impacts to listed species within the proposed project footprint as part of federal permitting processes. A permit is usually required by the U.S. Army Corps of Engineers for construction projects, including surface water intakes disturbing "waters of the United States" which includes most rivers and streams. Virginia law also affords protection to state listed species and may affect the permitting process for developing new water supplies. A Virginia Water Protection Permit (WPP) from DEQ is required for both ground and surface water withdrawals. In evaluating the permit application, DEQ may consult with other state agencies responsible for the protection of listed species. Relevant Virginia agencies include the Department of Game and Inland Fisheries (DGIF), the Department of Agriculture and Consumer Services (DACS), and DCR's Division of Natural Heritage (DNH). Protected animal species in Virginia are the responsibility of DGIF, while plant and insect species are the responsibility of DACS. Both agencies work jointly with DNH to maintain an inventory of listed species and their known occurrences in Virginia.

The documented occurrence of a rare, threatened or endangered species within the footprint of a proposed project may necessitate a redesign, mitigation actions, or project limitations, but does not typically prevent approval. Common direct impacts to projects with the potential for impacts to occurring rare, threatened, or endangered species and their habitats include limitations on water withdrawals (often on a seasonal basis) and to require project design, construction, and timing considerations which limit habitat disruption and organism capture, particularly in the case of surface water intakes.

As all of the potable water withdrawals in the County are derived directly from groundwater sources, impacts to rare, threatened and endangered species are usually avoided or relatively simple to mitigate. Water supplies relying on withdrawals from groundwater wells can be designed with small project footprints, limiting habitat disruption, and tend to have a much smaller direct impact on the hydrology of habitats, particularly in the case of wells that are deeply screened.

Proposals for new or expanded water withdrawals and for associated infrastructure should include considerations of the potential to encounter or impact rare, threatened or endangered species. Such development should incorporate consultations with relevant federal and state agencies to determine whether the potential for impacts to listed species is present. Written requests can be made to DGIF and DNH to search for known occurrences of listed species in the vicinity of the project and to determine the likelihood of impacts to the listed species based on the proposed project location and description.

Table 4-1:
Threatened and Endangered Species in Accomack County

Common Name	Global	Rank State Rank	Federal Status	State Status
PLANTS				
Seabeach Amaranth	G2	S1	LT	LT
Sea-beach Knotweed	G3	S1S2		
Blue maiden-cane	G4	S1		
Prairie False-indigo	G4	S1		
Southern Beach Spurge	G4G5	S2		
Horse-tail Spikerush	G4	S1		
Salt-marsh Spikerush	G4	S1		
Low Frostweed	G4	S1		
Big-head Rush	G4G5	S2		
Golden Puccoon	G4G5	S1		
Elongated Lobelia	G4G5	S1		
Salt Marsh Goosegrass	G3G5	S1		
Awned Mountain-mint	G4	S1		
Few-flowered Beakrush	G4	S1		
Long-beaked Baldrush	G4	S1		
One-flower Sclerolepis	G4	S1		
Large Cranberry	G4	S2		
Puerto Rico Peatmoss	G5	S1S2		
Sea-beach Sedge	G5	S1		
Hazel Dodder	G5	S2?		
Smartweed Dodder	G5	S2?		
Umbrella Flatsedge	G5	S1		
White-top Fleabane	G5	S2		
White Buttons	G5	S1		
Ten-angle Pipewort	G5	S2		
Seaside Heliotrope	G5	S1		
Northern St. John's-wort	G5	S2		
Brown-fruited Rush	G5	S1		
Sheep-laurel	G5	S2		

Common Name	Global	Rank State Rank	Federal Status	State Status
Big Floating-heart	G5	S1		
Joint Paspalum	G5	S2		
White Beakrush	G5	S2		
Slender Marsh Pink	G5	S2		
Whorled Nutrush	G5	S2		
Fraser's Marsh St. John's-wort	G5	S1		
Southern Bladderwort	G5	S2		
Colombia Water-meal	G5	S1		
Virginia Least Trillium	G3T2	S2	SOC	

Common Name	Global	Rank State Rank	Federal Status	State Status
ANIMALS				
Piping Plover	G3	S2B,S1N	LT	LT
Spectral Tiger Beetle	G3G4	S1		
Loggerhead (Sea Turtle)	G3	S1B,S1N	LT	LT
Saltmarsh Sharp-tailed Sparrow	G4	S2B,S3N	SC	
Peregrine Falcon	G4	S1B,	S2N	LT
Black Rail	G4	S2B,S2N		
Brown Pelican	G4	S1B,S3N	SC	
Least Tern	G4	S2B	SC	
Great Egret	G5	S2B,S3N	SC	
Wilson's Plover	G5	S1B	LE	
Northern Harrier	G5	S1S2B,S3S4N	SC	
Little Blue Heron	G5	S2B,S3N	SC	
Snowy Egret	G5	S2B,S3N		
Tricolored Heron	G5	S2B,S3N	SC	
Bald Eagle	G5	S2S3B,S3N	LT,PDL	LT
Black-necked Stilt	G5	S1B		
Glossy Ibis	G5	S2B,S1N	SC	
Sora	G5	S1B,S2N		
Virginia Rail	G5	S2B,S3N		
Black Skimmer	G5	S2B,S1N		
Caspian Tern	G5	S1B,S2N	SC	
Gull-billed Tern	G5	S2B	LT	
Bronze Copper	G5	S1		
Delta-spotted Spiketail	G5	S1		
Northeastern Beach tiger Beetle	G4T2	S2	LT	LT
Delmarva Fox Squirel	G5T3	S1	LE	LE

Global Ranking System	
RANK	**DESCRIPTION**
G1	Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction
G2	Very rare and imperiled with 6 to 20 occurrences or few remaining individuals; or because of some factor(s) making it vulnerable to extinction
G3	Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors
G4	Common and apparently secure globally, though it may be rare in parts of its range, especially at the periphery
G5	Very common and demonstrably secure globally, though it may be rare in parts of its range, especially at the periphery
GH	Formerly part of the world's biota with expectation that it may be rediscovered
GX	Believed extinct throughout its range with virtually no likelihood of rediscovery
G?	Unranked, or, if following a ranking, rank uncertain (ex. - G3?)
G_Q	The taxon has a questionable taxonomic assignment, such as G3Q
G_T	Signifies the rank of subspecies or variety. For example, a G5T1 would apply to a subspecies of a species that is demonstrably secure globally (G5) but the subspecies warrants a rank of T1, critically imperiled
State Ranking System	
RANK	**DESCRIPTION**
S1	Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals in Virginia; or because of some factor(s) making it especially vulnerable to extirpation in Virginia
S2	Very rare and imperiled with 6 to 20 occurrences or few remaining individuals in Virginia; or because of some factor(s) making it vulnerable to extirpation in Virginia
S3	Rate to uncommon in Virginia with between 20 and 100 occurrences; may have fewer occurrences if found to be common or abundant at some of these locations; may be somewhat vulnerable to extirpation in Virginia
S4	Common and apparently secure with more than 100 occurrences; may have fewer occurrences with numerous large populations
S5	Very common and demonstrably secure in Virginia
SH	Formerly part of Virginia biota with expectation that it may be rediscovered
SX	Believed extirpated from Virginia with virtually no likelihood of rediscovery
SE	Exotic; not believed to be a native component of Virginia's flora
SU	Possibly rare, but status uncertain and more data needed
S_?	Rank uncertain; for example, an S2? denotes a species with rarity that may range from S1 to S3, an SE? means a species may or may not be native to Virginia

Source: Accomack County, 2008.

4.2.2. Anadromous, Trout, and other Significant Fisheries

The Magnuson-Stevens Act, passed by Congress in 1996, promotes direct action to prevent or reverse habitat loss of marine fishery resources. Measures of the Magnuson-Stevens Act are overseen by NOAA's National Marine Fisheries service which coordinates with Regional Fishery Management Councils, resource users, federal and state agencies, to protect, conserve and enhance "essential fish habitat".

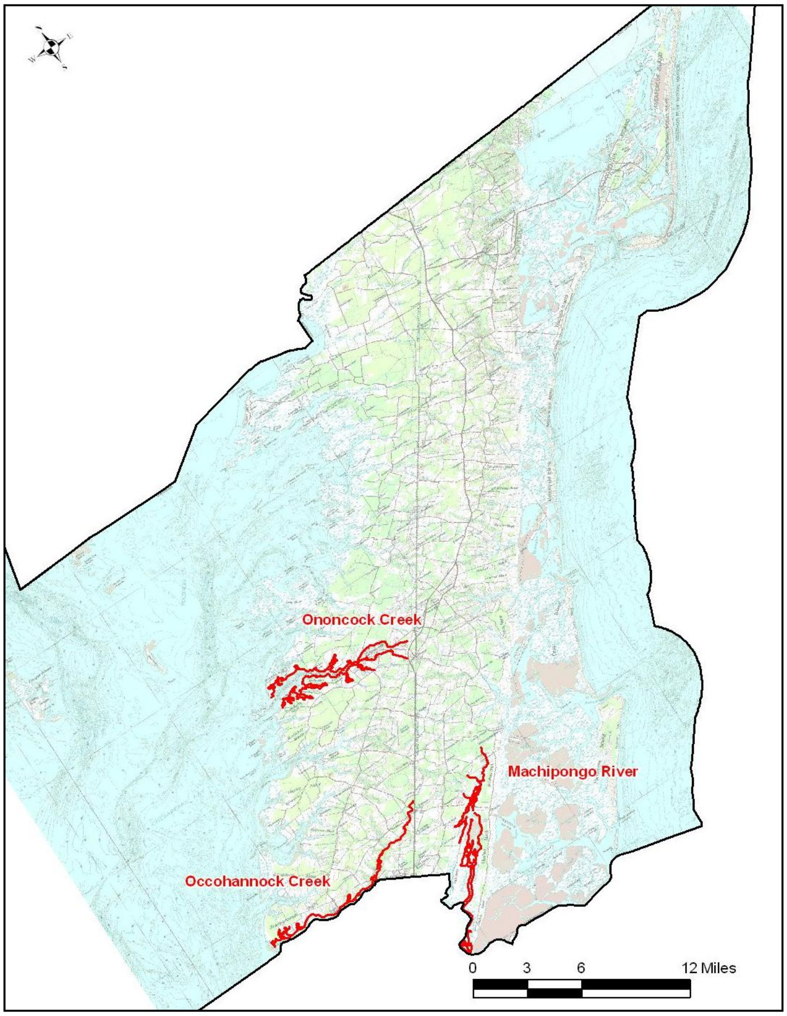
Given that streams and rivers in Accomack County are almost exclusively tidally influenced, freshwater withdrawals, particularly groundwater withdrawals have little impact on anadromous fish and trout. Hard clam aquaculture, which is a significant and growing part of the economy of the Eastern Shore ($24 million in 2004), also occurs in a saltwater environment, and is also therefore minimally impacted by the largely subsurface freshwater withdrawals in the County.

4.2.3. Recreational Significance and State Scenic River Status

The Virginia Scenic Rivers Act, passed in 1970, authorized the designation of scenic rivers. The Scenic Rivers Program was established with the purpose of identifying, designating and protecting streams and rivers of outstanding scenic, recreational, historic, and natural character with a focus in enhancing conservation and wise use of such streams and rivers and adjacent lands. In evaluating permit applications for proposed construction projects within the corridor of a designated stream or river, State agencies must consider the project's potential impacts to the stream and the characteristics leading to its designation. Considerations relevant to scenic rivers may affect project design, siting, and/or withdrawal amounts.

There are currently no recognized State Scenic Rivers in Accomack County; however, Occohannock Creek, Onancock Creek, and Machipongo River have been designated as potential candidates worthy of future study (**Figure 4-12**). Furthermore, as all of the potable water withdrawals in the County are derived directly from groundwater sources, impacts to scenic rivers are usually avoided or relatively simple to mitigate.

Figure 4-12: Candidates for State Scenic River Designation



4.2.4. Sites of Historical or Archeological Significance

The Virginia Landmarks Register (VLR) and the Natural Register of Historic Places (NRHP) are programs of State and National scope, respectively, that seek to identify and preserve important cultural, architectural, and archeological sites. The NRHP has been managed by the National Park Service since 1966 and is the official list of historic resources including structures, sites, objects, and districts that represent the cultural and historical foundations of the nation. The VLR is managed by the Virginia Department of Historic Resources (DHR), is the state's official list of properties important to the history of Virginia. The same criteria are used to evaluate resources for inclusion in both the NRHP and the VLR.

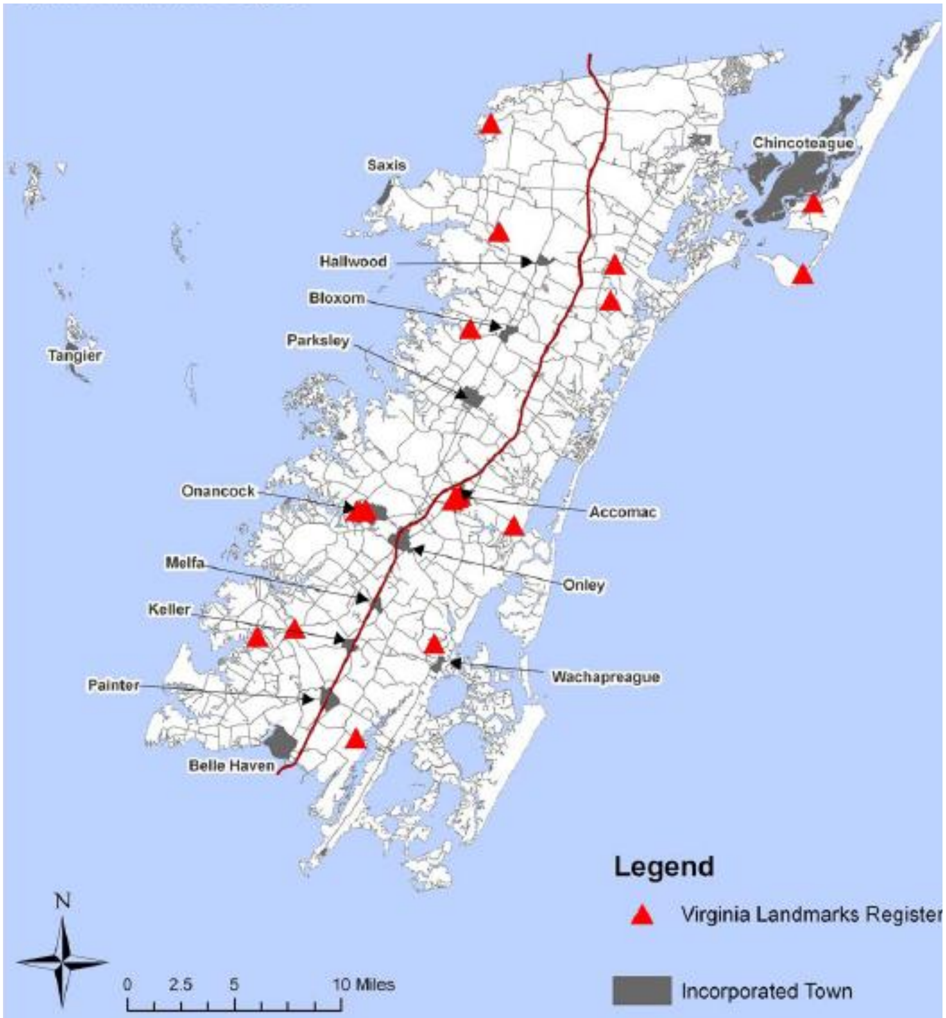
Inclusion in one or both of the Registers encourages the preservation and proper stewardship of the listed property and recognizes its historic value. Numerous incentives exist to encourage stewardship including tax incentives, technical assistance and rehabilitation funding from federal and state agencies; however, property owners accepting these incentives must abide by certain restrictions associated with the relevant program. Property owners in locally designated historic districts are also required to comply with applicable local ordinances.

There are a currently twenty-three sites and two districts (Accomac and Onancock) of historical, architectural, or cultural significance located in Accomack County that are listed in the VLR and NRHP (**Table 4-2** and **Figure 4-13**).

Table 4-2:
National and Virginia Landmark Register Sites in Accomack County

Jurisdiction/Property	USGS Quad Map	VLR	NRHP	DHR File
Accomac Historic District	Accomac	12/16/1980	7/21/1982	160-0020
Arbuckle Place	Bloxom	12/17/1985	5/22/1986	001-0066
Assateague Beach Coast Guard Station	Chincoteague East	2/20/1973	DOE 01-15-80	001-0172
Assateague Lighthouse	Chincoteague East	4/17/1973	6/4/1973	001-0078
Bank Building (Old Mercantile Bldg; Eastern Shore Chamber of Commerce)	Accomac	5/21/1974	7/23/1974	160-0013
Bowman's Folly	Metompkin Inlet	5/13/1969	11/12/1969	001-0002
Bunting Place	Wachapreague	12/4/2002	4/11/2003	001-0017
Cokesbury Church	Pungoteague	9/8/2004	11/27/2004	273-0001-0171
Debtor's Prison (Jailer's House)	Accomac	6/15/1976	11/7/1976	160-0009
Edmund Bayly House (Hermitage)	Accomac	11/18/1980	6/28/1982	001-0021
Edmund Bayly House (Hermitage), updated mapping	Accomac	5/17/2007	6/27/2007	001-0021
Hill's Farm	Parksley	6/19/2008	9/12/2008	001-0023
Hopkins and Brother Store	Pungoteague	5/13/1969	11/12/1969	273-0002
Kerr Place	Accomac	12/2/1969	2/26/1970	273-0003
Makemie Monument Park (Pocomoke Farm)	Saxis	9/6/2006	2/15/2007	001-0112
Mason House (Hinman-Mason House)	Parksley	9/17/1974	11/21/1974	001-0029
Onancock Historic District	Accomac, Pungoteague	4/22/1992	10/8/1992	273-0001
Pitts Neck Farm	Saxis	2/17/1976	10/21/1976	001-0038
Saint George's Episcopal Church	Pungoteague	6/2/1970	9/15/1970	001-0040
Saint James Episcopal Church	Accomac	11/5/1968	6/11/1969	160-0005
Scarborough House Archaeological Site (44AC04)	Jamesville	1/18/1983	5/16/1985	001-0064
Shepherd's Plain (Melrose)	Pungoteague	10/21/1980	6/28/1982	001-0032
Wessels Root Cellar	Saxis	12/2/1969	2/26/1970	001-0076
Wharton Place	Bloxom	4/18/1972	11/3/1972	001-0050
Willowdale	Exmore	9/6/2006	5/2/2007	001-0062

Figure 4-13: Virginia Landmark Register Sites in Accomack County



Source: Accomack Comprehensive Plan, 2008

Federal and state laws also offer protection to important cultural sites of the indigenous cultures that occupied the area before the Europeans, who settled in Virginia beginning in the fifteenth century. Archeological digs have found evidence of humans on the Shore as early as 8,000 and 10,000 B.C.E. Local Indian tribes were part of either the Powhatan or Algonquian Nations. The Commonwealth of Virginia has extended official recognition to eight tribes, none of which were associated with the Planning Region. There are no federally recognized reservations within the Planning Region. However, there are numerous archaeological sites that are not currently listed but may be eligible ranging in age from a few hundred to several thousand years[11].

Development of new water supply infrastructure must include consideration for historic and cultural resources that may be present in the project footprint. DHR maintains archive documenting historic, archeological and cultural resources which can serve as an initial source of information to determine whether these resources may be impacted by a proposed project. Section 106 of the National Historic Preservation Act requires projects utilizing federal funds to consult with the DHR State Historic Preservation Office and, in most cases, with recognized tribal representatives. Projects with State funding usually have similar requirements. Site investigations including archeological or architectural surveys may be required in order to determine whether sites in the project footprint are eligible for recognition and protection under the federal or state Registers.

As all of the potable water withdrawals in the County are derived directly from groundwater sources, impacts to historic, archeological and cultural resources are usually avoided or relatively simple to mitigate.

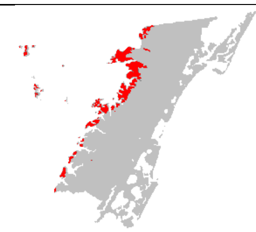
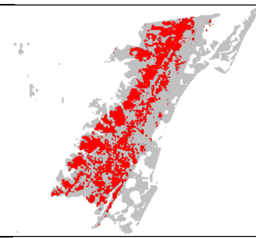
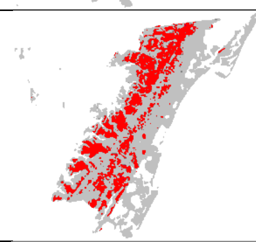
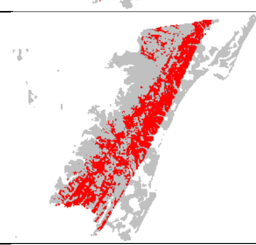
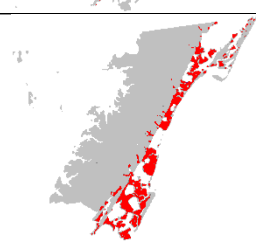
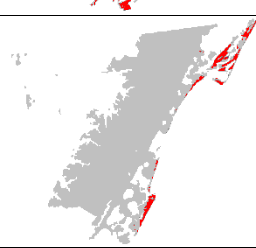
4.2.5. Geology and Soils

The geology of Accomack County consists of unconsolidated sediments on the Virginia Coastal Plain as discussed in Section 4.1.1 above. The type and distribution of soils in Accomack County is an important factor affecting land use and development, particularly for agriculture, construction, and sanitary operation of onsite disposal systems.

The soil profile in Accomack County generally consists of eight to ten inches of loam to sandy loam topsoil underlain by thirty inches of sandy loam subsoil. A series of continuous sand strata, commonly identified with the Columbia aquifer, is present below forty-four inches. Existing and potential agricultural and development use of the soils is largely determined by the seasonal high elevations of the water table.

A fairly comprehensive soil survey was completed by the USDA Soil Conservation Service in 1988. The survey is useful in identifying the general distribution and types of soils present in the County; however, it does not replace the need for applicable site-specific testing of soil suitability prior to planned changes in land use or development. Soil types identified in the soil survey have been grouped into associations, which is an area or areas of land with one or more soil types occurring in a characteristic pattern. The characteristic pattern in each soil association will have a similar soil horizon and other features which give it a distinctive landscape. There are six soil associations in Accomack County which are described in Table 4-3.

Table 4-3:
Soil Associations of Accomack County

SOIL ASSOCIATION AND DESCIPTION	GEOGRAPHIC DISTRIBUTION
Melfa-Hobucken (8%) ■ Composition: *loam* ■ Drainage: *poorly drained* ■ Slope: *level* ■ Origin: *marine and fluvial sediments* ■ Habitat: *brackish tidal marshes* ■ Common Uses: *wildlife habitat*	
Nimmo-Dragston-Munden (17%) ■ Drainage: *poorly to moderately well drained* ■ Slope: *nearly level* ■ Origin: *marine and fluvial sediments* ■ Habitat: *various* ■ Common Uses: *cultivated crops, woodland*	
Nimmo-Arapahoe-Polowana (19%) ■ Compostion: *loam, sand* ■ Drainage: *poorly drained* ■ Slope: *nearly level* ■ Origin: *marine and fluvial sediments* ■ Habitat: *flats and depressions of Carolina bays* ■ Common Uses: *woodland, wildlife*	
Bojac-Munden-Molena (34%) ■ Composition: *loam, sand* ■ Drainage: *moderately well to excessively drained* ■ Slope: *nearly level to very steep* ■ Origin: *marine and fluvial sediments* ■ Habitat: *various* ■ Common Uses: *prime farmland, residential development, cultivated crops, woodland, wildlife*	
Chincoteague (16%) ■ Drainage: *very poorly drained* ■ Slope: *level* ■ Origin: *marine and fluvial sediments* ■ Habitat: *tidal salt marshes* ■ Common Uses: *wildlife habitat*	
Camocca-Fisherman-Beaches (6%) ■ Drainage: *moderately well drained to poorly drained* ■ Slope: *nearly level to gently sloping soils* ■ Origin: *marine and fluvial sediments* ■ Habitat: *marshes, dunes, and beaches* ■ Common Uses: *wildlife habitat, recreation*	

A significant portion of the soils in the county contain hydric component soils, defined by the Natural Resources Conservation Service (NRCS) as soils that "formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part". The presence of hydric soils is one of several indications of the presence of regulated wetlands, along with the presence of wetland vegetation and hydrology. The presence of (regulated) wetlands, discussed below in Section 4.2.6, must be considered as part of project planning, design, and construction.

Some soils in the region have demonstrated direct economic value and are being actively quarried. As recently as 2008, there were fifteen quarries in Accomack county covering a total of 125 acres. Six quarries were active in the county in 2008 and a total of 124,000 tons of sand gravel were extracted.

Table 4-4:
Summary of 2008 Sand Quarry Activity in Accomack County

COMPANY NAME	MINE NAME/NUMBER	PERMIT	DISTURBED ACRES	PERMITTED ACRES	TONS	Active in 2008?
A. WILSON CUSTIS	#1, PUNGOTEAGUE	90322AA	15.7	15.7	13,881	Y
BRANSCOME INC	ONANCOCK/BAYSIDE PIT	07472AC	9	10	0	N
BRANSCOME INC	WATTSVILLE PIT	08157AC	33.5	33.5	14,196	Y
COASTAL AGGREGATES INC	#1	90465AA	6	14	25,700	Y
FRED A CAMDEN T/A CAMDEN BROS.	#1	90313AA	1.5	5	0	N
HILL SAND AND GRAVEL, INC.	HILL SAND & GRAVEL	90428AA	3.75	27.85	2,600	Y
JIM & NANCY ADAMS	ADAMS SAND PIT	90463AA	2.31	2.31	47,275	Y
KEITH BROADWATER	MINE # 1	90351AA	1	4.82	0	N
MARGARET R. STEPHENS	#1	90371AA	3	4.5	0	N
PARKS FARMS	NO.1	90336AA				N
PARKS FARMS	#2	90369AA				N
TRIPLE D SAND PIT	#1	08350AA				N
VIRGINIA SEAFOOD CORP.	#1	90287AB	8.5	8.5	0	N
VIRGINIA SEAFOOD CORP.	#2	90362AB	10.1	10.1	20,720	Y
WILLIAM F. MEARS, INC.	MEARS SAND & GRAVEL	06356AB	31	37		N
		ACCOMACK COUNTY	**125.36**	**173.28**	**124,372**	

Source: DMM Report PEPR.33 and TNPR.06 (2008)

4.2.6. Wetlands

Tidal wetlands are a significant resource in Accomack County covering approximately 110,000 acres in the County. Tidal wetlands have been identified as some of the most productive ecosystems in the world and provide habitat for a wide variety of species. Tidal wetlands have been defined in the Commonwealth of Virginia as part of the Wetlands Act (Title 62.1, Section 13.2, Code of Virginia) as "all land lying between and contiguous to mean low water and an elevation above mean low water equal to the factor 1.5 times the mean tide range at the site". Tidal wetlands are subdivided into vegetated and non-vegetated tidal wetlands. Vegetated tidal wetlands include swamps, marches, bogs and similar areas, while non-vegetated tidal wetlands include beaches, tidal flats and similar areas. The tidal wetlands of Accomack County are shown in Figure 4-14.

Figure 4-14: Tidal Wetlands in Accomack County

Source: Accomack Comprehensive Plan, 2008

The Virginia Water Protection Permit (VWPP) program is the process for regulating activities in tidal and non-tidal wetlands in the Commonwealth and is run by the Virginia DEQ. Section 401 and Section 404 of the Clean Water Act, also regulate impacts to wetlands under the jurisdiction of the US Army Corps of Engineers (USACE). Typically the placement of fill and/or removal of sediments from regulated wetlands requires a permit from either or both the USACE and the DEQ. The Virginia Marine Resources Commission (VMRC) oversees the Joint Permit Application (JPA) process for projects with potential impacts to sub-aqueous bottoms in the Commonwealth and coordinates the JPA process with DEQ and USACE, in consultation with other relevant federal, state and local agencies.

The US Fish and Wildlife Service (USFWS) collects and maintains extensive data on the distribution and types of wetlands as part of the National Wetland Inventory (NWI) program. Wetlands are inventoried and mapped at a local scale, useful for project planning, as part of the program. However, NWI information must usually be supplemented with field collected, site-specific soil, hydrology, and vegetation data to determine the presence, extent and quality of wetlands in the affected area of a proposed project. The presence of wetlands within a project footprint can significantly impact the siting, design, and sometimes feasibility of some projects. Projects that would alter the wetlands must demonstrate a lack of other suitable alternatives and mitigate impacts to affected wetlands, which can significantly increase project costs.

As all of the potable water withdrawals in the County are derived directly from groundwater sources, impacts to wetlands from existing and future water supply projects are usually avoided or are often simpler to mitigate than surface water projects.

4.2.7. Riparian Buffers

Riparian buffers are lands adjacent to water bodies, left in a natural vegetated state, used to preserve, promote, and protect water quality. Vegetation in the riparian buffers provide water quality protection by absorbing excess nitrogen and phosphorus in the stormwater runoff from adjacent fields and lawns. The level of nutrient removal is dependent on various factors such as buffer, slope, soils, and plant species. The Virginia Department of Forestry has noted that forested buffers up to 100 feet in width can remove up to 80 percent excess phosphorus and 89 percent nitrogen in the stormwater runoff from adjacent agricultural lands. In addition to nutrient removal, the riparian buffers also stabilize soils and decrease stormwater velocity and thereby reduce the amount of sediment runoff.

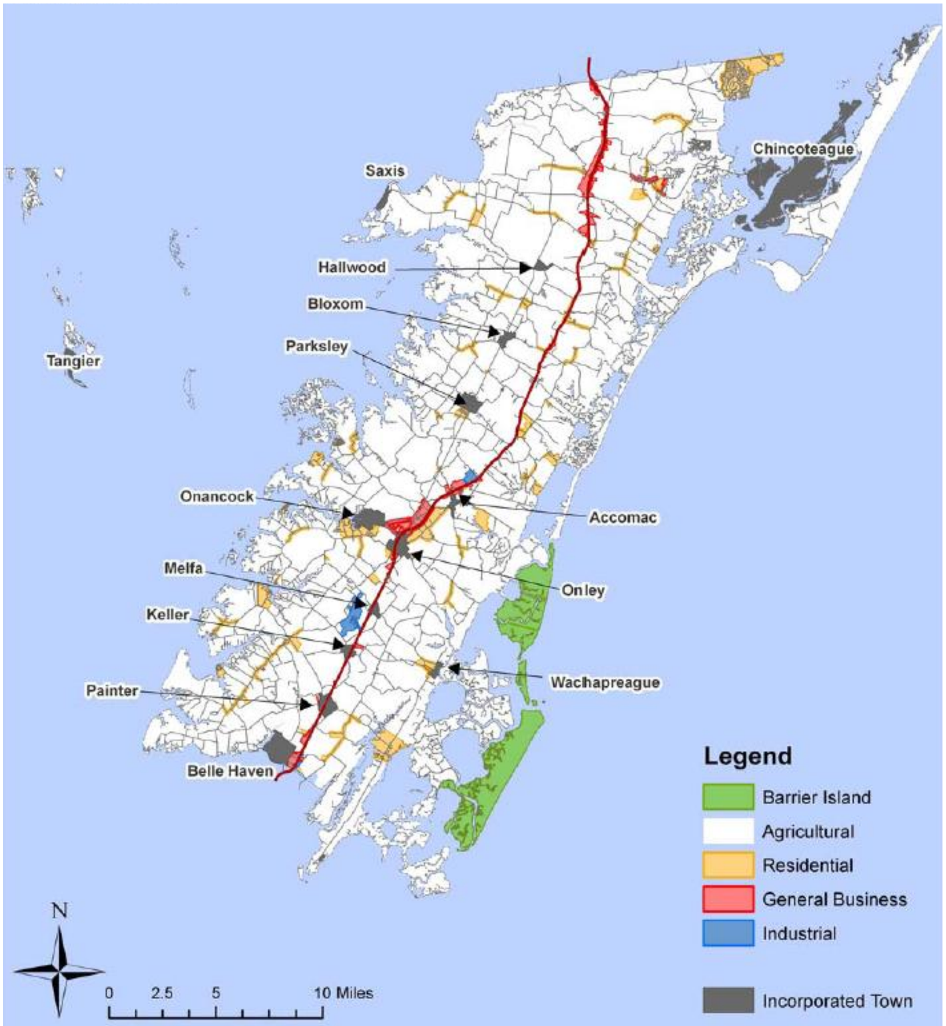
There are multiple government entities and programs in Virginia that fund or otherwise encourage the establishment of riparian buffers: the US Department of Agriculture

(USDA) Natural Resources Conservation Service (NRCS) promotes the riparian buffers adjacent to agricultural lands through a cost sharing program, DCR has numerous programs promoting riparian buffer creation and preservation, the Virginia Department of Forestry (DOF) provides a tax credit in conjunction with the establishment of riparian buffers in Virginia, and the Chesapeake Bay Preservation Act promotes the establishment of riparian buffers in the Chesapeake Bay watershed.

4.2.8. Land Use and Land Coverage

Land use and land cover can have a significant impact on local and regional hydrology and should play an important role in water supply planning. Variations in land use and land cover affect the geospatial variation of water demands and can have an impact on streamflow and groundwater water recharge, both in terms of quantity and quality. Land uses such as urban developments tend to have high proportions of impermeable land cover in the form of pavement and buildings. Without compensating design and planning, these areas will decrease the amount of rainfall percolating into the soil, and runoff rapidly into nearby streams and water bodies. This rapid runoff reduces the amount of water available for groundwater recharge and can impact water supply wells, particularly wells with shallow screens. Rapid runoff can also carry a greater sediment and contaminant load which can impact water quality in adjacent and downstream bodies of water. High sediment loads can also fill in downstream reservoirs and thereby reduce their yield over time.

Figure 4-15: Land Use in Accomack County



Source: Accomack Comprehensive Plan, 2008

This report relies on the land use/land cover data used in Accomack Counties' 2008 Comprehensive Plan (Figure 4-15). The County has a relatively very small percentage of impervious surfaces compared to the size of the area. Only about four percent of the area is developed, compared to 23 percent in agricultural use, over 50 percent in forested condition, with the remainder comprised on open water and wetlands.

As would be expected, the concentrations of impervious cover in the area are largely concentrated in the County's Towns and along the Route 13 corridor. The Route 13 corridor running north-south through the center of the County is a focal point for on-going economic and land development. As discussed below, economic activity concentrates in the corridor and will likely be a determining factor when planning to meet future increases in water demands.

The Virginia DCR requires localities to adopt stormwater management regulations and/or controls to minimize the runoff effects of new development. Typically, stormwater management measures may include leaving a portion of a developed property in an undeveloped state, or adding positive controls such as stormwater detention basins when new development occurs. The Chesapeake Bay Act also requires stormwater management measures to be considered in new and re-development projects of minimum size in the Chesapeake Bay watershed, which includes the western half of Accomack County, to control and reduce the nutrient and sediment loads reaching the Bay and its tributaries.

Although the percentage of developed land within Accomack County is relatively small, the County is heavily dependent on groundwater recharge for the continued replenishment of its water supply resources, as discussed above in Section 4.1. Therefore, special care must be taken in the on-going planning, design, and construction of development projects to ensure that the rate and quality of groundwater recharge is adequately protected and promoted. This is particularly important for the County's major groundwater recharge areas which largely coincide with the Route 13 corridor.

4.2.9. Impaired Streams and Rivers

In order to meet the requirements of Section 305(b) and 303(d) of the U.S. Clean Water Act, the Virginia DEQ compiles information about the Commonwealth's impaired streams, rivers, estuaries, other water bodies, and their watersheds on a biannual basis. The most recent survey of impaired waters is summarized in the 2008 Water Quality Assessment Integrated Report. The goals in the Water Quality Assessment Program are to inventory waters that do not meet water quality standards, and to design and implement a plan to restore water listed as impaired. The standards are based on the water quality required to support one or more of the six designated uses for surface waters, which include: aquatic life, fish consumptions, shellfish consumption, swimming, public water supplies (where applicable), and wildlife. A body of water with one or more parameters that do not meet applicable water quality standards are listed as "impaired" and are not considered to support the body of water's designated use. The primary mechanism for cleanup of impaired waters is to develop a total maximum daily load (TMDL) for those water quality parameters not meeting the standard. A TMDL is the site-specific planned total amount of a given contaminant associated with an impairment that can be assimilated by a 303(d) listed stream and is meant to sufficiently restore water quality to support one or more designated uses.

There are fourteen stream segments totaling approximately 28 miles in length and 1,070 square miles of estuaries that are listed as 303(d) impaired for Accomack County as part of the 2008 Integrated Report. It should be noted that the large majority of the estuarine impairments include the portions of the Chesapeake Bay located in Accomack County. Coves, inlets, and other open water areas account for only 33 square miles of the total listed estuarine water impairments in Accomack County. The most common impairments include failure to meet water quality standard for the following parameters: low dissolved oxygen (particularly in the summer months), submerged aquatic vegetation criteria, fecal coliform, enterococcus, benthic-macroinvertebrate bioassessments, copper, PCBs in fish tissue, and pH imbalances. These impairments result in failure to meet one or more of the following designated uses: fish consumption, aquatic life, shellfishing, recreation, and wildlife for listed water bodies.

Although surface water in Accomack County is not utilized for human consumption, fecal coliform can be of concern with respect to surface water if there are high levels in areas used for recreation, shellfish harvesting, and food crop irrigation. State water quality standards require that in all surface waters, except shellfish waters, the fecal coliform bacteria shall not exceed a geometric mean of 2,000 fecal coliform bacteria per liter of water for two or more samples over a calendar month period, or a fecal coliform bacteria level of 74,000 per liter in ten percent of samples in any given month.

4.2.10. Point Source Dischargers

Large discharges to waterways of the Commonwealth are regulated by the Virginia DEQ and DCR and reported to the USEPA. Discharges into surface water are regulated through Virginia Pollutant Discharge Elimination System (VPDES) permits. Permit holders are typically required to adhere to limits on the concentration and quantities of specified pollutants, properly maintain and operate facilities, monitor discharge, keep and submit proper records to DEQ on a monthly basis, and provide open access to inspections. VPDES permits can be granted on a site-specific or general category basis. Facilities with a VPDES permit in Accomack County are presented in Table 4-5 and Figure 4-17. Six seafood processing facilities are temporarily discharging under a Consent Order in Lieu of a VPDES permit, while DEQ finalizes regulations for a general VPDES permit for seafood processors.

Figure 4-16: 303(d) Impaired Waters and NPDES Discharges in Accomack County

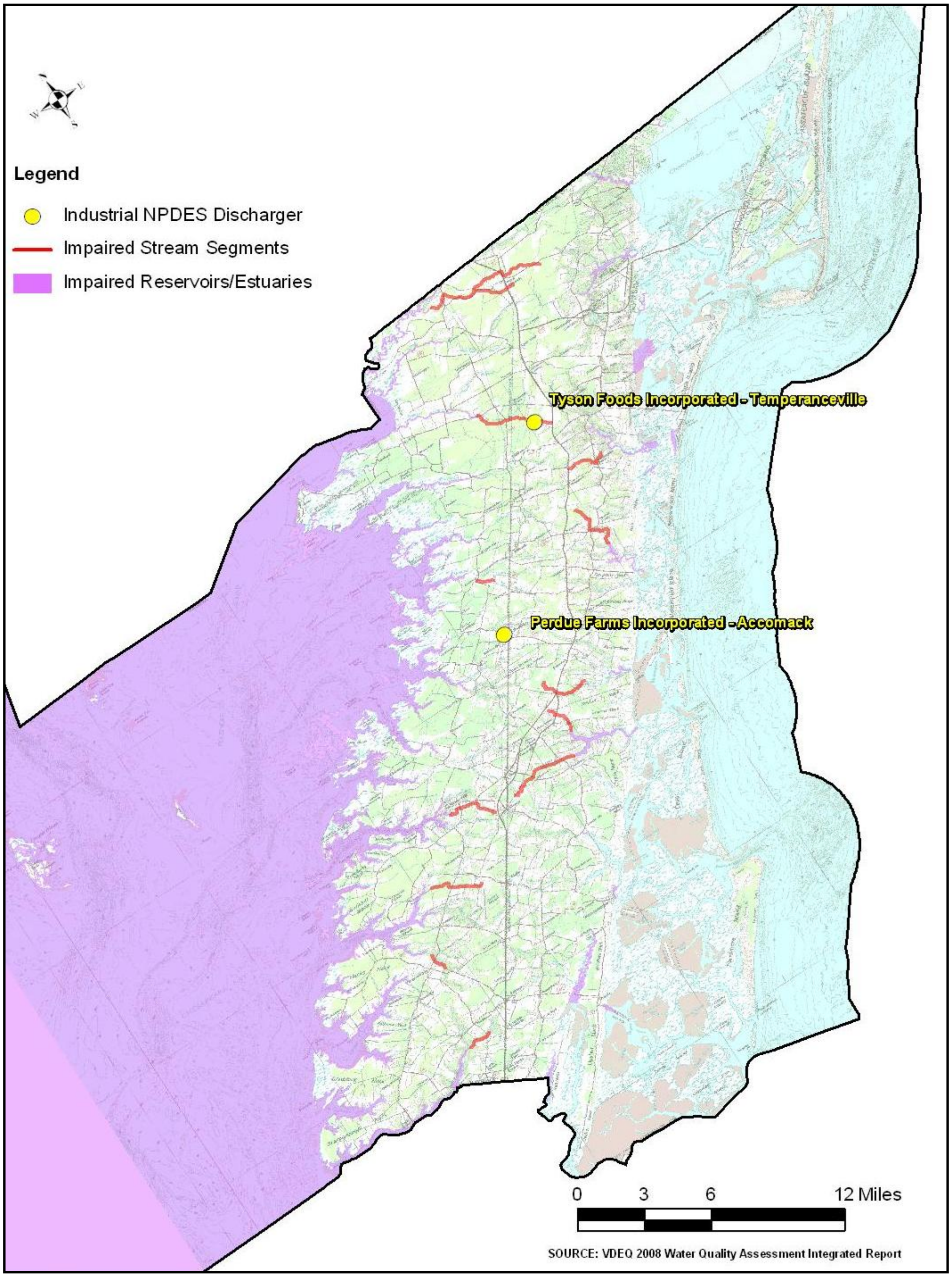


Figure 4-17: VPDES Discharge Sites in Accomack County

Source: Accomack County Comprehensive Plan, 2008.

A Virginia Pollution Abatement (VPA) Permit is required for operations that manage pollution through land application, reuse, or do not otherwise result in a point source discharge to surface waters. VPA permits are required for land application of sewage sludge, animal waste, or industrial waste and for closed systems that reuse and recycle waste water. Exclusions to the VPA permit program are discharges to permitted treatment systems, run-off from fields, return flows from irrigation, storage vessels, and land disposal of pollutants otherwise permitted. Permit requirements typically include the prohibiting of discharge to surface water, requirements regarding waste storage and disposal, best management practices (such as buffer strips, berms, and nutrient management plans) to protect adjacent surface waters, groundwater monitoring to detect possible contamination and sludge monitoring to determine the concentration of pollutants. Facilities with a VPA permit in Accomack County are listed in Table 4-5.

Table 4-5:
VPDES Permitted Facilities in Accomack County

PERMIT#	FACILITY NAME	LOCATION	EXP. DATE
	Individual Permits, VPDES - Municipal		
VA0091529	ACCOMACK COUNTY NORTH LANDFILL	Tasley	1/11/2010
VA0091596	BIRCHWOOD HOUSING DEVELOPMENT	Chincoteague	4/12/2010
VA0065196	CARDINAL VILLAGE	New Church	3/15/2010
VA0091618	CHINCOTEAGUE LANDMARK WWTP	Chincoteague Island	3/7/2010
VA0051756	CHINCOTEAGE WATER TREATMENT PLANT	Chincoteague Island	6/7/2012
VA0089265	COMFORT SUITES HOTEL WWTP	Chincoteague Island	4/24/2011
VA0090506	HAMPTON INN & SUITES	Chincoteague Island	10/3/2010
VA0027162	KEGOTANK ELEMENTARY SCHOOL	Mappsville	7/7/2007
VA0090875	OAK HALL SHOPPING CENTER LLC Oak Hall	Oak Hall	11/30/2011
VA0021253	ONANCOCK WWTP Onancock	Accomack Co.	4/20/2011
VA0003808	PERDUE FARMS	INC Accomac	6/29/2011
VA0027171	PUNGOTEAGUE ELEMENTARY SCHOOL	Melfa	7/7/2007
VA0092037	RAY'S SHANTY	Wattsville	7/19/2012
VA0063606	SHORE LIFECARE AT PARKSLEY	Parksley	8/16/2008
VA0054003	SUNSET BAY UTILITIES INC	Chincoteague Island	11/5/2006
VA0091049	SUNSET BAY UTILITIES-NORTH	Chincoteague Island	7/1/2007
VA0067423	TANGIER WWTP	Tangier Island	10/25/2014
VA0091677	TAYLOR LANDING	Chincoteague Island	2/21/2011
VA0004049	TYSON FARMS	INC Temperanceville	2/28/2010
VA0087327	US - COAST GUARD GROUP EASTERN	Chincoteague Island	6/4/2007
VA0024457	US – NASA WALLOPS FACILITY	Accomack	8/22/2009
VA0023078	VDOT ROUTE 13 VISITOR'S CENTER	New Church	6/29/2012
VA0088838	WHISPERING PINES MOTEL	Accomac	4/26/2010
	Individual Permits, VPA		
VPA01051	BYRD FOODS, INCORPORATED	Parksley	4/30/2013
VPA01005	CAPTAIN'S COVE UTILITY CO., INC.	Greenbackville	4/21/2009
VPA01057	EAST COAST BROKERS & PACKERS	Mappsville	6/14/2014
VPA01060	INTEGRATED FISHERIES INTERNATIONAL	Mappsville	3/8/2015
VPA01047	KUZZEN'S, INCORPORATED	Painter	8/28/2012
VPA01076	PERDUE FARMS INCORPORATED	Accomac	12/8/2012
VPA01044	TAYLOR & FULTON, INCORPORATED	Mappsville	6/8/2012
VPA01035	TYSON FOODS, INC.	Temperanceville	2/28/2010
	General Permit – Car Wash Facilities		
VAG750049	LIBERTINO, RICHARD CAR WASH	Chincoteague Island	10/15/2012
VAG750050	TIM'S CAR WASH	New Church	10/15/2012
VAG750068	WASH CITY	Melfa	10/15/2012
	General Permit – Concrete Ready Mix Plants and Fabricated Products		
VAG110027	T & W BLOCK, INC.	Onley	9/30/2008

PERMIT#	FACILITY NAME	LOCATION	EXP. DATE
	General Permit – Domestic Wastewater<1000 gallons/day		
VAG403030	CHAGNON AND VONGUGGENBERG	Chincoteague Island	8/1/2011
VAG403031	DIETZ AND JASZI AND GILBERT RESIDENCE	Chincoteague Island	8/1/2011
VAG403042	LUNN, JAMES T. JR. – RESIDENCE	Chincoteague Island	8/1/2011
VAG403035	MCCOMB AND LOCKLIN PROPERTIES	Chincoteague Island	8/1/2011
VAG403047	TARR, JERRY L. RESIDENCE	Chincoteague Island	8/1/2011
VAG403036	WETHERINGTON AND WILKINSON-ROEM	Chincoteague Island	8/1/2011
	General Permit – Nonmetallic Mineral Mining Operations		
VAG840001	CUSTIS MINE #1	Pungoteague	6/30/2009
VAG840061	T & W BLOCK	Onley	6/30/2009
	General Permit – Nutrient Discharges		
VAN050002	ONANCOCK WWTP	Onancock	12/31/201
VAN050004	TANGIER WWTP	Tangier Island	12/31/201
VAN050005	TYSON FARMS INCORPORATED	Temperanceville	12/31/201
	General Permit – Poultry Facility		
VPG250054	BOOTH, BOB - PIXIE FARM	Modest Town	12/1/2010
VPG250055	BROWN, CONTREL FARM	Oak Hall	12/1/2010
VPG250087	BUNDICK, GEORGE FARM	Modest Town	12/1/2010
VPG250063	BUSCHER, JOHN FARM	Melfa	12/1/2010
VPG250091	CHESSER, ROBERT FARM	Temperanceville	12/1/2010
VPG250094	CHESSER, RYAN FARM	Assawoman	12/1/2010
VPG250114	CHI KIM FARM	Hallwood	12/1/2010
VPG250022	CONKLIN, RICHARD I. SR. FARM	Chincoteague	12/1/2010
VPG250023	COOK, THOMAS D. & ANGELA – PECAN	Oak Hall	12/1/2010
VPG250060	DARBY, STEVE D+D POULTRY FARM	Temperanceville	12/1/2010
VPG250019	CHISHOLM, JOSEPH E. JR. FARM	New Church	12/1/2010
VPG250038	DAVIS, TOM FARMS	New Church	12/1/2010
VPG250090	DAVIS, TOMMY - BRITTINGHAM FARM	New Church	12/1/2010
VPG250104	EULO, NATHAN FARM	Mears Station	12/1/2010
VPG250108	EUI JIN CHOI FARM	Melfa	12/1/2010
VPG250024	FISHER, CHARLES S. - FISHER FARM INC.	Oak Hall	12/1/2010
VPG250050	GEORGE, PAUL FARM	Mappsville	12/1/2010
VPG250099	GLADDING, MARY T. FARM	Witham	12/1/2010
VPG250061	HALL, BEN F. JR., HOLDEN'S CREEK FARM	Temperanceville	12/1/2010
VPG250051	HALL, FRED III FARM	Hallwood	12/1/2010
VPG250111	HEAVEN SCENT POULTRY FARM	Parksley	12/1/2010
VPG250097	HOLLAND, FREDDY HOLLAND HOMESTEAD	New Church	12/1/2010
VPG250093	HOLLAND, W. T. & SONS, INC.	New Church	12/1/2010
VPG250070	HOP-NGUYEN-VAN POULTRY FARM	New Church	12/1/2010
VPG250035	IQBAL, MOHAMMAD FARM	Bloxom	12/1/2010
VPG250056	JEANNIE BUNDICK FARM	Bloxom	12/1/2010
VPG250112	JOSE RODRIGUEZ FARM	Craddockville	12/1/2010

PERMIT#	FACILITY NAME	LOCATION	EXP. DATE
VPG250027	JUSTICE, CARLTON FARM	New Church	12/1/2010
VPG250082	JUSTICE, JAMES H. JR., - JUSTICE POULTRY	New Church	12/1/2010
VPG250030	KELLEY, HORACE EDWARD III FARM	New Church	12/1/2010
VPG250006	KUHNE, DANNY FARM	Bloxom	12/1/2010
VPG250062	LAVELLE, JOHN E. FARM	Tasley	12/1/2010
VPG250029	LINTON, CLAUDE G. FARM	Temperanceville	12/1/2010
VPG250058	LOVELL, WILLIAM DAVIS FARM	Melfa	12/1/2010
VPG250049	MACKAY, BRIAN & VIRGINIA FARM	Parksley	12/1/2010
VPG250077	MARINER, WILLIAM FARM	Greenbackville	12/1/2010
VPG250041	MATTHEWS, RONNIE W. FARM	Greenbush	12/1/2010
VPG250040	MATTHEWS, F. D. FARMS, INC.	Greenbush	12/1/2010
VPG250113	MELINDA THORNTON FARM	Hallwood	12/1/2010
VPG250083	MINH MA & HIEN TRAN FARM	Oak Hall	12/1/2010
VPG250014	MOREY, ANDREW E. FARM	Melfa	12/1/2010
VPG250059	QUY TRAN FARM	Parksley	12/1/2010
VPG250109	RANTZ POULTRY FARM	Oakhall	12/1/2010
VPG250092	RAY, PHILIP FARM	New Church	12/1/2010
VPG250088	REVELL FARM, (STEPHENS/REVELL)	Atlantic	12/1/2010
VPG250042	ROGERS, ANTONIO FARM	Temperanceville	12/1/2010
VPG250085	ROHDE, DANIEL FARM	Melfa	12/1/2010
VPG250107	RYAN LEE BRADY FARM	Atlantic	12/1/2010
VPG250084	SHIELD, CAROLYN B. - CORBIN FARM	Parksley	12/1/2010
VPG250008	SIMPSON, WAYNE FARM	Oak Hall	12/1/2010
VPG250031	SMITH, JACK W. FARM	Bloxom	12/1/2010
VPG250079	SMITH, MARVIN V., JR. FARM	Onancock	12/1/2010
VPG250098	SPNA FARM	Withams	12/1/2010
VPG250100	TAYLOR, TAMMY FARM	Hall Wood	12/1/2010
VPG250039	TAYLOR, UPSHUR - EDDIE LEWIS FARM	Saxis	12/1/2010
VPG250105	THIEU NGUYEN FARM	Mears Station	12/1/2010
VPG250043	THOMAS, BENJAMIN FARM	Atlantic	12/1/2010
VPG250086	THOMPSON, JACK FARM	Temperanceville	12/1/2010
VPG250053	THORNTON, EDWARD FARM	Temperanceville	12/1/2010
VPG250102	THREE BLAIRS FARM	Craddockville	12/1/2010
VPG250096	TRADER, E. T. AND JAN FARM	New Church	12/1/2010
VPG250036	WARD FARM	Bloxom	12/1/2010
VPG250007	WAYNE'S WORLD FARM	Oak Hall	12/1/2010
VPG250028	WHITE, TERRY FARM	Mappsville	12/1/2010
VPG250032	WILLETT, RAY FARM	Parksley	12/1/2010
VPG250095	WILLIAMS, LINDA & CARLTON L. FARM	Bloxom	12/1/2010
VPG250069	YOUNG, C.E. FARM	Leemont	12/1/2010
	General Permit – Seafood		
VAG523020	CHINCOTEAGUE FISHERIES CO-OP	Chincoteague Island	7/23/2011
VAG523007	CHINCOTEAGUE SHELLFISH FARMS	Chincoteague Island	7/23/2011
VAG523022	EASTERN SHORE SEAFOOD COMPANY, INC.	Onancock	7/23/2011
VAG523026	EDGERTON FISH COMPANY	Chincoteague Island	7/23/2011
VAG523018	SHORE SEAFOOD, INCORPORATED #1	Saxis	7/23/2011

PERMIT#	FACILITY NAME	LOCATION	EXP. DATE
VAG523034	TOMS COVE AQUAFARMS	Chincoteague Island	7/23/2011
VAG523030	VIRGINIA-CAROLINA SEAFOOD CO.	Atlantic	7/23/2011
	General Permit - Industrial Storm Water		
VAR050328	ACCOMACK COUNTY AIRPORT	Melfa	6/30/2009
VAR051367	ACCOMACK COUNTY NORTH LANDFILL	Atlantic	6/30/2009
VAR051368	ACCOMACK COUNTY SOUTH LANDFILL	Melfa	6/30/2009
VAR051726	BOWSER & SON SALVAGE YARD	Saxis	6/30/2009
VAR051444	COASTLINE CHEMICALS	New Church	6/30/2009
VAR050238	DAVIS AUTO CENTER	New Church	6/30/2009
VAR050427	J. FRANKLIN JONES LUMBER	Accomac	6/30/2009
VAR050491	KMX CHEMICAL CORP.	New Church	6/30/2009

Source: VDEQ, March 1, 2008

5. Projected Water Demand
(9 VAC 25-780-100)

This section consists of projections to estimate future water demands. Estimates of populations in the County and the water needed to serve them are made in ten year increments from 2010 to 2040, thirty years into the future. The projections include considerations of both public and private sources of water. As discussed below, some of the projections are based on values and/or methodologies presented in the respective groundwater withdrawal permit applications. The relevant permit applications are presented in Appendix C.

5.1. Population Projections

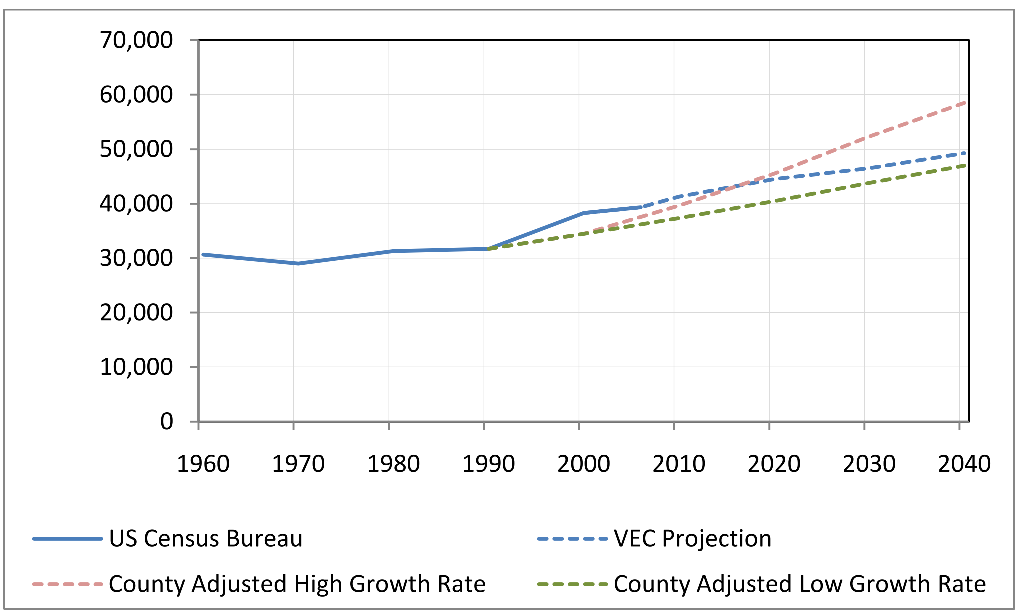
Population projections for Accomack County were estimated by the Virginia Employment Commission (VEC). Base year data for 2000 and population estimates for 2006 were compiled by the U.S. Census Bureau. The projections for 2010 through 2030 were estimated by VEC using the component cohort method. As part of its Comprehensive Plan, the County also provided lower and upper estimates of population growth to 2030 based on its corrected estimates of the 2000 Census population total and high and low growth rates of 1.4 percent and 0.8 percent, respectively. Projections for 2040 were not available and the growth rates predicted by VEC and the County were nearly linear ($R^2 \geq 0.98$), therefore a straight line interpolation was used to extrapolate the Accomack County population projections to 2040. Population projections for Accomack County are shown in Table 5-1 and in Figure 5-1. Overall, population in the County is projected to grow at an average annual rate of approximately 0.65 percent.

Table 5-1:
Accomack County Population Projections

YEAR \ SOURCE	US CENSUS BUREAU	VEC PROJECTION	COUNTY-ADJUSTED LOWER GROWTH	COUNTY-ADJUSTED HIGHER GROWTH
1960	30,635			
1970	29,004			
1980	31,268			
1990	31,703			
2000	38,305		34,488	34,488
2006	39,345			
2010		41,300	37,350	39,630
2020		44,500	40,446	45,540
2030		46,500	43,800	52,300
2040[†]		49,300	46,982	58,493
Average Annual Growth Rate	0.99%[*]	0.65%	0.8%	1.4%

[*] based on 1980-2000 growth
[†] Malcolm Pirnie, Inc. estimate

Figure 5-1: Accomack County Population Projections



5.2. Public Water Sources

Future water demands and service area populations were projected for each of the public water systems in Accomack County based extrapolations of recent historical data.

5.2.1. Arcadia Nursing Center

The Arcadia Nursing Center (Figure 5-2) currently has a population of 100 including occupants and on-site staff. Based on recent population data and assuming only modest expansion, the Center is expected to grow to an approximate total population of 112 occupants and on-site staff by 2040, as shown in Figure 5-3 and Table 5-2. Based on the projected population and a recent average use rate of 95 gallons per capita per day, the 2040 water demands are projected to be approximately 10,656 gallons per day. Water demands for Arcadia Nursing Center are considered to be 100 percent residential for the entire planning period. Maximum month demands were estimated by multiplying the historical ratio of maximum month demands to average month demands for a given year (1.5) by the projected average demands. The VDEQ groundwater withdrawal permit and application were not available at the time of writing of this report.

Figure 5-2: Arcadia Nursing Center Service Area

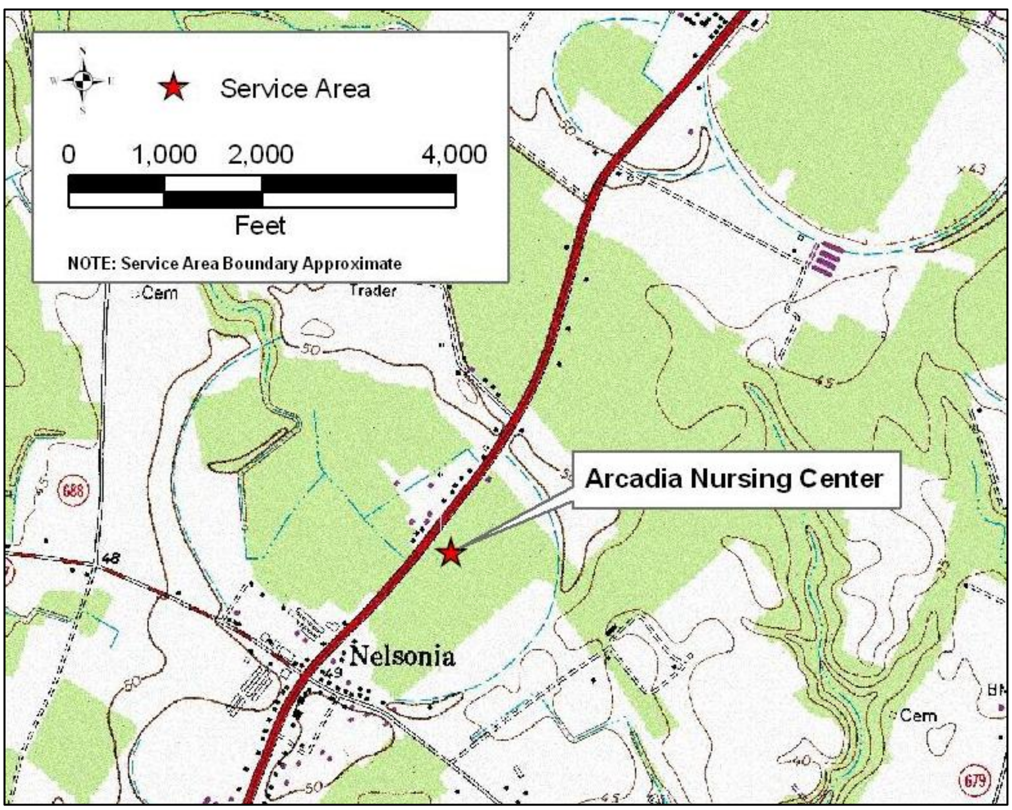


Figure 5-3: Arcadia Nursing Center Population and Demand Projections

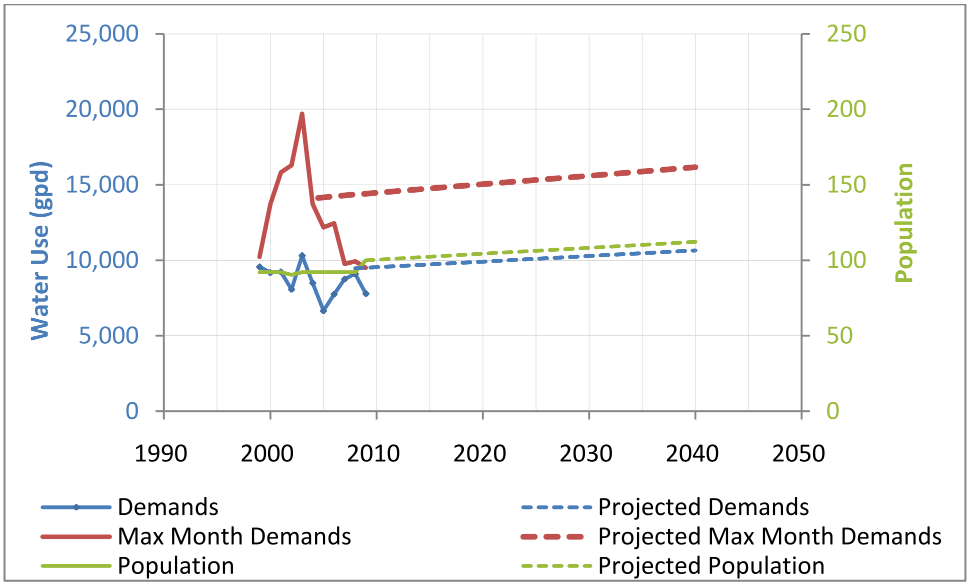


Table 5-2:
Arcadia Nursing Center Population and Demand Projections

YEAR	POPULATION	AVERAGE DEMANDS (GPD)	MAX MONTH DEMANDS (GPD)
Projected Data			
2010	100	9,537	14,470
2020	104	9,910	15,036
2030	108	10,283	15,601
2040	112	10,656	16,167

5.2.2. Captain's Cove Subdivision

The Captain's Cove Subdivision consists of 4,816 lots, 855 of which are currently connected to the subdivision's water supply system (Figure 5-4). The most recent projection of the population at Captain's Cove is included in the groundwater withdrawal permit. The projection indicates that the number of connections in the subdivision will increase by between 100 and 250 units per year until the expiration of the current permit in 2017. Projected values are presented in Table 5-3 and Figure 5-5. Demands are based on an assumed rate of 155 gpd per connection. Projections are adjusted from the values in the permit and are based on the existing number connections and the assumed number of new connections predicted in the permit application for values until 2020. Projections beyond 2020 are linearly extrapolated until buildout (all 4,816 lots are connected) occurs by approximately 2030. Demands are projected to remain relatively constant following buildout until the 2040 planning horizon. Maximum month demands are projected based on the historical max month to average demand ratio of approximately 1.87 until the withdrawal permit expiration in 2017 (20.2 MG/month). Following 2017, the max month to average demand ratio is anticipated to fall to approximately 1.6 based on planned conservation measures.

Figure 5-4: Captain's Cove Service Area

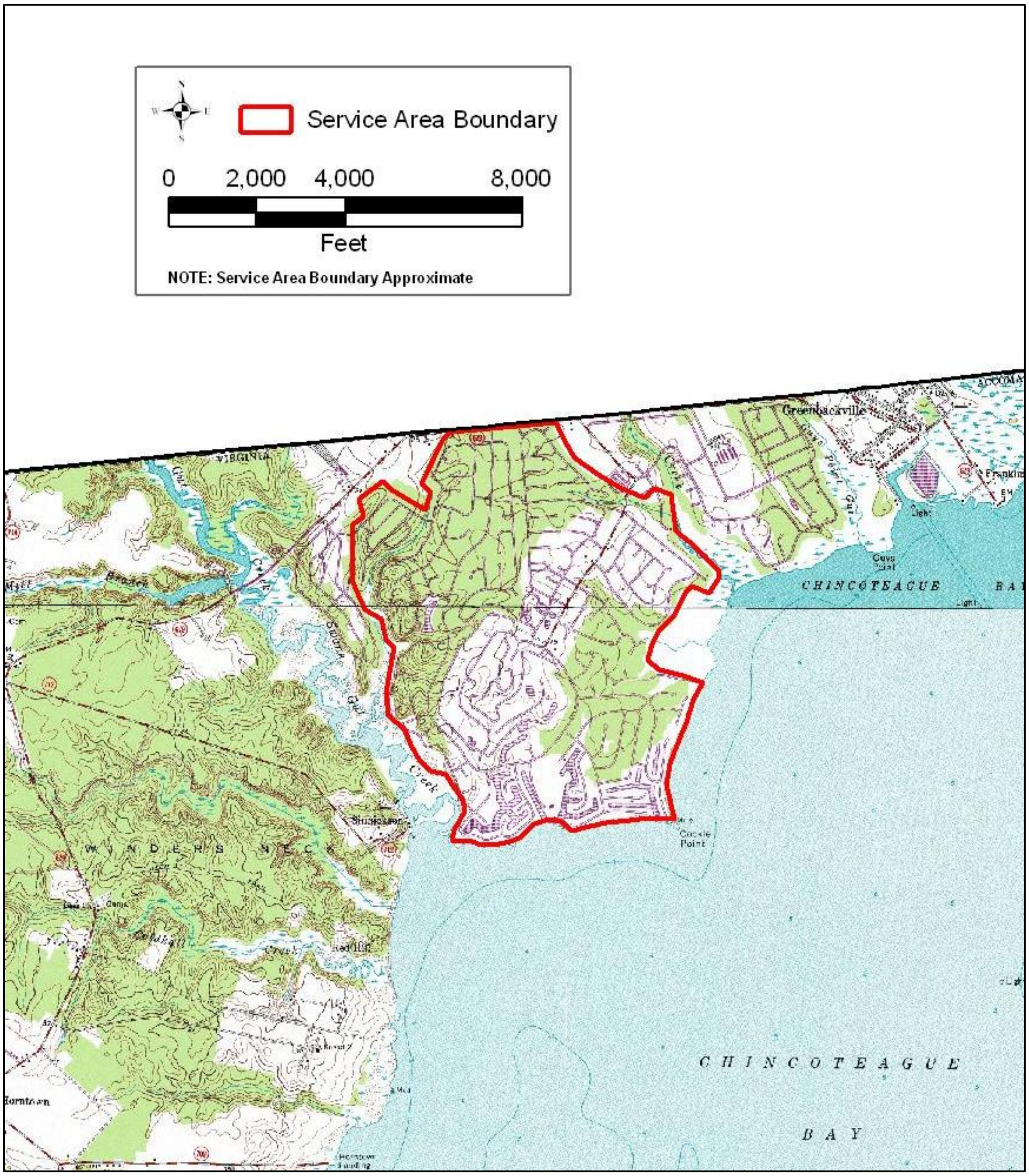
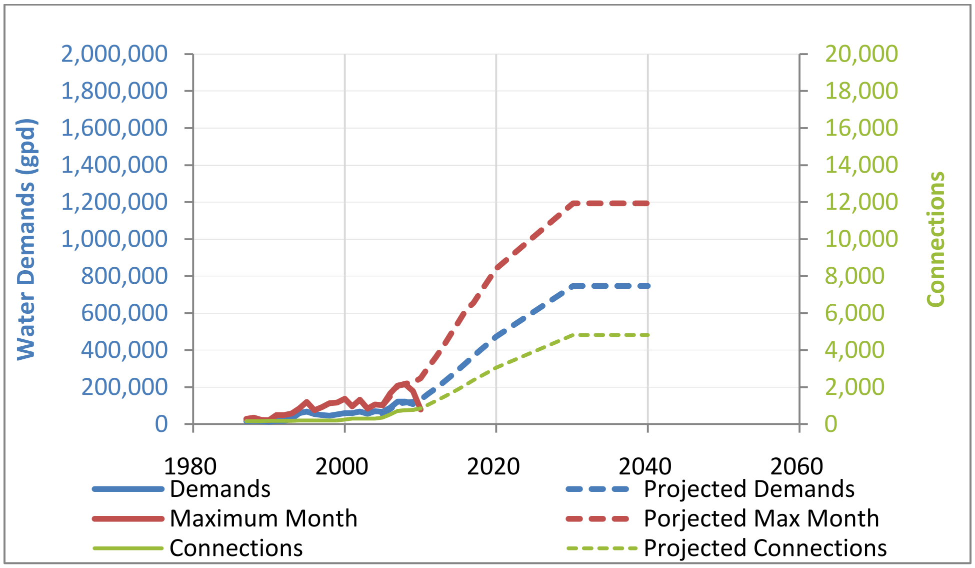


Figure 5-5: Captains' Cove Population and Demand Projections



Demands also include an estimated average of 1,630 gallons per day for the marina, gas station, and other commercial spaces in the subdivision. Therefore, demands are greater than 99 percent residential and less than 1 percent commercial, industrial, and/or light industrial (CIL).

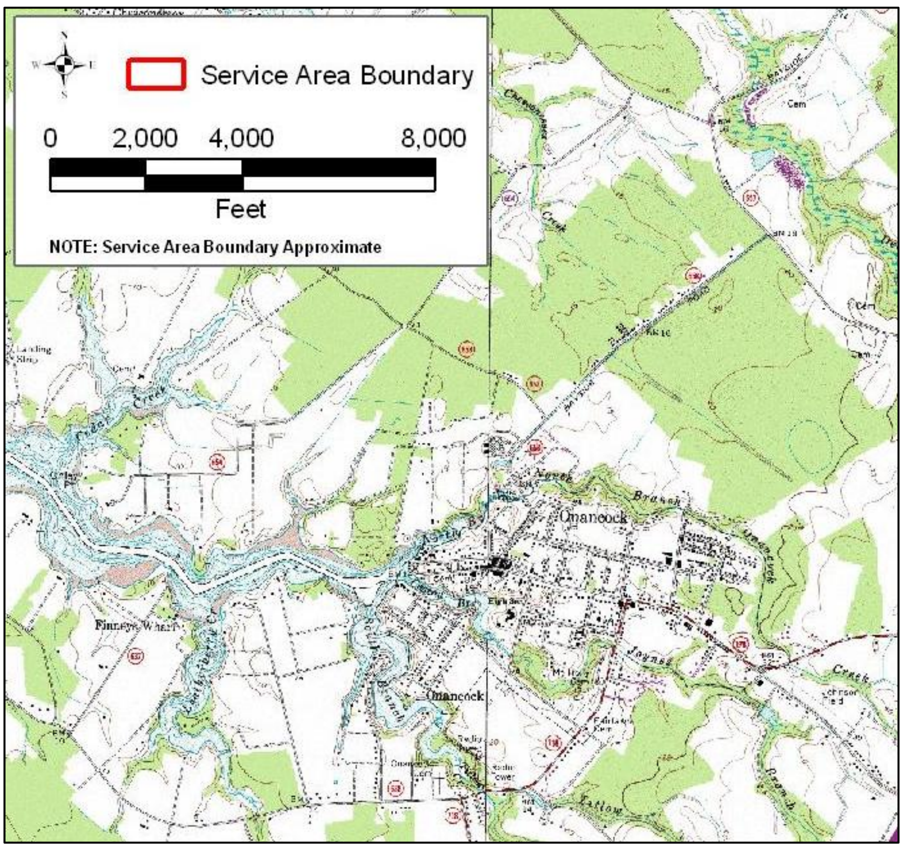
Table 5-3:
Captain's Cove Subdivision Population and Demand Projections

YEAR	CONNECTIONS	AVERAGE DEMAND (GPD)	MAX MONTH DEMAND (GPD)
Projected Data			
2010	855	132,525	100,442
2011	1,053	163,215	151,750
2012	1,246	193,130	206,728
2013	1,453	225,215	219,041
2014	1,672	259,160	224,643
2015	1,900	294,500	247,725
2016	2,135	330,925	305,093
2017	2,372	367,660	361,013
2018	2,606	403,930	420,988
2019	2,833	439,115	484,441
2020	3,048	472,440	550,501
2030	4,814	746,170	618,589
2040	4,814	746,170	654,435

5.2.3. Town of Onancock

The Onancock Water Service Area serves a population of approximately 1,525 people (Figure 5-6). The population was projected to the 2040 planning horizon by developing an average population trend of VDH reported data over the period between 1987 and 2009. The average trend indicates a linear growth rate of approximately 0.21 percent (3.26 inhabitants) per year which is fairly consistent with the lower range of countywide trends. Therefore, the projected population for the Town of Onancock is estimated to be approximately 1,623 at the 2040 planning horizon (Table 5-4 and Figure 5-7).

Figure 5-6: Town of Onancock Water Service Area



Demands were projected as part of the Town's most recent groundwater withdrawal permit. Demands were projected for the permit application based on a linear interpolation of historical demands in the between 1987 and 2003. Since more recent data has not shown an increase in demands, the projection was adjusted by assuming a same growth rate (i.e. slope of trendline), but offsetting the trendline intercept such that the projection continues from the (2003) historical maximum annual demand in 2010. Average annual demand projections incorporate an average annual demand increase of 1.58 million gallons per year and were based on a linear interpolation of historical data. Maximum monthly demands were projected by multiplying the average annual demands by the historical ratio of maximum month demands to average annual demands (1.23). Therefore, the 2040 projected average annual and maximum month demands are approximately 316,000 and 388,000 gallons per day, respectively.

Figure 5-7: Town of Onancock Projected Water Demands

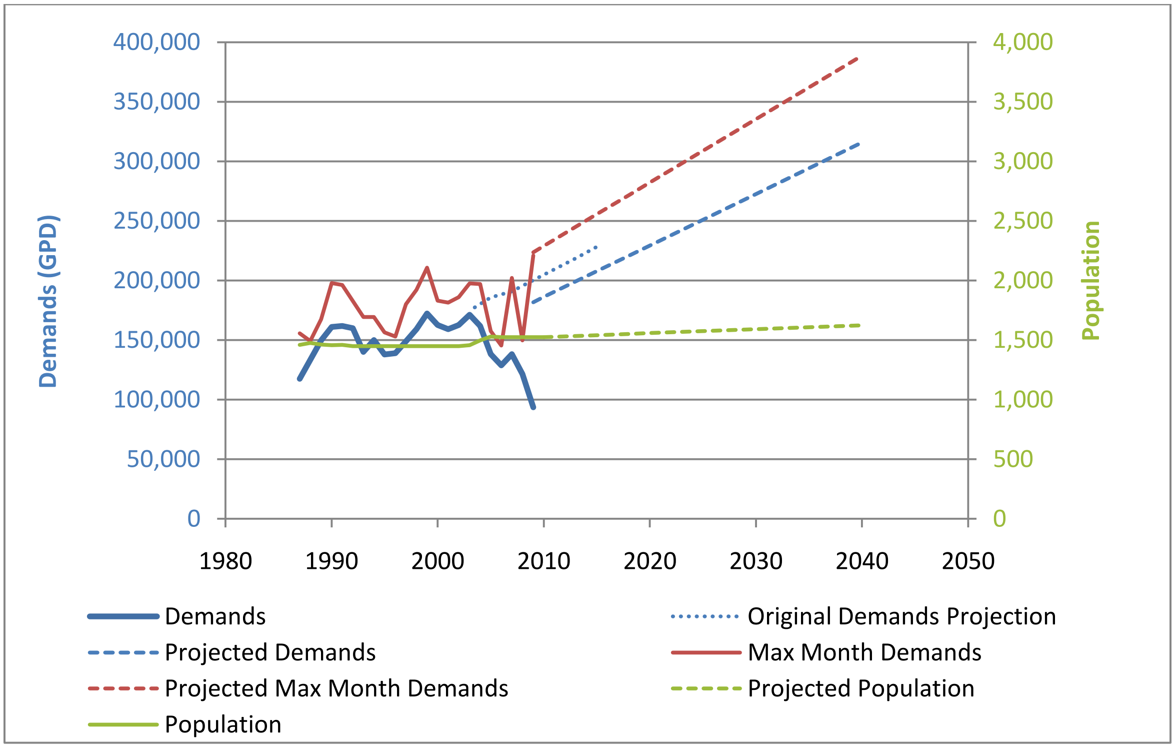


Table 5-4:
Onancock Population and Demand Projections

YEAR	POPULATION	AVERAGE DEMAND (GPD)	MAX MONTH DEMAND (GPD)
Projected Data			
2010	1,525	186,116	228,922
2020	1,558	229,361	282,114
2030	1,590	272,606	335,306
2040	1,623	315,852	388,498

The most recent available demand data for the breakdown of average annual demands by type was for the period between 2003 and 2004 and was as follows: residential (54.2 percent), commercial/industrial and light industrial (33.6 percent), fire protection (1.0 percent), unmetered/unaccounted for water (11.2 percent).

5.2.4. Town of Parksley

The Parksley Water Service Area serves a population of approximately 929 people (Figure 5-8). The population was projected to the 2040 planning horizon by developing an average population trend of VDH reported data over the growth period between 1995 and 2009. The average trend indicates a linear growth rate of approximately 0.39 percent (3.62 inhabitants) per year which is fairly consistent with the lower range of countywide trends. Therefore, the projected population for the Town of Parksley is estimated to be approximately 1,040 at the 2040 planning horizon (Table 5-5 and Figure 5-9).

Demands were projected as part of the Parksley's most recent groundwater withdrawal permit. Demands were projected for the permit application based on a linear interpolation of historical demands in the between 1988 and 2003. Water demands were extrapolated based on the projection methodology used in the groundwater withdrawal permit. The maximum annual withdrawal (2002) was used as a baseline demand for 2010, while demands were anticipated to grow at a rate of approximately 1.46 percent (1,104 GPD) per year. The growth rate was based on planned development in the service area. Maximum monthly demands were projected using the same method – the 2010 baseline maximum monthly demand was based on the historical maximum (120,161 GPD in August 2002) and a growth rate of 1.46 percent (1,710 GPD) was applied to future. Therefore, the 2040 projected average annual and maximum month demands are approximately 114,032 and 176,596 gallons per day, respectively.

Figure 5-8: Town of Parksley Water Service Area

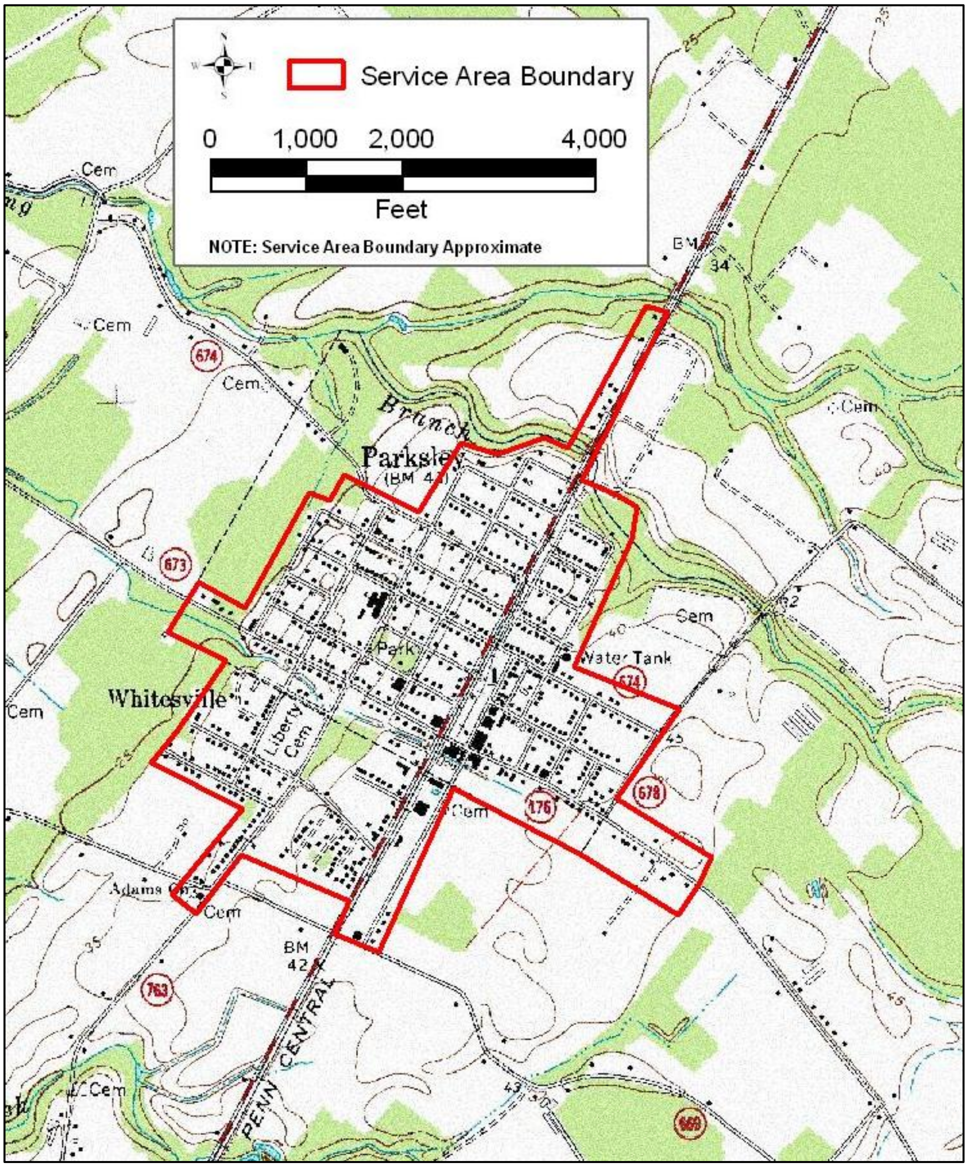
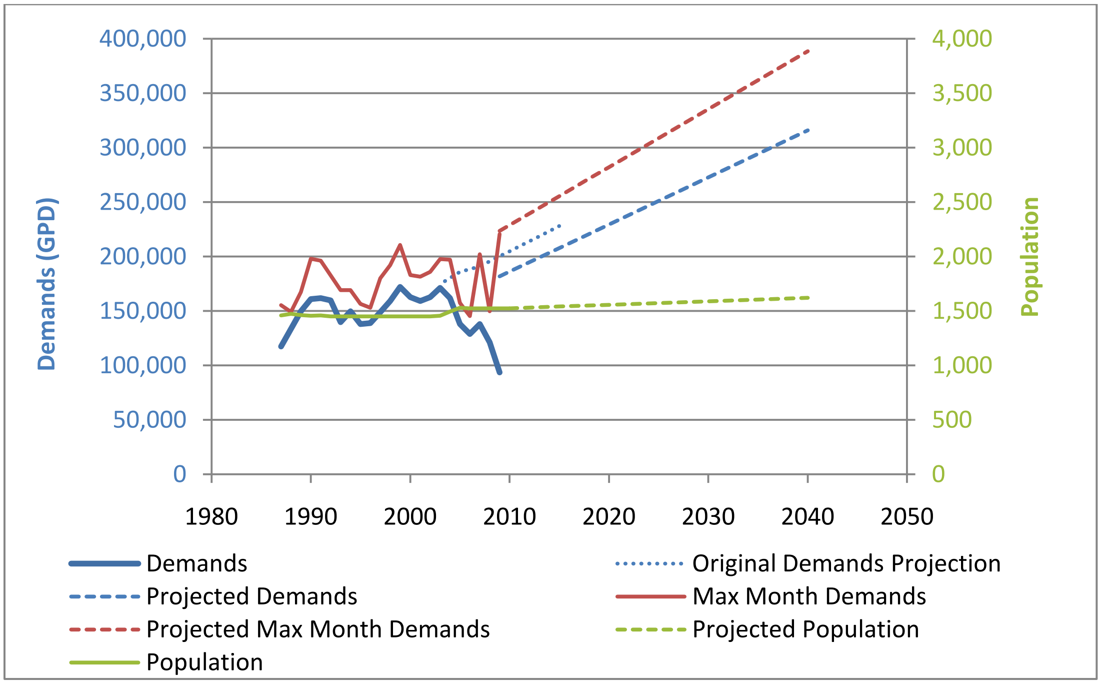


Table 5-5:
Parksley Population and Demand Projections

YEAR	POPULATION	AVERAGE DEMAND (GPD)	MAX MONTH DEMAND (GPD)
Projected Data			
2010	932	80,904	125,292
2020	968	91,946	142,393
2030	1,004	102,989	159,494
2040	1,040	114,032	176,596

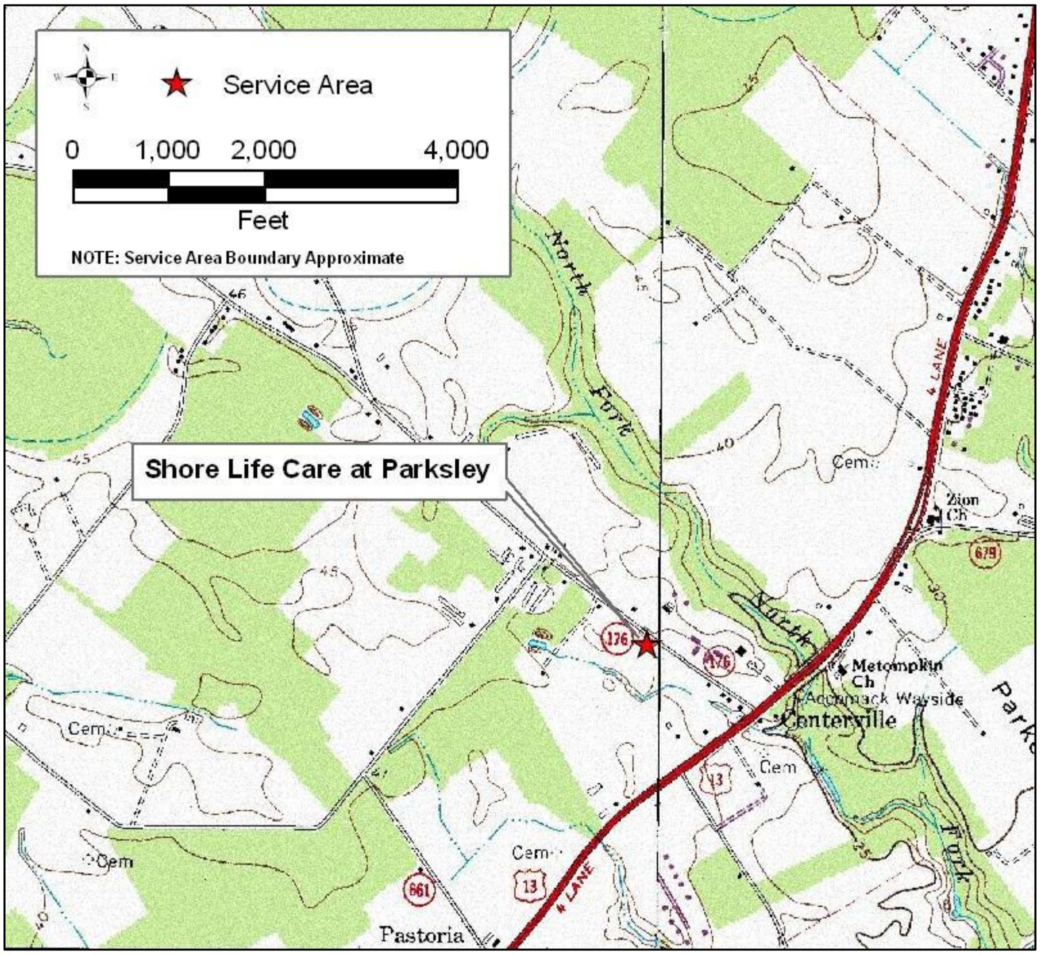
Figure 5-9: Town of Parksley Projected Water Demands



5.2.5. Shore Life Care of Parksley (formerly Accomack County Nursing Home)

Formerly Accomack County Nursing Home, the Shore Life Care of Parksley has recently had an average occupancy of 124 residents (in the period between 2001 and 2007) and a maximum occupancy of 137 residents (Figure 5-10). The facility has been operating for over thirty years and has no plans to expand other than to maintain and/or maximize occupancy. Therefore, the maximum projected population of Shore Life Care is expected to remain at or below 137 residents until 2040. Therefore, without future plans to expand the facility, the annual average demand was estimated based on the average demand data for the period between 2001 and 2007 and pro-rated to full occupancy as follows:

Figure 5-10: Shore Life Care of Parksley Water Service Area



Assuming the facility does not expand prior to 2040, the projected maximum month demands are anticipated to remain at or below the historical maximum monthly value of 591,000 gallons per month. Increases in occupancy are expected to be offset by improvements in water conservation measures. Water use at the facility is almost entirely residential, although a nominal amount is used for landscape irrigation - approximately 1,900 gallons/month in the period between April and September, which is less than one percent of total water use.

5.2.6. Tangier Island

Tangier Island (Figure 5-11) currently has an approximate population of approximately 650 residents, according to VDH records. The habitable area on the island is limited and the number or residents has been constant or declining since 1995. The maximum population reported to VDH was 750 residents (Table 5-6 and Figure 5-12). Given the spatial limitations of the island, the population of the island is projected to remain at or below 750 with the 2040 planning horizon. Over the same period VDH reported demands have varied between approximately 59,000 gpd and 111,000 gpd and shown a declining trend. Given that the population is anticipated to remain at or below it recent historical maximum, it is assumed that the maximum historical annual and monthly uses of 110,771 gpd and 125,618 gpd, respectively are representative of a reasonable upper bound of demands within the planning horizon. A breakdown of usage by type was not available at the writing of this report; however, it is assumed that the majority of water demands are residential in nature, with a limited amount of commercial demands.

Figure 5-11: Tangier Island Water Service Area

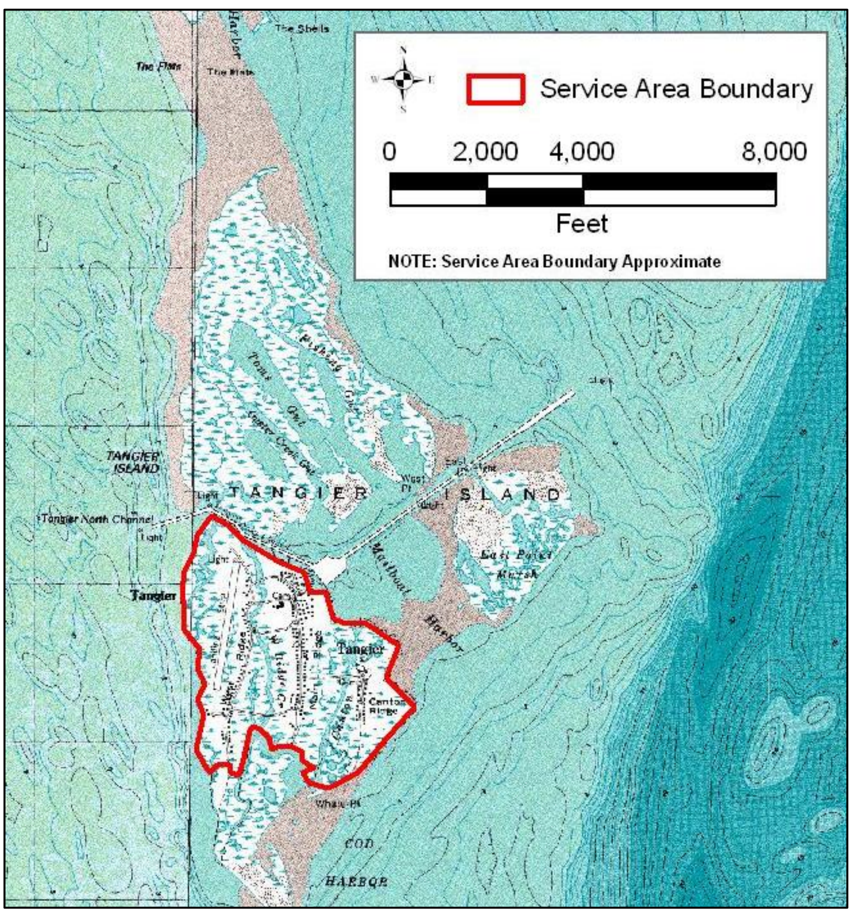


Figure 5-12: Tangier Island Projected Population and Water Demands

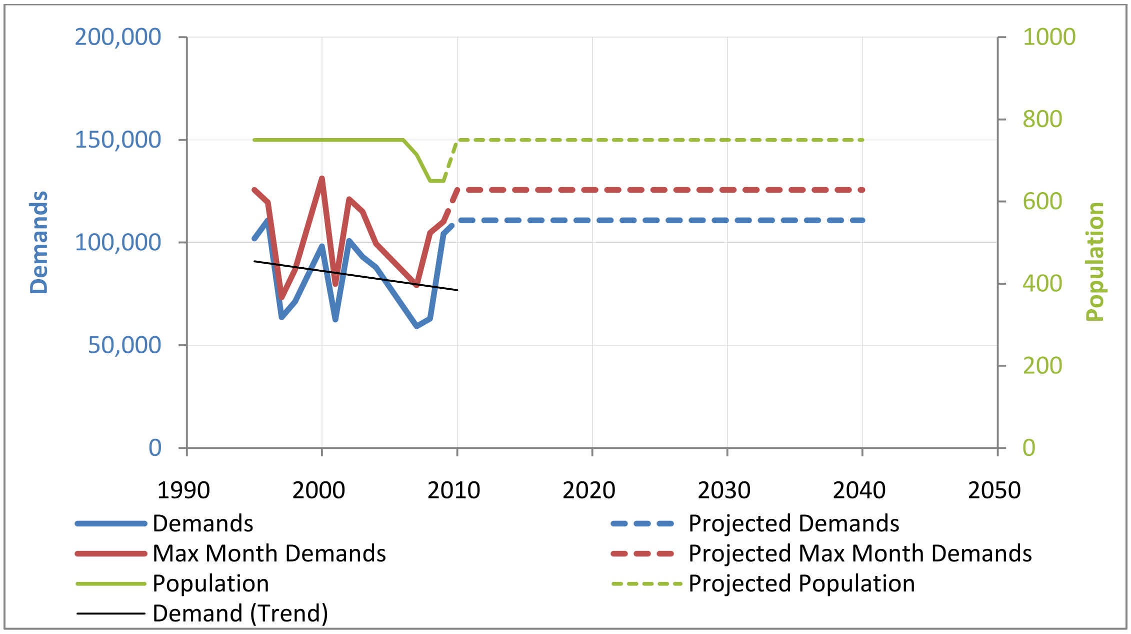


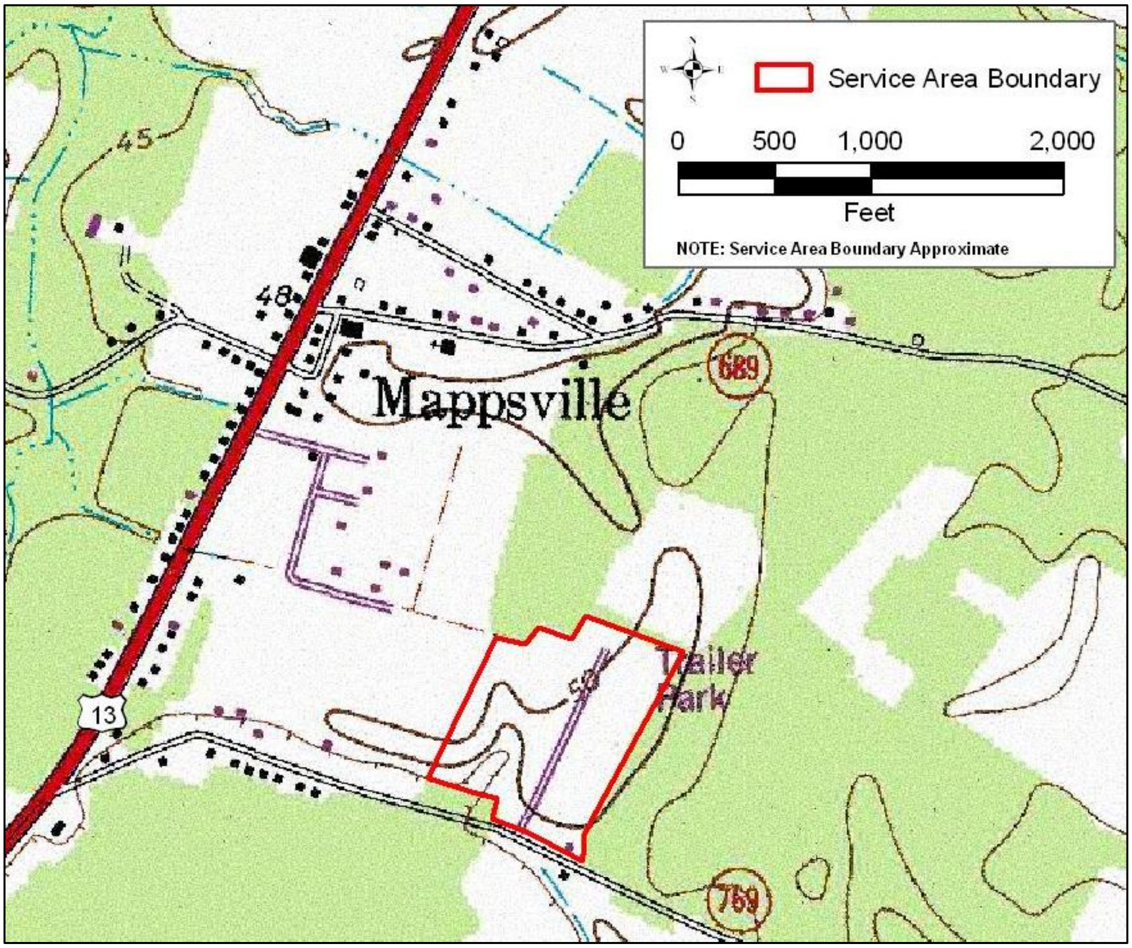
Table 5-6:
Tangier Island Population and Demand Projections

YEAR	POPULATION	AVERAGE DEMAND (GPD)	MAX MONTH DEMAND (GPD)
Projected Data			
2010	750	110,771	125,618
2020	750	110,771	125,618
2030	750	110,771	125,618
2040	750	110,771	125,618

5.2.7. Triangle Enterprises Mobile Home Park

Triangle Enterprises Mobile Home Park currently has 64 active connections and a maximum of 72 connections (Figure 5-13). The average population residing at the facility over the period between August 2006 and December 2006 was 244, which results in an average occupancy of 3.8 persons per connection. There are no plans to expand the number of connections at the Park; therefore, the number of occupants at the Park is likely to remain at or below 274 people (72 connections x 3.8 persons/connection).

Figure 5-13: Triangle Enterprises Mobile Home Park Water Service Area



Based on the experience of facility management, water usage data for the 2006 calendar year was considered to be the most representative data available to determine average and maximum monthly use rates. The average annual and maximum monthly per capita water use rates at the Park were estimated to be 97 and 147 gallons per capita per day, respectively. Therefore, without future plans to expand the facility, the average annual and maximum monthly demands were estimated by multiplying the maximum likely occupancy by the respective use rates as follows:

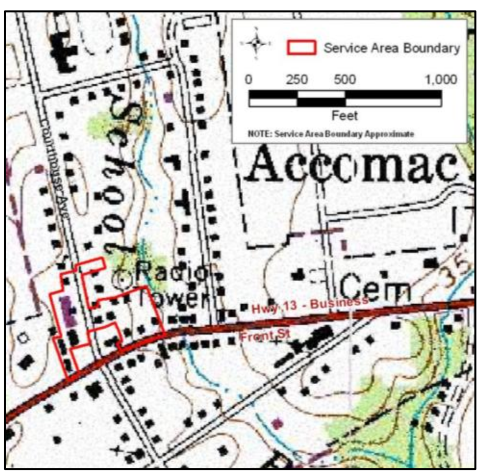
Water usage at the facility was assumed to be residential only.

5.3. Large Self-Supplied Non-Agricultural Users

5.3.1. Accomack County Buildings

The Accomack County Buildings are a collection of fourteen buildings including the County Administration Building, Courthouse, Jail, law office and associated buildings (Figure 5-14).

Figure 5-14: Accomack County Office Buildings



The most recent available water usage data for the Accomack County Building Water was obtained from the 2002 groundwater withdrawal permit. Average usage ranged between 10,300 and 136,000 gpd. The County Jail and its occupants account for the largest proportion of water demands in the complex and the Jail's population can fluctuate significantly over time. The groundwater withdrawal permit indicated that by 2012 annual water demands were anticipated to increase by as much as ten percent (one percent per year) to approximately 15,000 gpd, primarily due to the potential expansion of the County Jail. Beyond 2012, water demands were projected by assuming that demands would grow at the same linear rate as the County (0.65 percent per year). A similar process was used for maximum month demands, which were projected to reach 20,000 gpd by 2012 (Table 5-7 and Figure 5-15).

Figure 5-15: Accomack County Buildings Projected Water Demands

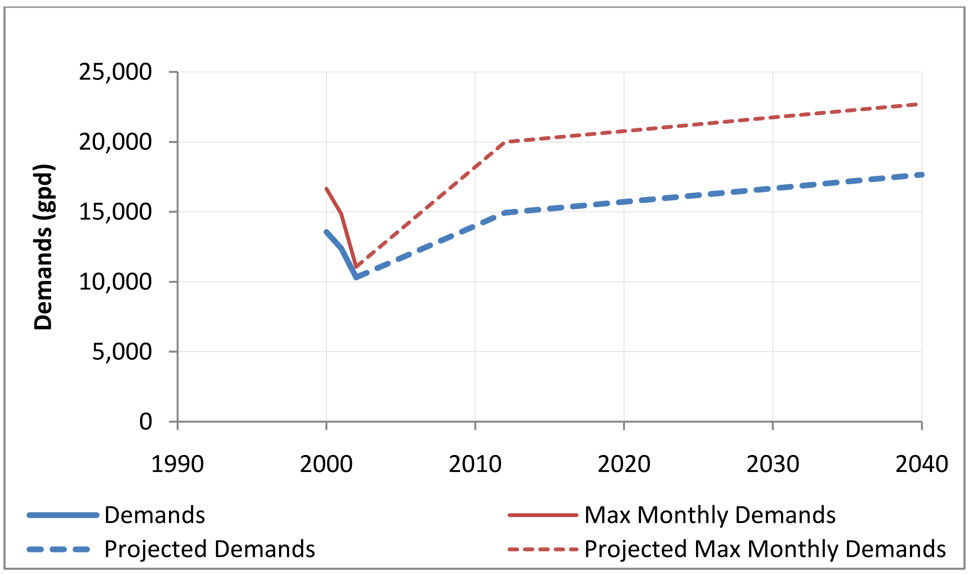


Table 5-7:
Accomack County Buildings Demand Projections

YEAR	AVERAGE DEMAND (GPD)	MAX MONTH DEMAND (GPD)
Projected Data		
2010	14,008	18,212
2020	15,705	20,776
2030	16,675	21,747
2040	17,645	22,717

5.3.2. KMX Chemical Corporation

Data for the KMX Chemical Corporation was not available at the time this report was written to use as a basis for water demand projections, it was assumed that the current permitted amounts of 60 million gallons per year and 6.5 million gallons per month will meet water demands to the 2040 planning horizon. Barring additional information, this assumption is supported by the fact that the previous annual permitted amount was 76.44 million gallons per year indicating a recent decreasing trend in water demands.

5.3.3. Perdue

The Perdue facility projected average annual and maximum monthly use of 700 million gallons per year (1.916 mgd average) and 78 million gallons per month (2.6 mgd average) are based on the requested amount in the Groundwater Withdrawal Permit Application. It was assumed that facility demands increase to the requested amounts by 2020 and that facility demands would continue to grow based on increased production associated with domestic and emerging market growth as mentioned in the permit application. The assumed growth rate was a linear interpolation between recent facility average demand levels and the 2020 projections, which results in estimated annual and maximum monthly demands of 2.077 mgd average and 3.621 mgd average, respectively by 2040 (Table 5-8 and Figure 5-16).

Figure 5-16: Perdue Projected Water Demands

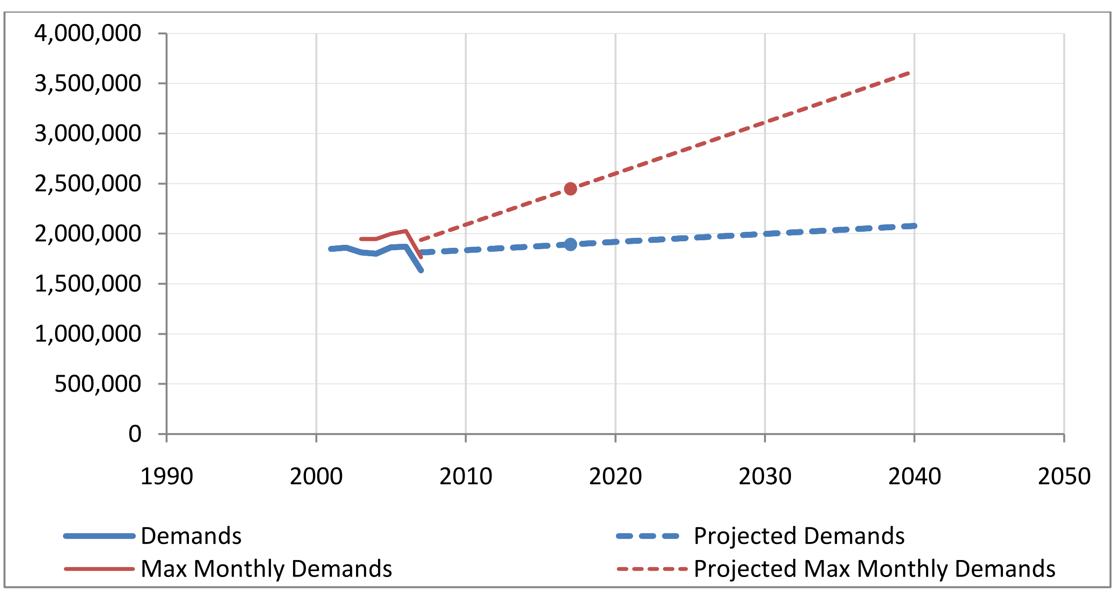


Table 5-8:
Perdue Demand Projections

YEAR	AVERAGE DEMAND (GPD)	MAX MONTH DEMAND (GPD)
Projected Data		
2010	1,836,393	2,089,674
2020	1,892,465	2,600,000
2030	1,916,496	3,110,326
2040	2,076,700	3,620,653

5.3.4. Tyson Foods

The Tyson facility projected average annual demands of 357.7 million gallons per year (0.98 mgd) are based on the requested amount in the Groundwater Withdrawal Permit Application. It was assumed that facility demands would continue at a constant rate through 2020 based the requested amount (982,379 gpd average) in the Groundwater Withdrawal Permit Application. Following 2020 through 2040 the rate was increased to the maximum amount recorded between 2000 and 2007 (1,010, 639 gpd average) to account for increased production over time (Table 5-9 and Figure 5-17).

Figure 5-17: Tyson Projected Water Demands

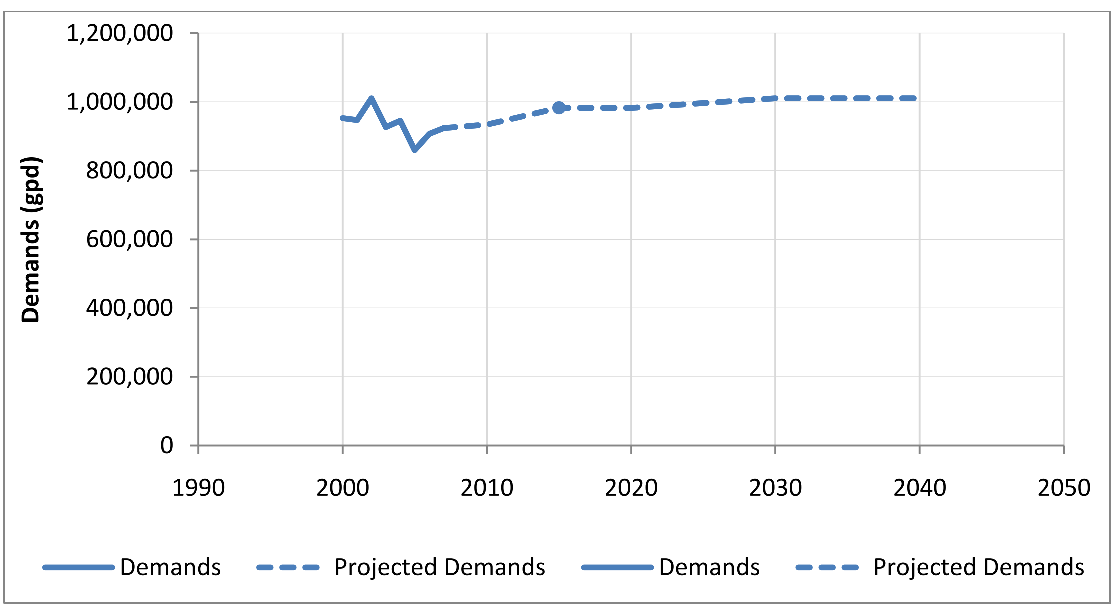


Table 5-9:
Tyson Demand Projections

YEAR	AVERAGE DEMAND (GPD)	MAX MONTH DEMAND (GPD)
Projected Data		
2010	982,739	1,207,742
2020	982,739	1,207,742
2030	1,010,639	1,207,742
2040	1,010,639	1,207,742

5.4. Large Self-Supplied Agricultural Users

No detailed historical usage was available upon which to base a series of projections for large agricultural demands at individual facilities. Furthermore, the USGS estimates of water usage for the County for the period between 1985 and 2005 indicate a level or declining trend in agricultural demands[12]. Therefore, it was assumed that, on average, the current permitted amounts for each facility will likely be sufficient to meet demands within the 2040 planning horizon (Table 5-10 and Table 5-11).

Table 5-10.
Projected Large Self-Supplied Agricultural Groundwater Demands

	Annual Permitted Withdrawal (gallons)	Monthly Permitted Withdrawal (gallons)
FACILITY/SYSTEM NAME	*Assumed 2010-2040 Demands*	*Assumed 2010-2040 Demands*
AL Mathews	41,904,000	14,142,000
Ames Farm	65,000,000	16,250,000
Bethel Church	32,400,000	16,200,000
Bobtown Nursery	10,900,000	4,000,000
Bowen Farm	42,620,000	16,000,000
Broadleaf Farms	3,700,000	1,000,000
Byrd Farm	22,650,000	9,910,000
Christian/Ames Farm	56,091,000	21,034,125
David Van Dessel Farm	4,500,000	1,200,000
Dennis Azaleas	2,700,000	500,000
Dennis Nursery	5,000,000	900,000

	Annual Permitted Withdrawal (gallons)	Monthly Permitted Withdrawal (gallons)
FACILITY/SYSTEM NAME	*Assumed 2010-2040 Demands*	*Assumed 2010-2040 Demands*
Drummond Farm	31,000,000	11,000,000
East Coast Brokers and Packers	13,500,000	2,400,000
Ed Goin	34,320,000	11,583,000
Evans or Oaks Farm	120,072,000	26,568,000
Gillespe Farm	28,000,000	12,500,000
Gunter Farm	12,500,000	6,300,000
Hagan Farm	17,000,000	5,700,000
Hickory Hill	34,560,000	17,280,000
Hogneck Farm	13,000,000	5,500,000
Home Farm	8,400,000	6,500,000
James Farm	54,000,000	7,900,000
Kelley Farm	30,124,000	14,300,000
Lang	51,840,000	12,960,000
Lewis Farm	24,300,000	11,500,000
Liberty Hall Farm	4,400,000	1,000,000
Mathews Farm	10,900,000	3,114,290
Melfa Farm	30,360,000	11,400,000
Middleton Farm	185,000,000	37,000,000
Mutton Hunk Fen Natural Area Preserve	40,340,000	19,100,000
Northam Somers	37,800,000	11,812,500
Painter Farm	18,400,000	8,520,000
Peach Orchard	42,600,000	8,520,000
Rew Farm	49,000,000	16,300,000
Robert Van Dessel Farm	3,400,000	900,000
Simpson Farm	21,517,000	10,193,000
Sommers Farm	24,300,000	11,500,000
Sterling	93,060,000	44,080,000
Tidewater Growers	1,800,000	600,000
Weaver Farm	32,900,000	11,000,000
Wes Powers	20,160,000	5,040,000
Wessells Farm	21,517,000	10,193,000
Wessells/ Watkinson Farm	13,500,000	3,375,000
Total Permitted Withdrawals (MG)	**1,411.04**	**466.77**

Table 5-11.
Projected Large Self-Supplied Agricultural Surface Water Demands

	Average Annual Use (MG)
User Name	*Assumed 2010-2040 Demands*
AL WESSELLS\BOB WATKINSON	14.01
BOBTOWN NURSERY	41.48
DUBLIN FARMS INC	506.00
EASTERN SHORE AGR. EXP. STN.	0.91
ED GOIN	32.04
F.A. HOLLAND & SONS	40.88
GODWIN'S NURSERY/PENINSULA PRO	0.35
GREEN ACRES FARMS	9.50
JOHN H DUER III	151.20
KELLEY FARM	21.98
KLUIS' NURSERIES	8.11
MATTHEWS FARM	21.74
NOCK FARM	5.47
PEACH ORCHARD FARM	12.50
STURGIS FARM	56.19
VAN KESTEREN FARMS INC	139.85
W.T. HOLLAND SONS INC	33.56
WEAVER FARM	28.12
WESSELLS FARM	11.59

5.5. Small Self-Supplied Use Outside of the Community Service Areas

Based on USGS estimates of small self-supplied population and water demands outside of the community service area, the County-wide trends for the period between 1985 and 2005 are decreasing[12]. The USGS data were extrapolated to 2040 using a linear interpolation for population and water demands (Table 5-12 and Figure 5-18).

Figure 5-18: Small Self-Supplied Water Demands Outside of the Community Service Areas

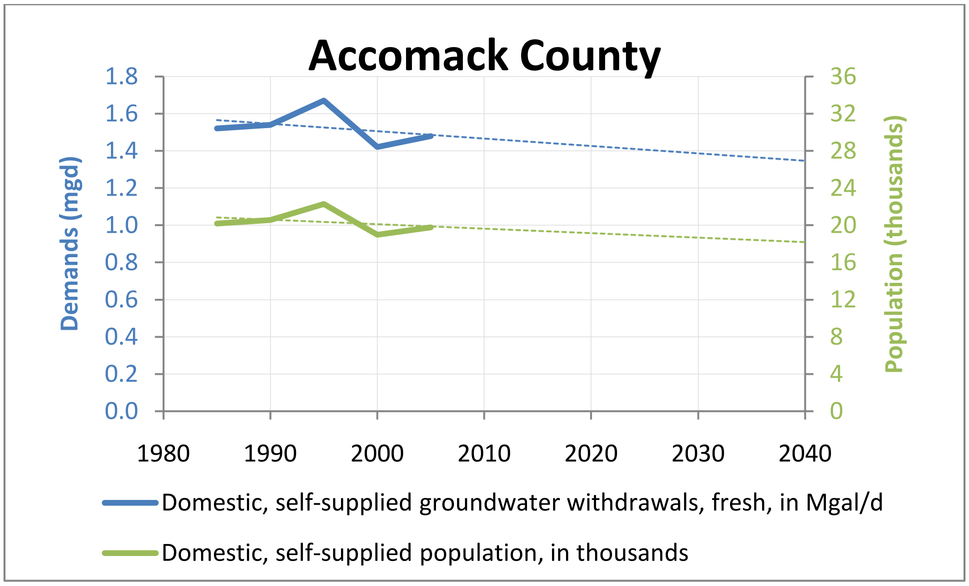


Table 5-12:
Small Self-Supplied Water Demand Projections

YEAR	POPULATION	AVERAGE DEMAND (GPD)
Projected Data		
2010	19,635	1,466,000
2020	19,151	1,426,000
2030	18,667	1,386,000
2040	18,183	1,346,000

6. Water Demand Management

(9 VAC 25-780-110)

Water demand management involves both an increase in efficiency of water use and a reduction of water losses. The net result is a decrease in demand for treated water that can defer development of new resources and reduce the cost of future water service. Each gallon of water conserved is one less requiring storage, treatment, and distribution. It may also represent one less gallon that has to be heated for washing or bathing, thus saving energy costs, or that must pass through a wastewater conveyance system and treatment before it is returned to the environment.

Conservation is an important complement to new supply sources. In some cases, conservation may eliminate the need for new sources of supply. Fresh water, like other natural resources, is a limited commodity which must be managed wisely to preserve the well-being of future generations. Efforts to conserve existing supplies and efficient allocation of water resources are important during each stage of the water supply planning process.

The Groundwater Management Act of 1992 requires a Groundwater Withdrawal Permit for all groundwater withdrawals greater than or equal to 300,000 gallons per month within declared Groundwater Management Areas, including the Eastern Shore Groundwater Management Area (ESGWMA). The Groundwater Withdrawal Regulations require that applications for new Groundwater Withdrawal Permits within the ESGWMA include a Water Conservation and Management Plan (WCMP) approved by the Virginia Department of Environmental Quality, Water Resources Division. The WCMP is included as an enforceable part of the permit to withdraw groundwater. Because groundwater is the sole source of water for public, commercial, and a majority of the industrial water supplies in Accomack County, the WCMPs that are part of the Groundwater Withdrawal Permit fulfill the Water Demand Management requirement under this section. Most agricultural uses that require irrigation also withdrawal groundwater at quantities requiring a permit, and will require a WCMP as part of the permit.

An approved WCMP must include:

- Use of water-saving plumbing and processes including, where appropriate, the use of water-saving fixtures in new and renovated plumbing as provided under the Uniform Statewide Building Code (USBC).
- A water loss reduction program.

- A water use education program.
- An evaluation of potential water reuse options.

There are also requirements for mandatory use reductions during water shortage emergencies, including, where appropriate, ordinances prohibiting the waste of water generally.

6.1. Public Water Supplies

The following are components associated with Water Demand Management common to public water supplies. Individual water systems will have their own WCMPs as part of their Groundwater Withdrawal Permits. These plans are provided in Appendix C.

6.1.1. Water Saving Equipment and Processes

The Building Officials and Code Administrators (BOCA) organization is a nonprofit organization which develops a series of performance-oriented model codes (BOCA, 1990). These codes were adopted by the Commonwealth of Virginia as part of the Virginia Uniform Statewide Building Code (USBC, 2006). These codes directly specify the use of water conservation fixtures in commercial and residential applications.

The USBC applies to all new construction and some remodeling of existing structures. The USBC requires that:

> *When reconstruction, renovation, or repair of existing buildings is undertaken, existing materials and equipment may be replaced with materials and equipment of similar kind or replaced with greater capacity equipment in the same location when not considered a hazard; however, when new systems, materials, and equipment that were not part of the original existing building are added, the new systems, materials, and equipment shall be subject to the edition of the USBC in effect at the time of their installation. Existing parts of such buildings not being reconstructed, renovated, or repaired need not be brought into compliance with the current edition of the USBC.*

The International Plumbing Code (IPC) sets maximum flow standards (Section 605.4) for a variety of fixtures and appliances. These standards are presented in the following table.

Plumbing Fixture or Fixture Setting	Maximum Flow Rate or Quantity [1]
Water Closet	1.6 gallons per flushing cycle

Urinal	1.0 gallon per flushing cycle
Shower head	2.5 gpm at 80 psi
Lavatory, private	2.2 gpm at 60 psi
Lavatory, public	0.5 gpm at 80 psi
Lavatory, public, metering or self-closing	0.25 gallon per metering cycle
Sink faucet	2.2 gpm at 60 psi

1 gpm - gallons per minute

The current standards set a maximum limit of 2.2 gallons per minute (gpm) at 80 pounds per square inch (psi) for showers and private lavatories. Water closets are limited to 1.6 gallons per flushing cycle, and urinals are limited to 1.0 gallons per cycle. In addition, lavatories in public facilities are limited to 0.5 gpm for those with standard valve or spring faucets and 0.25 gallons per cycle for self-closing metering valves (IPC, 2006).

The USBC in Virginia was adopted from the International Plumbing Code. States are permitted to develop plumbing codes that implement stricter measures than those imposed by the National Plumbing Code. However, localities in Virginia must obtain State authorization to develop a stricter code.

6.1.2. Water Loss Reduction Program

6.1.2.1. Water Loss Audit

Annually a water loss audit will be conducted to determine the volume and nature of lost and unaccounted-for water within the water supply system. The purpose of this audit is to identify sources of demand that would normally escape detection by the metering system. This type of demand includes:

1. Fire Fighting. The Fire Department will submit an estimate of all water used on a monthly basis including water used for fire-fighting and for hydrant flushing.

2. Main Flushing. All main flushing performed by the PWS will require the submittal of a water consumption estimate.

3. Theft. Any observed theft will be reported to the PWS and the appropriate action will be taken. An estimate of the volume of water stolen will be submitted as part of the annual water loss audit.

4. Main Breaks. All main breaks will require the reporting by PWS personnel of the estimated volume of water lost.

5. Tank Drainage. All draining of storage tanks in the main distribution system will be reported.

6. Unmetered Services. Every effort will be made to install meters on any portion of the system that is not yet metered as soon as funding becomes available. Grants will be solicited to provide funding.

7. Leaks. Upon completion of the first water loss audit, the PWS will develop a leak detection program which will have as its goal the complete survey of all distribution pipes and mains within the system, to be phased in over the next five years.

8. Meter Errors. The PWS will replace meters at a rate such that a complete system-wide meter turnover takes place every fifteen years, which is the typical warranty period for water meters. The size of meters requested by commercial and industrial customers will be evaluated and the developer will be consulted to help in determining the appropriate meter size for a particular site based on water use and the anticipated demand. Preventing the installation of oversized meters minimizes unwarranted waste of water.

9. Equipment Calibration. All meters at the well heads will be calibrated on an annual basis. There will be service to check and replace inaccurate meters. Large customer meters that are accessible will be field calibrated yearly. An on-going maintenance program will be implemented to locate and repair plant pipe leaks at the water treatment facilities.

All forms for reporting leaks and unaccounted-for water loss will be maintained by the PWS. These forms will be reviewed by PWS personnel on a daily basis so that measures can be taken to reduce unaccounted-for water loss.

6.1.2.2. Leak Repair Program

The owner of any residential unit, commercial establishment, or industrial establishment who is found, based on the water loss audit or by other methods, to be an excessive user of water due to leakage from water lines or plumbing fixtures on the premises will be notified by the PWS. These owners will be required to repair and stop such leakage within a reasonable period of time or will be subject to financial penalties.

6.1.3. Water Use Education Program

Public education concerning the importance of water conservation is a key factor in reducing excessive water use. Education programs should include information about how drinking water is produced and why it is important to conserve. Providing consumers with a better understanding of the reasons conservation is necessary allows them to better appreciate and participate in conservation activities.

The public education program planned by the PWS will include the following components:

1. Billing Inserts. Inserts will be included with water bills. The inserts will include information concerning water conservation techniques and leak detection strategies.

2. Brochures. Water conservation brochures and pamphlets will be made available to the public and at exhibits set up during public events.

3. Video Tapes. A variety of water conservation video tapes will be available from the PWS free of charge. They will be available to the general public, to schools for classroom instruction, and for public meetings. The videos will also be provided to cable television companies for showing on government channels.

4. Water Conservation Hot Line. A telephone number will be available through which residents can have their conservation questions answered by a knowledgeable Town employee. In addition, requests for information on various water conservation topics, speakers, or other personal contacts will be coordinated through this telephone line.

5. News Releases. News releases to the print media, radio, and television will keep the public informed. This process will be used not only during emergencies but also on a regular basis to keep the public informed about conservation-related issues.

6. School Education. Programs will be available for presentation by PWS staff at local schools. Programs will be targeted to specific age groups. Assistance will be made available for teachers who wish to develop their own water awareness programs.

7. Speakers. PWS staff will be available for speaking engagements or personal contacts. These individuals will work with local clubs and organizations to develop public awareness concerning the need to conserve water along with other topics related to the water supply industry.

8. Support of water table groundwater wells for irrigation of lawns and landscaping by residents, businesses and industries within the service area. The use of wells

screened in the water table aquifer for these activities helps to minimize the use of the confined Yorktown-Eastover aquifer.

6.1.4. Economic Incentives

Block rate schedules provide a mechanism for his schedule encourages conservation by not providing a lower rate to high volume water users. By charging large and small water users the same rate, large users have a greater incentive to conserve.

The Town will analyze its water rates annually. Rate setting goals will be as follows:

- Perpetuating Public Utilities self-sufficiency while maintaining the highest water quality standards.
- Recommending appropriate rates for water usage and special service charges that are equitable to all customers.
- Continuing a comprehensive water conservation policy by using public information and charges which will discourage nonessential use of water.

6.1.5. Water Reuse

Water reuse may be either direct or indirect and for potable or non-potable uses. Direct reuse involves introducing highly treated, reclaimed water directly to a potable water distribution system, while indirect reuse involves returning treated wastewater to the environment for dilution and natural purification, and subsequent withdrawal for water supply. Potable reuse (which is referred to as recycle by the Virginia Department of Health (VDH)) is the specific use of treated wastewater as a drinking water source.

Indirect potable reuse occurs widely in the United States, each time treated wastewater effluent is discharged to a natural waterway upstream of a water supply intake. In most cases, it is unintentional. Past experience indicates that indirect reuse was acceptable because the application of water and wastewater treatment techniques, the near-universal use of some form of disinfectant, and the natural dilution and purification that occurs in natural waterways adequately treated the water. However, in recent years the effectiveness of these measures in protecting against viral and trace organic contaminants has come under increasing scrutiny.

Unplanned and unintentional reuse of this type is classified as uncontrolled potable reuse, and represents the overwhelming majority of cases of indirect potable reuse.

6.1.5.1. Potable Reuse

The Virginia Department of Health has prepared a Recycle Issues paper dated November 24, 1992. The VDH stated its opposition to both direct and indirect potable reuse projects when naturally occurring sources of water are available. The VDH insists that the highest quality, best source of water be selected when alternatives are available. The VDH also listed several other requirements which would apply to a potable reuse project, pertaining to independent monitoring, dilution, liability, removal of biological hazards and toxics, and utilization of natural purification processes. Given the current position of the VDH, reuse of wastewater treatment plant effluent for potable purposes is not deemed a practicable reuse alternative to conserve water.

6.1.5.2. Non-Potable Reuse

Many industrial water demands are for non-potable uses. One method of reducing demands on potable water sources is to supply non-potable demands using treated wastewater plant effluent. Detailed regulations for implementation of a water reuse project do not exist in the Commonwealth of Virginia. Permitting of a water reuse project would most likely involve both the VDH and the Virginia Department of Environmental Quality (VDEQ). In addition, a Virginia Pollution Discharge Elimination System (VPDES) Permit would be required for discharge to State waters if the flow is not contaminated during its use; if it is contaminated, the approval of VDH and/or VDEQ would be required.

Several states including California, Arizona, Texas, Utah, and Florida have developed regulations and state statutes that specify the required minimum quality of reclaimed water, depending on the intended use of the water. In general, the requirements become more stringent as the likelihood of public contact increases. In California, if treated reclaimed water for industrial use meets the state's standards for full body contact recreation, workers are not required to avoid contact with the water or to wear protective clothing. However, precautions are required should the treated reclaimed water fail to meet these criteria. With the approval of State and local health departments, reclaimed water can be used for soil compaction, dust control, and other construction purposes.

As mentioned previously, recycling will be required in all new car washes and existing car washes will be required to be retrofitted. In addition, required recycling systems are being considered for all new construction and all repair or replacement of continuous flow devices, including any water connector, device, or appliance which requires a continuous flow of 5 gallons per minute or more.

Typically, non-potable markets for reused water include irrigation uses, industrial uses, and creation of recreational lakes. Many factors affect the market for reused water, including:

- Size and location of demand.
- Water quality requirements.
- Degree of treatment required for discharge.
- Cost of reclaimed water.

- Cost and availability of alternative supplies.

It is likely that additional reuse methodologies will be evaluated in the future. Industries within the service area that use large quantities of water are continually evaluating their processes and looking for ways to lower production costs. For these industries, water represents one of their greatest operating expenses. It is in the best interest of these industries to stay abreast of the latest reuse technologies and employ them whenever feasible.

6.2. Commercial and Industrial Supplies

The following are components associated with Water Demand Management common to commercial and industrial water supplies. Individual water systems will have their own WCMPs as part of their Groundwater Withdrawal Permits. These plans are provided in Appendix C.

6.2.1. Water Saving Equipment and Processes

The Building Officials and Code Administrators (BOCA) organization is a nonprofit organization which develops a series of performance-oriented model codes (BOCA, 1990). These codes were adopted by the Commonwealth of Virginia as part of the Virginia Uniform Statewide Building Code (USBC, 2006). These codes directly specify the use of water conservation fixtures in commercial and residential applications.

The USBC applies to all new construction and some remodeling of existing structures. The USBC requires that:

> *When reconstruction, renovation, or repair of existing buildings is undertaken, existing materials and equipment may be replaced with materials and equipment of similar kind or replaced with greater capacity equipment in the same location when not considered a hazard; however, when new systems, materials, and equipment that were not part of the original existing building are added, the new systems, materials, and equipment shall be subject to the edition of the USBC in effect at the time of their installation. Existing parts of such buildings not being reconstructed, renovated, or repaired need not be brought into compliance with the current edition of the USBC.*

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Lavatory, public	0.5 gpm at 80 psi
Lavatory, public, metering or self-closing	0.25 gallon per metering cycle
Sink faucet	2.5 gpm at 60 psi

1 gpm - gallons per minute

The current standards set a maximum limit of 2.5 gallons per minute (gpm) at 80 pounds per square inch (psi) for showers and private lavatories. Water closets are limited to 1.6 gallons per flushing cycle, and urinals are limited to 1.0 gallons per cycle. In addition, lavatories in public facilities are limited to 0.5 gpm for those with standard valve or spring faucets and 0.25 gallons per cycle for self-closing metering valves (IPC, 1996).

The USBC in Virginia was adopted from the International Plumbing Code. States are permitted to develop plumbing codes that implement stricter measures than those imposed by the National Plumbing Code. However, localities in Virginia must obtain State authorization to develop a stricter code.

6.2.2. Water Loss Reduction Program

There are a wide variety of commercial and industrial uses of water and water loss reduction programs specific to that enterprise are included in the WCMPs provided in Appendix C. However, there are common components that apply to most commercial and industrial uses:

- Routinely record water meter readings. Review use to identify changes that might indicate a leak. Use of historical tables, time-trend graphs, and/or process limits as applicable will be used to identify abnormal use patterns.
- Routinely inspect piping and tanks for any indication of leaks.
- Implement written procedures to address leaks that will include means for a rapid repair and/or leak bypass to minimize water loss.
- Replace meters at a rate such that a complete system-wide meter turnover takes place every fifteen years, which is the typical warranty period for water meters.

- All meters at the well heads will be calibrated on an annual basis. There will be service to check and replace inaccurate meters.

6.2.3. Water Use Education Program

Water use education is highly specific to the commercial and/or industrial use. Education programs for individual commercial and industrial users are described in the WCMPs included in Appendix C.

6.2.4. Water Reuse

Water reuse may be either direct or indirect and for potable or non-potable uses. Direct reuse involves introducing highly treated, reclaimed water directly to a potable water distribution system, while indirect reuse involves returning treated wastewater to the environment for dilution and natural purification, and subsequent withdrawal for water supply. Potable reuse (which is referred to as recycle by the Virginia Department of Health (VDH)) is the specific use of treated wastewater as a drinking water source.

Indirect potable reuse occurs widely in the United States, each time treated wastewater effluent is discharged to a natural waterway upstream of a water supply intake. In most cases, it is unintentional. Past experience indicates that indirect reuse was acceptable because the application of water and wastewater treatment techniques, the near-universal use of some form of disinfectant, and the natural dilution and purification that occurs in natural waterways adequately treated the water. However, in recent years the effectiveness of these measures in protecting against viral and trace organic contaminants has come under increasing scrutiny.

Unplanned and unintentional reuse of this type is classified as uncontrolled potable reuse, and represents the overwhelming majority of cases of indirect potable reuse.

6.2.4.1. Potable Reuse

The Virginia Department of Health has prepared a Recycle Issues paper dated November 24, 1992. The VDH stated its opposition to both direct and indirect potable reuse projects when naturally occurring sources of water are available. The VDH insists that the highest quality, best source of water be selected when alternatives are available. The VDH also listed several other requirements which would apply to a potable reuse project, pertaining to independent monitoring, dilution, liability, removal of biological hazards and toxics, and utilization of natural purification processes. Given the current position of the VDH, reuse of wastewater treatment plant effluent for potable purposes is not deemed a practicable reuse alternative to conserve water.

6.2.4.2. Non-Potable Reuse

Many industrial water demands are for non-potable uses. One method of reducing demands on potable water sources is to supply non-potable demands using treated wastewater plant effluent. Detailed regulations for implementation of a water reuse project do not exist in the Commonwealth of Virginia. Permitting of a water reuse project would most likely involve both the VDH and the Virginia Department of Environmental Quality (VDEQ). In addition, a Virginia Pollution Discharge Elimination System (VPDES) Permit would be required for discharge to State waters if the flow is not contaminated during its use; if it is contaminated, the approval of VDH and/or VDEQ would be required.

Several states including California, Arizona, Texas, Utah, and Florida have developed regulations and state statutes that specify the required minimum quality of reclaimed water, depending on the intended use of the water. In general, the requirements become more stringent as the likelihood of public contact increases. In California, if treated reclaimed water for industrial use meets the state's standards for full body contact recreation, workers are not required to avoid contact with the water or to wear protective clothing. However, precautions are required should the treated reclaimed water fail to meet these criteria. With the approval of State and local health departments, reclaimed water can be used for soil compaction, dust control, and other construction purposes.

As mentioned previously, recycling will be required in all new car washes and existing car washes will be required to be retrofitted. In addition, required recycling systems are being considered for all new construction and all repair or replacement of continuous flow devices, including any water connector, device, or appliance which requires a continuous flow of 5 gallons per minute or more.

Typically, non-potable markets for reused water include irrigation uses, industrial uses, and creation of recreational lakes. Many factors affect the market for reused water, including:

- Size and location of demand.
- Water quality requirements.
- Degree of treatment required for discharge.
- Cost of reclaimed water.
- Cost and availability of alternative supplies.

It is likely that additional reuse methodologies will be evaluated in the future. Industries within the service area that use large quantities of water are continually evaluating their processes and looking for ways to lower production costs. For these industries, water represents one of their greatest operating expenses. It is in the best interest of these industries to stay abreast of the latest reuse technologies and employ them whenever feasible.

6.3. Agricultural Supplies

The following are components associated with Water Demand Management common to agricultural irrigation systems. Agricultural irrigation systems that use greater or equal to 300,000 gallons per month will have their own WCMPs as part of their Groundwater Withdrawal Permits. These plans are provided in Appendix C. In addition to the WCMPs, the Natural Resources Conservation Service (NRCS) provides significant technical and financial assistance to the agricultural community in implementing measures that directly conserves water. The program that has the greatest impact is the Environmental Quality Incentive Program (EQIP) that provides irrigation efficiency upgrades, irrigation pond and pond expansions, Irrigation Water Management Plans, and tailwater recovery systems.

6.3.1. Water Saving Equipment and Processes

The primary water savings for agricultural supplies rely on methods for irrigation scheduling and use of high efficiency irrigation systems, including use of computerized irrigation systems. Irrigation scheduling includes:

- Assessing soil moisture levels (e.g.; tensiometers)
- Morning and evening irrigation
- Low wind conditions

High efficiency irrigation systems generally refer to systems that achieve 80% or better efficiency. While the most efficient systems are drip irrigation systems, and micro-irrigation systems, there are some overhead systems such as center-pivot that, if equipped with high efficiency heads (low pressure sprinklers and end guns) and operated at times to minimize loss, can achieve high levels of efficiency. The NRCS, through the EQIP program assists the agricultural community in implementing irrigation efficiency upgrades to the systems. Some of the significant system upgrades funded through the EQIP program include:

- Converting overhead impact sprinklers to drops
- Converting overhead sprays to drops
- Updating nozzles and pressure regulators on existing drops
- Updating nozzles and pressure regulators on existing overhead
- Providing end guns, valves, shut-off devices, and booster pumps

Continued support for the EQIP program is critical for continued improvement in these systems.

6.3.2. Water Loss Reduction Program

Water and water loss reduction programs specific to a agricultural user are included in the individual WCMPs provided in Appendix C. However, there are common components that apply to most agricultural uses:

- Routinely record use. Review use to identify changes that might indicate a leak. Use of historical tables, time-trend graphs, and/or process limits as applicable will be used to identify abnormal use patterns.
- Routinely inspect piping and tanks for any indication of leaks.
- Implement written procedures to address leaks that will include means for a rapid repair and/or leak bypass to minimize water loss.

While also directly related to re-use, irrigation ponds, and expansion of irrigation ponds assist in reducing water loss by capturing storm water runoff. When an irrigation pond is sited, and when agricultural land is re-graded, directing storm water to the irrigation pond significantly increases the storage capacity of these systems.

6.3.3. Water Use Education Program

Water use education is accomplished primarily through NRCS programs, such as the EQIP programs and agricultural extension programs through the local co-op agencies and Farm Bureau.

6.3.4. Water Reuse

Reuse consists principally of recapturing two types of flow:

- Tailwater Recovery
- Wastewater Reuse

Tailwater recovery systems have the potential to significantly capture any excess irrigation water and storm water for reuse as irrigation water. These systems are widely promoted by the NRCS as a conservation practice standard and, through the EQIP program have implemented several tailwater recovery systems on the Eastern Shore. Expansion of these systems should be encouraged.

Wastewater reuse somewhat restricted by FDA requirements for certain agricultural products. However, reuse has been implemented for number agricultural systems, most noticeably for some nursery operations.

6.4. Resource Protection Ordinance

Accomack County has adopted an Ordinance, *§106-235*, which includes provisions to protect and preserve the water resource. This Ordinance provides for water resource protection for some developments that may use less than the 300,000 gallon per month requirement for a Groundwater Withdrawal Permit. Specifically, the Ordinance applies to *"any commercial or industrial development which creates five acres or more impervious surface, or any subdivision which creates 50 or more lots"*.

The objectives of the Ordinance includes the provision to *"maintain water supply quality and quantity standards at a suitable level necessary to serve adequately and efficiently the public need, health, and welfare; and sustain the integrity of water resources and other sensitive natural resources."* The Ordinance requires preparation of a Resource Quality Protection Plan that includes the following components that directly address the water resources:

- Goals to:
    - Minimize or eliminate the transport of pollutants from development activities to surface and groundwater.
    - Prevent harm to the community by activities which adversely affect surface water, groundwater, and other sensitive natural resources.
    - Maintain or restore groundwater recharge areas and groundwater storage levels.
    - Prevent damage to tidal and non-tidal wetlands which aid in the maintenance of surface water and groundwater quality.
- An evaluation of potential groundwater quality and quantity effects that include the following information:
    - Average and daily proposed withdrawals
    - Number of wells, locations, capacity, and screen interval
    - Water quality analysis (chlorides)
    - An evaluation of potential groundwater quality and quantity effects.
- A provision that groundwater withdrawal will not limit the ability to use the water associated with the development or any existing groundwater use

A copy of the Accomack County Ordinance is included in Appendix D.

7. Drought Response and Contingency Plan

(9 VAC 25-780-120)

In accordance with Water Supply Planning Regulations, Section 9 VAC 25-780-120, the following discussion presents a Drought Response and Contingency Plan (DRCP) as a component of the WSP.

A drought is a period of unusually dry weather, including lower than normal levels of precipitation, which persists long enough to cause serious problems such as water supply shortages and/or crop damage. The present DRCP is focused on identifying drought conditions and implementing appropriate responses in order to maintain adequate water supplies in Accomack County. The successful response to drought conditions in the Planning Region largely depends upon public education and involvement.

The DRCP outlines a regional approach to responding to drought, while recognizing that drought conditions will vary across the County, and specific response and contingency actions will be made based on local conditions. The plan recognizes the unique characteristics of water sources within the region, as well as the beneficial uses of the water.

The DRCP includes four graduated stages of responses to the onset of drought conditions within the Planning Area:

DRCP STAGE	VDEQ DROUGHT MONITOR CONDITIONS	CONDITIONS	MAJOR RESPONSE
■ Normal Conditions	--	Normal Conditions	--
	D0	Abnormally dry (short-term)	
■ Drought Watch	D1	Moderate Drought	Public awareness campaign
■ Drought Warning	D2	Severe Drought	Voluntary restrictions
■ Drought Emergency	D3	Extreme Drought	Mandatory restrictions
	D4	Exceptional Drought	

The plan is based on enacted local ordinances (Appendix D) and procedures for the implementation and enforcement of the plan, in accordance with 9 VAC 25-780-120.3. Furthermore, the DRCP acknowledges the role of the Commonwealth in monitoring and responding to drought conditions as outlined in the Virginia Drought Assessment and

Response Plan, dated March 28, 2003 (Appendix E), while reserving the right to respond to those conditions and enforce the actions presented in this plan based on local conditions and local procedures.

7.1. Purpose

The purpose of this DRCP is to provide a contingency plan to:

- Manage the use of water resources in Accomack County in the event of drought conditions or other water supply emergencies,
- Establish an enforceable programmed response for each drought stage that will reduce water consumption with the least adverse impact on the residents and businesses of Accomack County
- Respond to non-climate related water supply emergencies, such as contamination or equipment failure, which may result in the need to restrict water use until water service can be restored.

7.2. Drought Indicators

The process of determining the presence or severity of a drought is complex and can be based on numerous indicators. In the Commonwealth of Virginia, drought evaluations are made by the Virginia Drought Monitoring Task Force (VDMTF), an interagency group of technical representatives from state and federal agencies responsible for monitoring natural resource conditions and the effects of drought on various segments of society. During periods of normal moisture conditions, the VDEQ monitors the NOAA U.S. Drought Monitor and prepares a monthly report and drought map specific to Virginia. The VDMTF is activated following an occurrence of moderate drought conditions (D1) as reported by the U.S. Drought Monitor program. The VDMTF may also active following the occurrence of smaller scale drought conditions that occur below the resolution of the Drought Monitor. The VDMTF monitors the progression of drought conditions (using typical drought indicators including precipitation deficits, groundwater levels, stream flows, and reservoir storage) and their effects on various sectors of society including water supply, agriculture, forestry and recreation. The VDMTF remains active until drought conditions have receded to unusually dry levels (D0) as reported by the U.S. Drought Monitor on a state wide level and may remain active longer if small areas beneath the resolution of the Drought Monitor continue to experience drought impacts. The VDMTF also provides recommendations for the declaration of the various drought stages. Virginia is currently divided into thirteen drought evaluation regions, including the Eastern Shore Drought Evaluation Region to which Accomack County belongs.

7.2.1. Precipitation Deficits

Precipitation deficits are monitored by the VDMTF which compares current local precipitation amounts (compiled by the Office of the State Climatologist) with 30-year local precipitation normals (developed by NOAA). Deficits are evaluated as running averages from the start of a water year (which begins on October 1), or on a trailing 12-month average for more extended events (Table 7-1 and Figure 7-1).

Figure 7-1: Seasonal drought triggers relative to precipitation normals

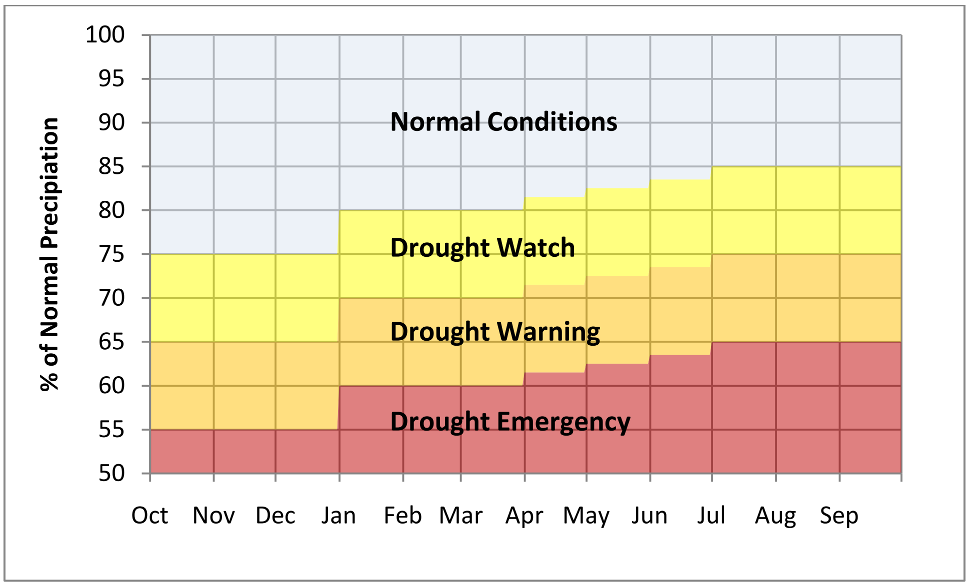


Table 7-1:
Seasonal drought triggers relative to precipitation normals

	DROUGHT STAGE			
Months Analyzed	**Normal Conditions**	**Drought Watch**	**Drought Warning**	**Drought Emergency**
	(% of Normal Precipitation)			
October-December	>75.0	<75.0	<65.0	<55.0
October-January	>80.0	<80.0	<70.0	<60.0
October-February	>80.0	<80.0	<70.0	<60.0
October-March	>80.0	<80.0	<70.0	<60.0
October-April	>81.5	<81.5	<71.5	<61.5
October-May	>82.5	<82.5	<72.5	<62.5
October-June	>83.5	<83.5	<73.5	<63.5
October-July	>85.0	<85.0	<75.0	<65.0
October-August	>85.0	<85.0	<75.0	<65.0

October – September (and previous 12 months)	>85.0	<85.0	<75.0	<65.0

7.2.2. Groundwater Levels

Groundwater monitoring wells located in the water table aquifer representing drought evaluation regions are used by the VDMTF to monitor shallow groundwater responses to drought conditions. Measured water levels are compared to the historic water level statistics for the entire period of record of a given monitoring well. Measured groundwater levels within the ranges shown in Table 7-2 have been recommended by the Drought Response Technical Advisory Committee to be indicative one of the four drought conditions.

Table 7-2:
Measured groundwater level relative to statistical occurrence

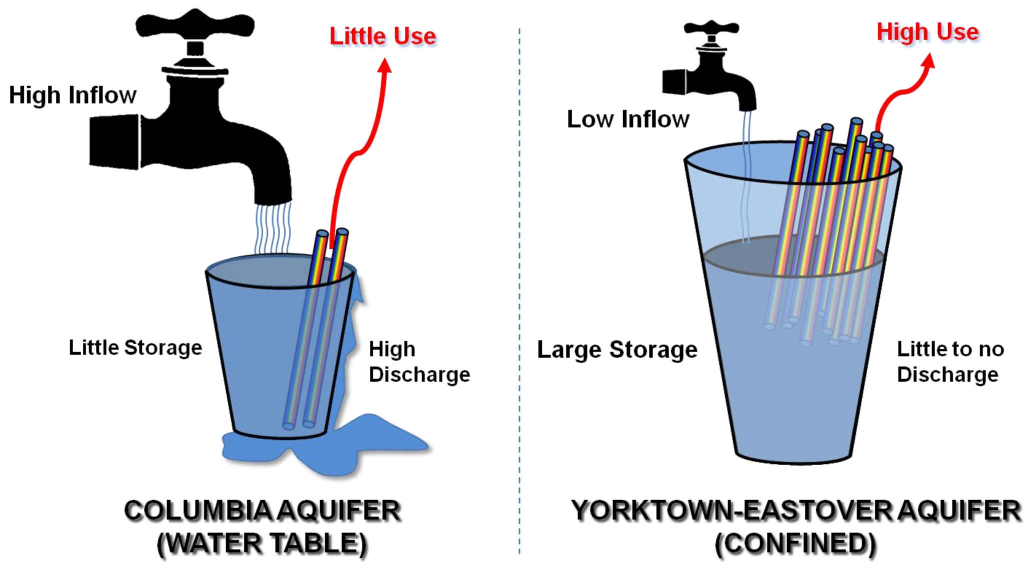
	DROUGHT STAGE			
	Normal Conditions	**Drought Watch**	**Drought Warning**	**Drought Emergency**
	(% occurrence relative to all historical measured groundwater levels)			
Measured Groundwater Level	>25 %	10-25 %	5-10 %	<5 %

Representative monitoring wells were selected by the Drought Response Technical Advisory Committee as part of the Drought Assessment and Response Plan process on the basis of period of record and relative location within the drought evaluation region. The Withmans Observation Well (USGS local number 19 SOW 110S) was selected as the monitoring well most representative of conditions in Accomack County.

Information from the USGS well wells will be used only to provide general insights into regional conditions, which will then be shared with the public, but will not represent a primary criterion for drought evaluation in Accomack County. This is because despite the Accomack County's nearly complete reliance on groundwater, at current usage rates, the effects of droughts occurring over time frames of less than a few years have little *direct* impact on the availability of water, provided water usage does not significantly increase during the drought. In the water table aquifer, the average recharge rate typically far exceeds water usage (625 MGD vs. less than 1 MGD, respectively) and the large majority of recharge is returned to the hypergean environment through evapotranspiration and discharge to surface water bodies. In the confined aquifers, the recharge rate is much lower and is on the same order of magnitude as withdrawals (9 MGD, vs. approximately 10 MGD) with little discharge to overlying aquifers and surface water bodies; however the storage in the confined aquifers is far greater than in the water table aquifer and temporary recharge deficits have a small impact on the total storage.

Furthermore, increased usage in the confined aquifer(s) will be somewhat offset by a lesser yet proportional increase in leakage from the overlying aquifer(s). A conceptual representation of the relative differences in water budgets between the water table and confined aquifers is shown in Figure 7-2. Furthermore, variations in water availability occur on a scale that can be fairly localized and measured water levels in a single well are not likely to be representative may not representative of conditions across the entire County.

Figure 7-2: Conceptual differences in water budgets between the water table and confined aquifers on the Eastern Shore of Virginia



However, significant drought events are typically associated with increased water demands, particularly for agricultural and landscaping irrigation and other seasonal water uses. *Indirect* impacts to groundwater availability during drought events on the Eastern Shore are typically associated with local water level declines due to increased usage. Therefore, for a given drought to be based on groundwater indicators alone, it may be preferable to provide the flexibility to discrete water supply systems (community, agricultural and other self-supplied systems) such that local groundwater water levels may be used as indicators of local drought conditions and severity for each system or portions of the County. The recommended indicator of a drought emergency for a (community or individual) groundwater water supply system is either a water level less than 5 ft above the intake or 80 percent of available drawdown in a production well. For systems where production well water level measurements are impracticable, a nearby observation well may also be used.

7.2.3. Streamflow and Reservoir Storage

As discussed in previous sections of the present WSP, Accomack County does not have any significant fresh surface water features and derives all of its water supply from groundwater, with the exception of a few irrigation ponds. Therefore, the use of streamflow and reservoir storage as an indicator of drought is not particularly pertinent in Accomack County.

7.2.4. Other Indicators

The DMTF also evaluates other available indicators including the VDOF Cumulative Severity and Keech-Byrum Drought Indeces and other data for forest impacts and information compiled by the Virginia Agricultural Statistics Service and the Virginia Cooperative Extension Service to assess the impacts of drought on agricultural interests, in addition to the number of requests for federal drought disaster designation reported by the Virginia Department of Agriculture and Consumer Services. Furthermore, the VDMTF also considers operating conditions at public waterworks in the determination of drought recommendations.

7.3. Drought Stage Declarations

The DMTF and individual water system managers may use the indicators described above to assess drought conditions across the County and at individual systems, respectively. The following general descriptions will be used to guide drought stage declarations locally and to make recommendations to the Virginia Drought Coordinator for County-wide declarations:

- **Normal Conditions**
  - Precipitation exceeds the percent of normal precipitation threshold specified for normal conditions and the relevant time period shown in Table 7-1 and
  - Groundwater levels are above the 25th percentile for all historic levels

- **Drought Watch**
  - Precipitation at or below the percent of normal precipitation threshold specified for drought watch conditions and the relevant time period shown in Table 7-1 or
  - Groundwater levels are between the 25th and 10th percentile for all historic levels

- **Drought Warning**
  - Precipitation at or below the percent of normal precipitation threshold specified for drought warning conditions and the relevant time period or
  - Groundwater levels are between the 25th and 10th percentile for all historic levels

- **Drought Emergency**
  - Precipitation at or below the percent of normal precipitation threshold specified for drought emergency conditions and the relevant time period,
  - Groundwater levels measured in production wells levels are less than 5 ft above the pump intake, or
  - Groundwater level measured in production or nearby observation wells show drawdown greater than 80 percent relative to non-pumping water levels.

The process of determining the presence or severity of a drought is complex and requires a certain level of professional judgment, therefore, the preceding descriptions should not be viewed as absolute requirements for drought designation, but rather as a mechanism to be used to reach consensus on the appropriate drought recommendations at the County-wide and local levels.

Drought Stages conditions may be declared for the entire county or portions of the county by the Virginia Drought Coordinator and for individual community and self-supplied water supply systems by their respective management. The more stringent of differing declarations should apply in the case of a discrepancy, subject to spatial jurisdiction.

7.4. Drought Stage Responses

As discussed above, the DRCP includes the use of four graduated drought stages: normal conditions, drought watch, drought warning, and drought emergency. Normal conditions represent status quo operating conditions.

The drought watch stage responses are generally responses intended to raise awareness of water users in the jurisdiction to climatic conditions that are likely to precede the occurrence of a significant drought event. Public outreach activities to raise this awareness are identified as well as conservation activities that may be used to reduce demand.

Drought warning stage responses are generally responses that are required when the onset of a significant drought event is imminent. Voluntary water conservation activities are identified with the goal of reducing water use by 5 – 10%, in accordance with 9 VAC 25-780-120.A.2.b.

Drought emergency stage responses are generally responses that are required during the height of a significant drought event. Mandatory water conservation activities are identified with the goal of reducing water use by 10 – 15%, in accordance with 9 VAC 25-780-120.A.2.c.

The subsections below represent guidelines and language that may be used to develop local or county wide Drought Management and Contingency Planning ordinances.

7.4.1. Normal Operation

Community water supply systems servicing incorporated towns in Accomack County shall be operated by a qualified operator and division supervisor under the purview of the director of public works and town manager. The supply system operator and/or supervisor shall report routine operations and monthly water usage to the director of public works and town manager. The town manager shall further advise the public works committee of the town council and the mayor. Other community water supply systems shall be operated by a qualified operator coordinating with relevant County and State agencies. Normal operation of community water systems will include at least monthly water level measurements in production wells or nearby observation wells and the collection or review of local precipitation data to monitor the potential for drought conditions to occur. More frequent data collection may be required during dry conditions.

7.4.2. Drought Watch

Following the declaration of a countywide, regional or local drought watch, the town manager, system operator/supervisor, and/or director of public works for affected individual public water supply systems and the administrators of affected large self-supplied water withdrawals exceeding 10,000 gpd will:

- Review existing drought water conservation and contingency plans and
- Make reasonable efforts to pursue leak detection and repair programs.

Furthermore, where an individual public water supply system unilaterally declares a drought watch for their service area, the system operator/supervisor will:

- Inform the VDH of their self-declared drought watch and
- Issue a press release indicating the reasons for the declaration.

If a major water leak or water supply equipment occurs in a community water supply system, repairs shall be immediately initiated by the relevant department and the town manager shall be immediately notified of such. In conjunction with the town manager and public works committee chair, the waterworks supervisor/operator and director of public works shall determine if a water shortage will occur as a result of the leak or equipment failure.

7.4.3. Drought Warning

Following the declaration of a Countywide, regional or local drought warning or serious water shortage due to a major leak, equipment failure non-climate related water supply disruption, the town manager, system operator/supervisor, and/or director of public works for affected public water supply systems will:

- Issue public announcements encouraging the voluntary reduction or elimination of non-essential water uses including car washing, lawn watering, garden watering, and water usage by swimming pools and other recreational facilities after consultations with the mayor and public works committee chair and
- Voluntarily reduce or eliminate non-essential flushing of water lines and other operational water uses.

The goal of the voluntary water use restrictions shall be to reduce total water consumption by 5 to 10 percent. If the drought warning is self-declared, the town manager, system operator/supervisor, and/or director of public works for individual community water supply systems will also notify the VDH.

Following the declaration of a Countywide or regional the administrators of large self-supplied water withdrawals exceeding 10,000 gpd will voluntarily reduce or eliminate non-essential flushing of water lines and other operational water uses.

7.4.4. Drought Emergency

Following the declaration of a Statewide, Countywide, or regional drought emergency by the Governor by executive order, the town manager, system operator/supervisor, and/or director of public works for affected public water supply systems will:

- Issue public announcements declaring the mandatory reduction or elimination of non-essential water uses including car washing, lawn and garden watering, and water usage by swimming pools and other recreational facilities. The following specific prohibitions will apply:

Unrestricted irrigation of lawns, gardens and other landscaped areas is prohibited

- Newly sodded and seeded areas may be irrigated to establish cover on bare ground at the minimum rate necessary for no more than a period of 60 days, irrigation rate may not exceed a total of one inch of applied water in any seven day period.
- Gardens, bedding plants, trees, shrubs and other landscape materials may be water with hand held containers, hand-held hoses equipped with an automatic shutoff device, sprinklers, or other automated water devices at the minimum rate necessary but in no case more frequently than twice per week.
- All allowed lawn irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Irrigation systems may be tested after installation, routine maintenance or repair for no more than ten minutes per zone.

Unrestricted irrigation of golf courses is prohibited

- Tees and greens may be irrigated between the hours of 9:00PM and 10 AM a the minimum rate necessary
- Localized dry areas may be irrigated with a hand held container or hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Greens may be cooled by syringing or by the application of water with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Fairways may be irrigated between the hours of 9:00 PM and 10:00 AM at the minimum rate necessary not to exceed one inch of applied water in any ten-day period.
- Fairways, tees and greens may be irrigated during necessary overseeding or resodding operations in September and October at the minimum rate necessary. Irrigation rates during this restorations period may not exceed one inch of applied water in any seven-day period.
- Newly constructed fairways, tees and greens and areas that are re-established by sprigging or sodding may be irrigated at the minimum rate necessary not to exceed one inch of applied water in any seven-day period for a total period that does not exceed 60 days.
- Fairways, tees and greens may be irrigated without regard to the restrictions listed above so long as:

  - The only water sources utilized are water features whose primary purpose is stormwater management,
  - Any water features utilized do not impound permanent streams,
  - During declared Drought Emergencies these water features receive no recharge from other water sources such as ground water wells, surface water intakes, or sources of public water supply, and,
  - All irrigation occurs between 9:00 p.m. and 10:00 a.m.
- All allowed golf course irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Rough areas may not be irrigated.

Unrestricted irrigation of athletic fields is prohibited.

- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at a rate not to exceed one inch per application or more than a total of one inch in multiple applications during any ten-day period. All irrigation water must fall on playing surfaces with no outlying areas receiving irrigation water directly from irrigation heads.
- Localized dry areas that show signs of drought stress and wilt (curled leaves, foot-printing, purpling) may be syringed by the application of water for a cumulative time not to exceed fifteen minutes during any twenty four hour period. Syringing may be accomplished with an automated irrigation system or with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. during necessary overseeding, sprigging or resodding operations at the minimum rate necessary for a period that does not exceed 60 days. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period. Syringing is permitted during signs of drought stress and wilt (curled leaves, foot-printing, purpling).
- All allowed athletic field irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Irrigation is prohibited on athletic fields that are not scheduled for use within the next 120-day period.
- Water may be used for the daily maintenance of pitching mounds, home plate areas and base areas with the use of hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary.
- Skinned infield areas may utilize water to control dust and improve playing surface conditions utilizing hand held containers or hand held hoses equipped

with an automatic shutoff device at the minimum rate necessary no earlier than two hours prior to official game time.

Washing paved surfaces such as streets, roads, sidewalks, driveways, garages, parking areas, tennis courts, and patios is prohibited.

- Driveways and roadways may be pre-washed in preparation for recoating and sealing.
- Tennis courts composed of clay or similar materials may be wetted by means of a hand-held hose equipped with an automatic shutoff device at the minimum rate necessary for maintenance. Automatic wetting systems may be used between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.
- Public eating and drinking areas may be washed using the minimum amount of water required to assure sanitation and public health.
- Water may be used at the minimum rate necessary to maintain effective dust control during the construction of highways and roads.

Use of water for washing or cleaning of mobile equipment including automobiles, trucks, trailers and boats is prohibited.

- Mobile equipment may be washed using hand held containers or hand held hoses equipped with automatic shutoff devices provided that no mobile equipment is washed more than once per calendar month and the minimum amount of water is utilized.
- Construction, emergency or public transportation vehicles may be washed as necessary to preserve the proper functioning and safe operation of the vehicle.
- Mobile equipment may be washed at car washes that utilize reclaimed water as part of the wash process or reduce water consumption by at least 10% when compared to a similar period when water use restrictions were not in effect.
- Automobile dealers may wash cars that are in inventory no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
- Automobile rental agencies may wash cars no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or

automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.

- Marine engines may be flushed with water for a period that does not exceed 5 minutes after each use.

Use of water for the operation of ornamental fountains, artificial waterfalls, misting machines, and reflecting pools is prohibited.

- Fountains and other means of aeration necessary to support aquatic life are permitted.
- Use of water to fill and top off outdoor swimming pools is prohibited.
- Newly built or repaired pools may be filled to protect their structural integrity.
- Outdoor pools operated by commercial ventures, community associations, recreation associations, and similar institutions open to the public may be refilled as long as:
  - Levels are maintained at mid-skimmer depth or lower,
  - Any visible leaks are immediately repaired
  - Backwashing occurs only when necessary to assure proper filter operation,
  - Deck areas are washed no more than once per calendar month (except where chemical spills or other health hazards occur),
  - All water features (other than slides) that increase losses due to evaporation are eliminated, and
  - Slides are turned off when the pool is not in operation.
- Swimming pools operated by health care facilities used in relation to patient care and rehabilitation may be filled or topped off.
- Indoor pools may be filled or topped off.
- Residential swimming pools may be filled only to protect structural integrity, public welfare, safety and health and may not be filled to allow the continued operation of such pools.

- Declare mandatory water use restrictions for hotels, motels, tourist homes, campgrounds, trailer parks, and all other commercial establishments. Such establishments shall be required to notify their patrons and restrict water usage for bathing and other purposes to a bare minimum. Restaurants and food service establishments will provide water to customers only when requested, and
- Place a moratorium on all new water service connections.

- Coordinate with law enforcement officials who shall issue tickets to violators of mandatory use restrictions. Upon conviction, a violator shall be guilty of a class 4 misdemeanor, and each incident shall be considered a separate offence.

The goal of the voluntary water use restrictions shall be to reduce total water consumption between 10 and 15 percent, or higher depending on the severity of the drought or critical water supply emergency. All residential, business and industrial water users; whether supplied by public water supplies, self-supplied sources, or private water wells; who do not normally utilize water for any of the listed prohibited uses are requested to voluntarily reduce water consumption by at least 10%. This reduction may be the result of elimination of other non-essential water uses, application of water conservation practices, or reduction in essential water uses.

If the drought emergency or water supply emergency is self-declared, the town manager, system operator/supervisor, and/or director of public works for individual community water supply systems will also notify the VDH and the Virginia Emergency Operations Center.

Water Rationing

In some cases, the mandatory non-essential water use restrictions may not be sufficient to protect the supplies of an individual public waterworks. When an individual waterworks' sources are so depleted as to threaten public health and safety, it may become necessary to ration water within that system in order to assure that water is available to support essential uses. Rationing water is a more severe measure than merely banning nonessential uses of water. Under rationing, each customer is allotted a given amount of water, based on a method of allotment developed by the waterworks or local government. Generally, it will be based on a percentage of previous usage or on a specific daily quantity per household. Rationing is more likely to have some effect on welfare than mandatory non-essential use restrictions, because industrial and commercial water uses may be curtailed or eliminated to assure an adequate supply is available for human consumptive uses.

The decision to ration water will typically be made by the local government or waterworks operator. The Virginia Drought Coordinator will work closely with any entity where water rationing is required to assure that all available State resources are effectively used to support these highly stressed water supply systems. The Virginia Department of Emergency Management (VDEM) is the first point of contact for waterworks or local governments who decide to ration water. VDEM will coordinate the Commonwealth's response and assistance to such entities.

8. Statement of Need and Alternatives
(9 VAC 25-780-130)

This Section describes the adequacy of the existing water sources and whether they meet the current and projected demands. In addition, potential alternatives to increase current supplies or develop new water supplies are discussed.

8.1. Adequacy of Existing Water Sources

The Columbia and Yorktown-Eastover multi-aquifer system within Accomack County and the Eastern Shore of Virginia has been designated a Sole Source Aquifer by the USEPA. As such, availability of fresh water supply in Accomack County is limited. However, given the current and projected demands, there is sufficient water supply to meet the overall needs of Accomack County. The challenge for the County in the future is to manage the resource in a manner that will avoid local degradation of the water supply that can occur even under the current demands. The greatest risk is from local saltwater intrusion in the confined Yorktown-Eastover aquifer due to over pumping and contamination of the Columbia aquifer from various land use activities. The following alternatives help to avoid or mitigate these impacts.

8.2. Alternatives Analysis

Available alternatives to reduce potential impacts from saltwater intrusion in the Yorktown-Eastover aquifer and land use derived contamination to the Columbia aquifer can be divided into two general categories:

- Potential new or expansion of underutilized sources
- Use of new or emerging technologies that improve availability or provides access to previously unavailable sources

8.2.1. Alternatives Analysis: Potential New or Expanded Water Supply Sources

8.2.1.1. Water table withdrawals

Recharge to the water table aquifer is several orders of magnitude greater than the confined aquifer. As such, this groundwater resource is far more renewable. Benefits of encouraging use of the water table aquifer are:

- Encourage, proactively, use of the water table aquifer over the confined aquifers.

- Avoid retroactively waiting until all of the confined aquifers are “critical” before using the water table.
- The significantly higher recharge to the water table greatly reduces impacts of a withdrawal from the aquifer. A withdrawal from the water table system is far more sustainable than from the confined aquifers.
- Increased use of the water table aquifer helps to preserve the confined aquifers.

For water supply development, the water table aquifer is not targeted as a preferred source in large part due to:

- Individual well yields are typically lower: the water table aquifer is shallower than confined aquifers and is not under pressure.
- Because the aquifer is not under pressure, the wells are often more difficult to develop following construction.
- The aquifer is more susceptible to contamination from land use activities.
- Cost to develop a water table supply is often greater than for a confined aquifer. Additional field investigation and multiple wells are often required to provide the same yield.

To encourage use of the water table aquifer, funding through programs such as the NRCS EQIP have the potential to significantly increase the number of water table withdrawals for agricultural uses. Additionally, changes to the DEQ Groundwater Withdrawal Regulations to recognize the lesser impact from using this aquifer would encourage use of the Columbia aquifer over the confined Yorktown-Eastover aquifer for all withdrawals, including some for public water supply.

8.2.1.2. Dug ponds

Similar to groundwater withdrawals from the water table aquifer, this alternative focuses on maximizing use of the water table aquifer. Unlike water table withdrawals, dug ponds are used exclusively for agricultural irrigation and industrial cooling water supply. Currently, dug ponds are not a source of water for public water supplies in Accomack County.

The primary impediment to use of dug ponds as a source of water supply is the area required to create the pond. To avoid impacts to wetlands, upland areas that are also often prime agricultural lands must be used for the ponds. Increased funding through the NRCS EQIP program for new ponds or existing pond expansion could significantly improve the capacity and use of these ponds.

8.2.2. Alternatives Analysis: Potential New and Emerging Technologies

8.2.2.1. Aquifer Storage and Recovery (ASR)

Aquifer Storage and Recovery is a technology that uses confined aquifers as a reservoir to store water that will later be withdrawn for use. ASR can be used as a direct source of water or it can be used to impede saltwater intrusion, thereby increasing availability of fresh groundwater in the Yorktown-Eastover aquifer. The principal benefits of ASR are:

- Encourages use of a technology that can significantly increase recharge to the aquifer.
- Can result in a no-net-loss operation.
- Reduces impacts of withdrawals for all groundwater users.
- Reduces the potential for saltwater intrusion to occur

While there are significant technological costs associated with operation of an ASR system, this method of water management has been successfully used throughout the United States. The most significant impediment to expanded use of ASR within the Virginia Groundwater Management Areas, including Accomack County is the lack of specific criteria that clearly differentiates ASR as a system that uses the aquifer as a reservoir from conventional groundwater withdrawals.

8.2.2.2. Desalinization

Use of brackish groundwater through reverse osmosis is a technology that has been used in the Coastal Plain of Virginia since 1989, with the operation of the Suffolk EDR facility. Subsequently, reverse osmosis has been used by a large number of communities in the Coastal Plain of Virginia, including most of the major municipal systems, such as James City County, Newport News Waterworks, and Chesapeake. Additionally, over the past 10-years, cost of constructing new or retrofitting old systems has decreased on average 10% per-year.

For areas of Accomack County where there is a significant brackish water source, particularly along the coastal areas, desalinization has significant potential for providing a source of high quality potable water. Additionally, membrane treatment is a viable technology for areas where the quality of water in the Columbia aquifer is impaired. As cost for reverse osmosis or membrane treatment continues decline and as efficiency of these systems continue to improve, this technology has significant potential for providing additional water supply to Accomack County.

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Appendix A

Accomack County Community Water System Well Summary

Virginia's Eastern Shore

MALCOLM PIRNIE

Accomack County - Community Water System Well Summary

Water System and Well Name	Well Completion Date	Well Depth (ft)	Pumping Level (ft)	Diameter (in)	Casing Depth (ft)	Screen Depth (ft)	Annual Permitted Withdrawal (Gallons)	Max. Monthly Permitted Withdrawal (Gallons)
Accomack County Office Buildings Waterworks								
County Bldg(100-00955)	5/5/1988	245	93	n/a	n/a	n/a	5,453,000	600,000
Courthouse(100-00956)	5/9/1988	245	93	n/a	n/a	n/a	5,453,000	600,000
Accomack Manor								
Missing Well Information	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Arcadia Nursing Center								
Missing Well Information	n/a	n/a	n/a	n/a	n/a	n/a	3,668,980	n/a
Captains Cove								
Well #1(100-00165)	4/30/1972	290	161	n/a	n/a	n/a	n/a	n/a
Well #2(100-00031)	7/24/1970	200	178	n/a	n/a	n/a	n/a	n/a
Well #3(100-00039)	6/10/1971	410	252	n/a	n/a	n/a	n/a	n/a
Chincoteague Town of								
PW#8(100-00945)	4/8/2004	255	143.98	n/a	n/a	n/a	n/a	n/a
Well #4(100-00028)	1/31/1965	244.5	n/a	n/a	n/a	n/a	n/a	n/a
Well #5(100-00032)	1/7/1972	256	n/a	n/a	n/a	n/a	n/a	n/a
Well #6(100-00320)	11/18/1977	225	87.5	n/a	n/a	n/a	n/a	n/a
Well #7A(100-00493)	9/15/1983	107	80	n/a	n/a	n/a	n/a	n/a
Well #7B(100-00494)	9/9/1983	106	80	n/a	n/a	n/a	n/a	n/a
Well 3A(100-00850)	7/18/1989	55	43	n/a	n/a	n/a	n/a	n/a
Well 3B(100-00851)	7/18/1989	59	36	n/a	n/a	n/a	n/a	n/a
Well 3C(100-00852)	7/19/1989	60	36.92	n/a	n/a	n/a	n/a	n/a
Well 7C(100-00495)	9/20/1983	100	80	n/a	n/a	n/a	n/a	n/a
Onancock, Town of								
#2(100-00036)	1/7/1953	159	134	n/a	n/a	n/a	70,807,500	7,109,600
#4(100-00037)	n/a	177	0	n/a	n/a	n/a	70,807,500	7,109,600
#5(100-00038)	n/a	166	0	n/a	n/a	n/a	70,807,500	7,109,600
Well 1(100-00002)	5/30/1968	282	14	n/a	n/a	n/a	70,807,500	7,109,600
Well 7(100-01015)	12/5/2004	220	n/a	n/a	n/a	n/a	80,615,000	8,079,200
Well 8(100-01016)	1/7/2005	220	n/a	n/a	n/a	n/a	80,615,000	8,079,200
Well 9(100-01017)	1/24/2005	220	n/a	n/a	n/a	n/a	80,615,000	8,079,200
Parksley, Town of								
Missing Well Information	n/a	n/a	n/a	n/a	n/a	n/a	70,080,000	n/a
Rolling Acres Subdivision								
Missing Well Information	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Shore LifeCare at Parksley								
Nursing Home Well(100-00041)	6/26/1969	142	40	n/a	n/a	n/a	6,800,000	800,000
Tangier								
Missing Well Information	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trails End Utility Company Incorporated								
Trails End #1(100-00453)	8/6/1973	310	133.83	n/a	n/a	n/a	15,700,000	2,600,000
Trails End #2(100-00803)	7/18/1974	71	75	n/a	n/a	n/a	15,700,000	2,600,000
Trails End #3(100-00899)	6/24/1981	70	39	n/a	n/a	n/a	15,700,000	2,600,000
Triangle Mobile Home Park								
Corner Well (100-1104)	n/a	260	150	n/a	240	260	15,111,000	n/a
New Well (100-1105)	n/a	305	150	n/a	275	305	15,111,000	n/a
US NASA -Goddard Space Flight Center								
#3(100-00568)	6/10/1987	265	177	n/a	n/a	n/a	13,300,000	1,800,000
#4(100-00844)	2/23/1989	260	96	n/a	n/a	n/a	13,300,000	1,800,000
Main Base Well #1(100-00966)	n/a	n/a	n/a	n/a	n/a	n/a	0	3,937,000
Main Base Well #2(100-00967)	n/a	n/a	n/a	n/a	n/a	n/a	0	3,937,000
Main Base Well #3(100-00968)	n/a	n/a	n/a	n/a	n/a	n/a	0	3,937,000
Main Base Well #4(100-00969)	n/a	n/a	n/a	n/a	n/a	n/a	0	3,937,000
Main Base Well #5(H-115)(100-00970)	2/14/1990	260	84	n/a	n/a	n/a	0	3,937,000

***Source** : VDEQ Data (Well and System Info.xls) and paper copies of DEQ withdrawal permits*

Accomack County
Water Supply Plan

Appendix B

Accomack County
Large Non-Agricultural User Well Summary

Virginia's Eastern Shore

MALCOLM PIRNIE

3100-001 / NEW

Accomack County - Large Non-Agricultural User Well Summary

Water System and Well Name	Well Completion Date	Well Depth (ft)	Pumping Level (ft)	Diameter (in)	Casing Depth (ft)	Screen Depth (ft)	Annual Permitted Withdrawal (Gallons)	Max. Monthly Permitted Withdrawal (Gallons)
Commonwealth Chesapeake Power Station								
DW-1A(100-00916)	5/9/2000	155	98	n/a	n/a	n/a	61,400,000	10,800,000
P-1(100-00907)	7/18/2000	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-2(100-00908)	1/15/2001	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-3(100-00909)	7/6/2000	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-4(100-00910)	1/18/2001	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-5(100-00911)	1/23/2001	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-6(100-00912)	1/26/2001	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-7(100-00913)	7/11/2000	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-8(100-00914)	7/13/2000	50	25	n/a	n/a	30-50	61,400,000	10,800,000
P-9(100-00915)	2/2/2001	50	25	n/a	n/a	30-50	61,400,000	10,800,000
Eastern Shore Yacht and Country Club								
12S(100-00857)	6/17/1992	180	58	n/a	n/a	n/a	25,000,000	6,500,000
17 N(100-00856)	6/19/1992	180	n/a	n/a	n/a	n/a	25,000,000	6,500,000
Clubhouse(100-00858)	10/16/1996	185	n/a	n/a	n/a	n/a	25,000,000	6,500,000
Maint. Shed(100-00860)	1/24/1991	50	31	n/a	n/a	n/a	25,000,000	6,500,000
Pool(100-00950)	2/27/2002	180	85	n/a	n/a	n/a	25,000,000	6,500,000
Pumphouse(100-00859)	n/a	n/a	n/a	n/a	n/a	n/a	25,000,000	6,500,000
Restroom(100-00882)	n/a	n/a	n/a	n/a	n/a	n/a	25,000,000	6,500,000
Integrated Fisheries International Limited								
100-843(100-00843)	8/14/1987	255	120	n/a	n/a	n/a	95,000,000	10,500,000
Production Well 1(100-00884)	2/20/1988	250	175	n/a	n/a	n/a	95,000,000	10,500,000
Production Well 2(100-00885)	1/20/1990	290	55	n/a	n/a	n/a	95,000,000	10,500,000
Production Well 3(100-00886)	2/20/1990	290	55	n/a	n/a	n/a	95,000,000	10,500,000
Production Well 4(100-00887)	3/12/1988	290	55	n/a	n/a	n/a	95,000,000	10,500,000
Production Well 5(100-00888)	2/10/1990	290	55	n/a	n/a	n/a	95,000,000	10,500,000
Production Well 6(100-00889)	2/16/1990	290	55	n/a	n/a	n/a	95,000,000	10,500,000
Production Well 7(100-00890)	2/28/1990	290	55	n/a	n/a	n/a	95,000,000	10,500,000
Public Water Supply 1(100-00291)	6/16/1969	245	70	n/a	n/a	n/a	95,000,000	10,500,000
Public Water Supply 3(100-00901)	12/23/1994	286	114	n/a	n/a	n/a	95,000,000	10,500,000
Standby 1(100-00900)	3/30/1989	255	120	n/a	n/a	n/a	95,000,000	10,500,000
KMX Chemical Corporation								
North Well #1(100-00258)	7/31/1947	259	0	n/a	n/a	n/a	76,440,400	8,768,300
South Well #2(100-00365)	7/31/1947	253	0	n/a	n/a	n/a	76,440,400	8,768,300
Perdue								
Missing Well Information	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Tyson Foods Incorporated								
#2(100-00011)	11/1/1917	325	114	n/a	138-146, 157-171, 200-212, 216-224, 234-242, 273-288	n/a	n/a	n/a
#4(100-00009)	12/31/1967	292	41.75	n/a	132-140, 156-170, 196-208, 214-222, 226-234, 272-287	n/a	n/a	n/a
#5(100-00196)	4/30/1968	285	75	n/a	130-138, 152-166, 196-208, 214-222, 226-234, 270-285	n/a	n/a	
#6(100-00566)	11/30/1987	250	137	n/a	170-250	n/a	n/a	n/a

Source: VDEQ Data (Well and System Info.xls) and paper copies of DEQ withdrawal permits

Accomack County
Water Supply Plan

Appendix C

Accomack County
Groundwater Withdrawal Permits and Demand Management Plans

Virginia's Eastern Shore

MALCOLM PIRNIE

COMMUNITY WATER SUPPLY SYSTEMS

3100-001 / NEW

Arcadia Nursing Center

3100-001 / NEW

Captain's Cove Subdivision

3100-001 / NEW

INTRODUCTION

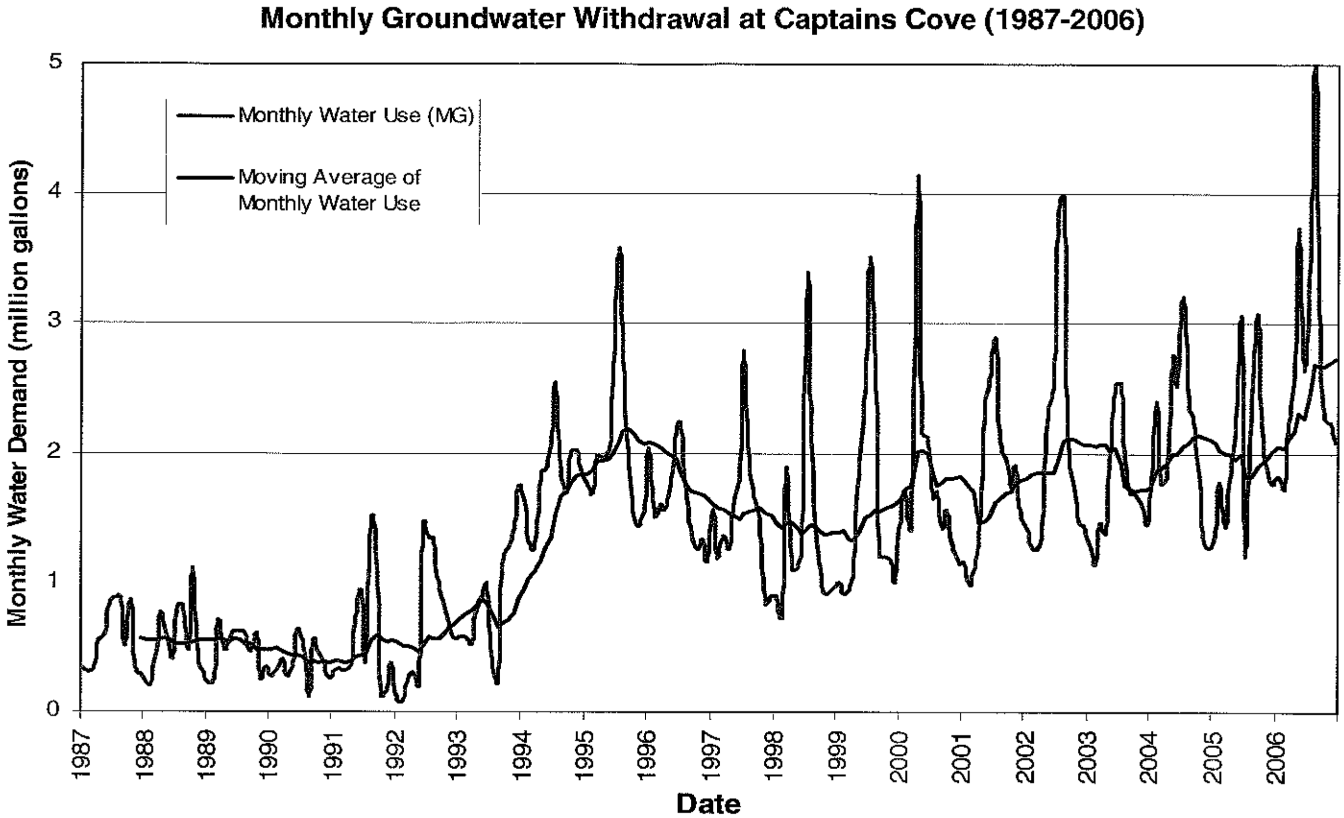
Captains Cove Utility Company, Inc. (CCUC) provides water and wastewater services to the Captains Cove residential community which is located near Greenbackville in northern Accomack County, Virginia just south of the Maryland border. Captains Cove is a 4,814-lot residential community situated on approximately 1,965 acres of prime real estate on Chincoteague Bay across from Chincoteague Island. The system consists of six water supply wells (Wells 1, 2, 3, 3U, 4 and 4U), two 5,000 gallon hydropneumatic tanks, and one 200,000 gallon standpipe which is not currently operational. Each well facility is equipped with a well building equipped with a chlorination system, flow control valves, and flow meters. A 500,000 gallon elevated tank is currently under construction and will be completed by the end of 2007.

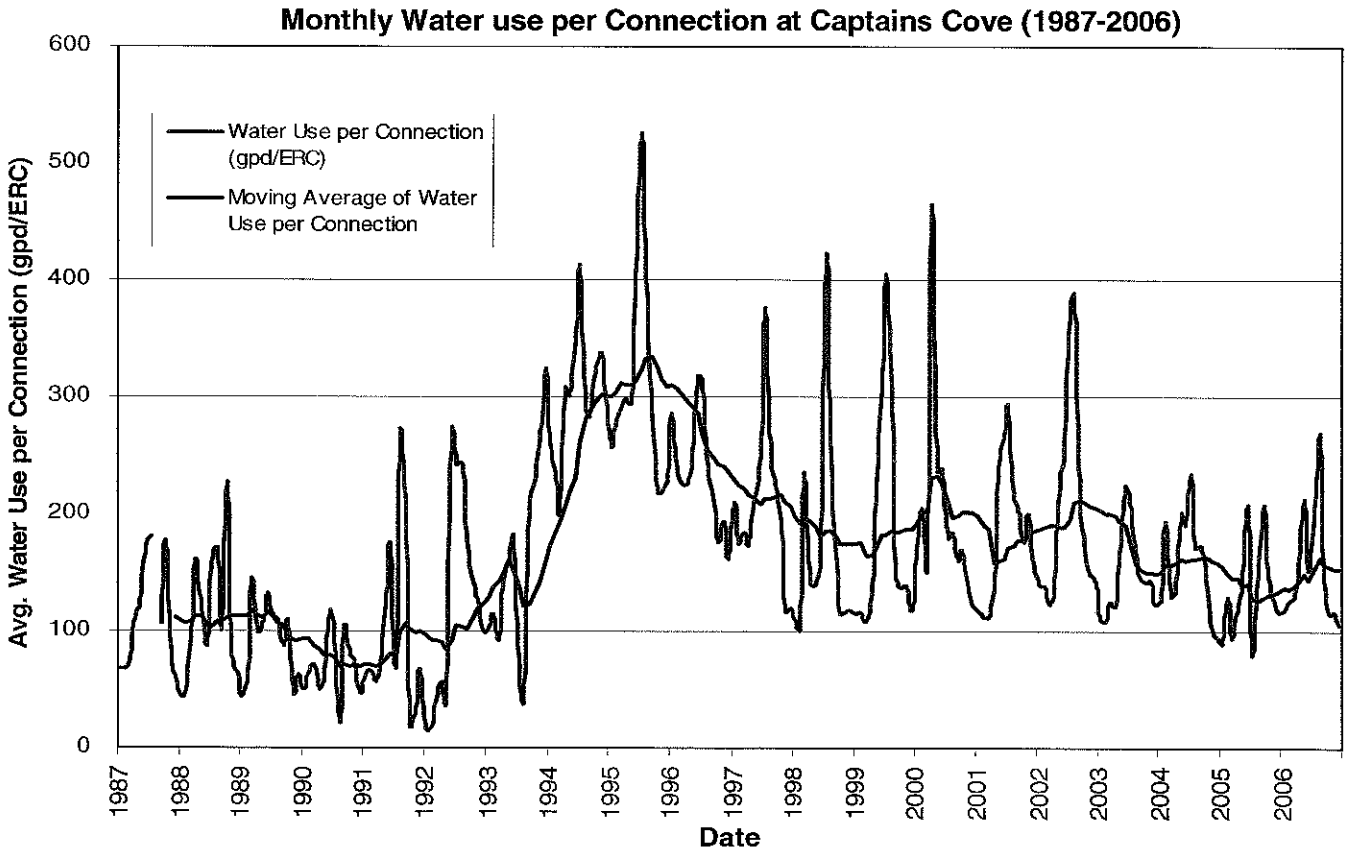
WATER DEMAND PROJECTIONS

Historic Water Use Data

Groundwater withdrawal data and water use at Captains Cove is available on a monthly basis from 1987 to 2006. An annual summary and statistical analysis of water withdrawal data and average annual water use per equivalent residential connection (gpd/ERC) is summarized in Table 1. Monthly water usage and monthly water usage per connection from 1987 to 2006 is shown in Figure 1. The annual average groundwater withdrawal/water use since 1999 has averaged 174 gpd per ERC and declined to an average of 148 gpd/ERC during the 4-year period 2003 through 2006. This water use rate is inclusive of water demand by the Captains Cove pro shop and snack bar, and unaccounted for water such as flushing of the water pipelines to remove stagnant water. As shown, water use is highest during summer months due to higher home occupancy rates and larger water use for lawn and shrub irrigation. Summertime water use was highest during the 1999-2002 drought and dropped off considerably during 2003 even with the increased number of homes in the subdivision.

Over 50 percent of current homes in Captains Cove are occupied by full-time residents and the remaining homes are primarily utilized as vacation homes and/or vacation rentals, and are typically occupied full time during the summer and weekends and holidays during the most of the remainder of the year. Water use rates at Captains Cove are expected to increase in the future as a greater proportion of homes in the community are occupied by permanent residents. Increased permanent occupancy is expected due to the planned enhancements to the community, increased job opportunity in the area, and increased baby boomer retirement. Expected increases in water use rates will likely be offset partially by planned water system improvements and water conservation efforts. Water system improvements and build out of the subdivision should decrease the need for flushing and other unaccounted for water use. Also, Captains Cove plans to install water meters at all existing and future homes. Metering will allow adoption of a water conservation-based rate structure, such as flat rates, increasing block rates, seasonal rates, or quantity-based surcharges. Captains Cove also plans on implementing a public education program to encourage water conservation. This will likely include water bill inserts and encouragement of indoor water conservation devices such as showerheads, toilet flappers, and faucet aerators.





Golder Associates

DATE: 03/12/2007

Project #: 043-6776

Prepared By: PWN

Reviewed By: BBW

Title:

MONTHLY GROUNDWATER WITHDRAWAL (1987-2006)

Captains Cove, Accomack County, Virginia

Figure No. 1

Table 1
Annual Groundwater Withdrawal Estimates
Captains Cove, Accomack County, Virginia

Date	Annual Total Water Withdrawal (gpd)	Annual Average Daily Demand (gpd)	Estimated[1] Average No. of Connections	Annual Use per Connection (gpd/ERC)
1987	5,846,920	17,506	158	111
1988	6,544,100	17,929	158	113
1989	5,705,970	15,633	169	93
1990	4,567,860	12,515	180	70
1991	6,579,390	18,026	180	100
1992	6,723,520	18,421	180	102
1993	10,444,523	28,615	180	159
1994	21,941,795	60,115	200	301
1995	24,751,600	67,813	220	308
1996	19,731,200	54,058	230	235
1997	18,170,300	49,782	240	207
1998	16,601,800	45,484	260	175
1999	19,222,300	52,664	280	188
2000	21,834,900	59,822	297	201
2001	21,461,200	58,798	317	185
2002	24,859,900	68,109	331	206
2003	20,644,700	56,561	381	148
2004	25,281,900	69,265	441	157
2005	24,095,200	66,014	494	134
2006	33,672,700	92,254	547	169
Statistical Summary of Water Use (1997-2006)				
Minimum	19,222,300	52,664		134
Maximum	33,672,700	92,254		206
Average	23,884,100	65,436		174
Average (2003-2006)	25,692,025	70,389		148

1. The number of residential connections since 1999 is based on new billing software and includes the number of connections on a monthly basis. The average number of connections for the year represents an average of the reported monthly connections. Prior to 1999, the number of connections is estimated.

Projected Future Water Demand Estimates

Incremental Residential Water Demand Estimate

Considerable home building activity is occurring in Captains Cove. A total of 138 homes were constructed and connected to the central water system in 2006 bringing the total water connections in the development to 638. On average, the number of homes constructed and connected to the water system increased by 18% per year from 2003 through 2006. This growth has been stimulated by local and regional trends in the housing industry and because of the large amount of investment in the Captains Cove community. The Captains Cove Group, LLC (CCG) CCG has invested substantially in creating new and replacing aged amenities in the Captains Cove community. In 2005, significant improvements were completed on the existing 9-hole golf course. In 2006, a new entranceway to the community was completed. In 2007, a new bay-front marina building with indoor and outdoor pools, an exercise facility, a restaurant and bar with a professional-quality kitchen, banquet facilities, meeting rooms, and administrative offices will be completed. The existing swimming pool, tennis courts, basketball courts, pro shop, and snack bar will be renovated in the near future, and other amenities are planned. Over 20,000 square feet of commercial space at the entrance to the community is being designed to include professional office space, retail shops, real estate sales, a food and beverage operation, and possibly a gas station and convenience store.

These improvements will stimulate and sustain continued growth in Captains Cove helping it to attract new families and retirees. The planned expansion of the NASA facility at nearby Wallops Island and the planned Wallops Research Park will bring new jobs into the area and new families to Captains Cove. National and regional demographics and the ongoing demand from the aging and retiring baby-boomer generation will drive the demand for permanent, retirement, vacation, and second homes in Captains Cove at a pace unseen in the past.

Continued growth is expected within the Captains Cove community. Conservatively, it is estimated that the number of new residential connections will continue to grow at a minimum rate of between 10% and 15% over the 10-year period of the groundwater withdrawal permit (i.e., 2008 through 2017). This is equivalent to a construction rate of between 100 and 235 new homes per year. Based on this, the total number of homes in the Captains Cove community will likely grow to at least 2,604 by 2017.

A water use rate of 155 gpd per residential connection is used for projecting future water demand at Captains Cove. This is less than the current average of 174 gpd/ERC to account for the likely water use reduction effects of planned water conservation efforts, and is slightly more than the wet-year average (2003-2006) water use of 150 gpd/ERC to account for drier periods and changing demographics (i.e., more full time residents including retirees and families). The water use rate of 155 gpd/ERC is also based on water use from the Ocean Pines community as discussed below. Assuming an annual average water consumption rate of 155 gpd per ERC and 2,604 connections, the estimated daily water demand for residential use in 2017 is **403,620 gpd** on an annual average basis. The projected incremental residential water demand at Captains Cove is shown in Table 2.

Case Study – Ocean Pines, Worchester County, Maryland

Ocean Pines is a planned community located just outside of Ocean City, Maryland. It is similar in many ways to Captains Cove and can be used as a guide for estimating residential growth and water use rates at Captains Cove. Ocean Pines was started in the early 1970s. Growth was slow in 1970s, but picked up in the 1980s and Ocean Pines is currently 90% built out with over 8,000 of the total 8,950 available platted lots developed. Over the last seventeen years, Ocean Pines grew at a rate of approximately 280 new homes per year and Ocean Pines did not have the presence of a developer or a national homebuilder to accelerate the rate of growth like at Captains Cove. The average growth rate of 10 to 15% for Captains Cove is conservative but is considered reasonable due to its more isolated location in northeastern Accomack County.

Ocean Pines has a full time population of more than 15,000 with 7,500 more summertime residents. This means that approximately two-thirds of the residents live in the community year-round. Most of these are elderly (73% of Ocean Pines' residents are over 56, based on a newspaper article in The Courier dated March 16, 2005). Community water use records for Ocean Pines from 1995 through 2004 indicate that the average annual water use ranged from 146 to 159 gpd/ERC and averaged 152 gpd/ERC.

Table 2
Annual Water Demand / Groundwater Withdrawal Estimates
Captains Cove, Accomack County, Virginia

Date	Number of New Connections (ERCs)	Total # of Connections[1] (ERCs)	Annual Connection Growth Rate (%)	Residential Water Demand[2] (gpd)	Commercial Water Demand[3] (gpd)	Total Water Demand Estimate (gpd)
2005	59	500	13%	77,500		77,500
2006	138	638	28%	98,890		98,890
2007	96	734	15%	113,770		113,770
2008	110	844	15%	130,820	1,642	132,462
2009	127	971	15%	150,505	1,642	152,147
2010	146	1117	15%	173,135	1,642	174,777
2011	168	1285	15%	199,175	3,272	202,447
2012	193	1478	15%	229,090	3,272	232,362
2013	207	1685	14%	261,175	3,272	264,447
2014	219	1904	13%	295,120	3,272	298,392
2015	228	2132	12%	330,460	3,272	333,732
2016	235	2367	11%	366,885	3,272	370,157
2017	**237**	**2604**	**10%**	**403,620**	**3,272**	**406,892**
2018	234	2838	9%	439,890	3,272	443,162
2019	227	3065	8%	475,075	3,272	478,347
2020	215	3280	7%	508,400	3,272	511,672

1. Connections based on assumption that housing starts will increase annually by 10-15% over the 10-year permit period projections.
2. Estimated residential water demand is based on an estimated water use of 155 gpd per residential connection on an annualized average daily basis. This low water use rate is based on water use rates observed in a similar community (Ocean Pines) and assumes rates will decline as strict water conservation measures are adapted.
3. Other water-using amenities include the marina and clubhouse facilities (1,642 gpd) and commercial facilities (1,630 gpd) for a total annualized daily use of 3,272 gpd.

WATER DEMAND ESTIMATES FOR MARINA

A new Marina and Clubhouse is currently under construction and is scheduled to be completed by December 2007. Water demand estimates for the new Marina building is based on four main customer uses that will require potable water supplies. These include: (1) normal daily use of the fitness center, library, and bar; (2) special event use of the 250-seat restaurant and banquet facilities; (3) seasonal and year-round use of the indoor and outdoor swimming pools, and (4) seasonal use of the marina boating facilities. Normal daily use of the fitness center, library, and bar is projected to average 50 people per day on an annual basis (Bob Wilkinson, personal communication). Customer use will be continuous year round but will have a slight seasonal component with greater use during summer months. Water use is expected to be 15 gpd per customer for bathroom, shower and restaurant/bar facilities. The water use estimate of 15 gpd per customer is based on Virginia Department of Health (VDH) average daily water use estimates for high schools with showers. The total daily water demand on an annual average basis will be 750 gpd (50 customers * 15 gpd).

The banquet facilities are projected to be utilized for 24 events each year. The water demand per event is estimated to be 3,750 gallons based on 250 seats and an average water use of 15 gpd per seat per event. The 15 gpd per seat is inclusive of bathroom and kitchen facilities. It should be noted that VDH recommends using an average daily demand of 50 gpd per restaurant seat assuming that each seat will be turned over several times a day. Based on 24 events per year, the annualized daily use is projected to be approximately 247 gpd.

Currently, there is one public swimming pool in Captains Cove. The new Clubhouse will have two additional swimming pools including an indoor pool which will receive year-round use. The existing pool averages 35 swimmers per day which is approximately 7 percent of the total number of homes in the community currently. The projected number of swimmers for all indoor and outdoor is estimated to gradually increase to between 100 to 150 swimmers per day over the next 10 years. This use will primarily occur during the summer (90-day period between Memorial Day and Labor Day). During the remainder of the year, the average number of swimmers in the indoor pool is estimated to be 15 swimmers per day. Water use is expected to be 10 gpd per swimmer (based on VDH Waterworks Regulations estimates) for bathroom and shower facilities and for consumptive losses from the pools. The total water use for the swimming pools at Captains Cove assuming up to 150 swimmers per day in the summer and 15 swimmers per day the remainder of the year is 176,250 gallons per year. This equates to an annualized average water demand for the swimming pools 483 gpd.

The Marina will have 60 boat slips. On average, about half of the boat slips are used on a daily basis from April 15 through October 30 of each year. Assuming two people per boat, approximately 60 boaters per day will be using the facilities (i.e., bathroom, fish cleaning, etc.) at the Marina. Assuming a water use rate of 5 gpd per boater, the annualized water demand for boaters is projected to be 163 gpd. The total estimated water demand for the Marina on an annualized daily basis is **1,642 gpd** by the end of the permit period. Table 3 summarizes the water demand estimate for the Marina.

Table 3
Water Demand Estimate for the Marina
Captains Cove, Accomack County, Virginia

Water Use Category	Quantity	Units	Water Use Rate (gpd)	Duration of Use (Days)	Annual Water Use (gallon)	Average Daily Use (gpd)
1. Daily Use (Fitness, Library, Bar)	50	people	15	365	273,750	750
2. Restaurant/Banquet	250	seats	25	24	150,000	411
3. Swimming Pools	100	people	1,500	90	135,000	370
Indoor Pool	20	people	150	275	41,250	113
Subtotal					176,250	483
4. Marina Boat Slips	60	people	5	198	59,400	163
					Total Water Use	**1,642**

WATER DEMAND ESTIMATES FOR COMMERCIAL PROPERTY

The commercial development at Captains Cove will contain approximately 20,000 square feet (sf) of retail and office space likely broken down in the following manner:

Convenience Store/Gas	3,000 sf
Retail shop space	2,000 sf
Office Space	15,000 sf

Daily water demand for the commercial property was estimated using annual water demand estimates provided in the VDH Waterworks Regulations (12 VAC-590-690) based on floor space, number of employees or number of customers as described below.

- Water use at the convenience store/gas station was estimated at 100 customers per day at a water use rate of 1 gpd per customer
  (100 customers X 1 gpd per customer = 100 gpd)
- Water use in retail space was estimated at a rate of 300 gpd per 1,000 sf of selling floor space. Selling space is assumed to represent 80% of total space

*(2,000 sf * 80% = 1,600 sf selling space X 300 gpd per 1,000 sf = 480 gpd)*

- Water use in office space was estimated on the basis of 25 gpd per employee. The number of employees was estimated assuming 70% of total office space is usable and that each employee would occupy 250 sf.
  *(15,000 sf * 70%=10,500 sf of usable office space. Maximum occupancy is estimated 47 employees assuming 250 sf per employee. Water demand = 42 employees X 25 gpd per employee = 1,050 gpd.*

Based on this, the annual average daily water demand for the commercial property is estimated to be 1,630 gpd (100 gpd + 480 gpd + 1,050 gpd).

REQUESTED WITHDRAWAL AMOUNT

The combined total water demand estimate for Captains Cove in 2017 inclusive of the residential, recreational, and commercial water uses is estimated to be **406,892 gpd**. The total annual groundwater withdrawal needed to meet this projected water demand is 148,515,580 gallons (406,892 gpd X 365 days), or **148.5 MG** rounded to the nearest 100,000 gallons.

The monthly withdrawal estimate is based on an estimate of maximum daily demand, which typically occurs during the summer months and reflects increased seasonal usage due to increased seasonal population, increased lawn watering and car washing, boating, swimming and other recreational activities along with unaccounted for water use such as water line leaks, fire fighting, and line flushing. The ratio between maximum and average daily demand (MDD/ADD) for Captains Cove historically has ranged from 1.6 to 2.7 and has averaged 1.8 over the last 20 years. By 2017, this ratio is expected to decline to approximately 1.6 or less. Based on this, the monthly requested withdrawal for Captains Cove is 20,181,843 gallons (406,892 gpd X 31 days X 1.6), or **20.2 MG** rounded to the nearest 100,000 gallons.

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL

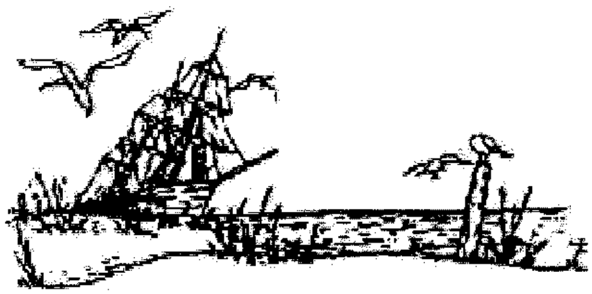
The requested withdrawal is supported by historical water use data, a projected increase in housing construction of 10-15% per year, water demand estimates for new community amenities, and a decreased average water use rate per residential connection based on strict water conservation measures being adapted.

WATER CONSERVATION & MANAGEMENT PLAN

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT

GROUNDWATER WITHDRAWAL PERMIT NO. GW004600

CAPTAINS COVE UTILITY CO., INC.
2512 Captain's Corridor
Greenbackville, VA 23356



March 2007

WATER CONSERVATION & MANAGEMENT PLAN

REGULATORY REQUIREMENTS

In 1992, Virginia adopted the Groundwater Management Act (Title 62.1, Chapter 25, code of Virginia, 1950, as amended) regulating groundwater withdrawals in critical aquifer use areas. The Eastern Virginia and the Eastern Shore Groundwater Management Areas were established at that time due to a decline in groundwater levels of up to 200 feet in some places due to excessive groundwater use. In these management areas, a groundwater withdrawal permit is required for any application to initiate a new withdrawal or expand an existing withdrawal in the groundwater management area. As part of the Ground Water Withdrawal Permit (GWWP) application, a Water Conservation and Management Plan (WCMP) must be submitted with the GWWP application and becomes an enforceable part of the GWWP permit. In accordance with 9VAC25-610-100, a WCMP must include at a minimum the following items.

- The use of water saving plumbing and processes including, where appropriate, the use of water saving fixtures in new and renovated plumbing as provided in the Uniform Statewide Building Code;
- A water loss reduction program;
- A water use education program;
- An evaluation of potential water reuse options; and
- Requirements for mandatory water use restrictions during water shortage emergencies declared by the local governing body.

THE NEED FOR WATER CONSERVATION

Water conservation is a focused effort by a water user to reduce the use of water. This effort can minimize development of new resources and reduce the cost of future water service. Each gallon of water that is not used through conservation is one less that needs to be stored, treated, pumped and distributed. The reduction in the use of water may also result in energy savings if the water needs to be heated for washing or bathing or pass through a wastewater treatment system before it is returned to the environment.

Water conservation has reached a new level of awareness. Conservation may represent a practical alternative to developing and increasing the water supply or at least complement new water supply development projects until technologies evolve to meet the needs of an ever growing population. Clean water supplies, like other natural resources, are a limited resource, which must be managed carefully so that they are preserved for future generations. Efforts to conserve existing supplies and the efficient allocation of water resources need to be made at each stage of the water supply planning process.

OBJECTIVES

The objective of the Water Conservation and Management Plan is to develop a documented, effective conservation and management strategy that is designed to minimize the demand for groundwater and comply with 9VAC25-610. The plan consists of operational programs and strategies that will be used every day in the management and maintenance of the water and wastewater utility. The specific conservation and management strategies are presented in the following sections and are briefly summarized in the conclusion.

CONSERVATION MEASURES AND MANAGEMENT STRATEGIES

Captain's Cove Utility Company, Inc. ("CCUC" or "Utility") supplies water to the Captain's Cove subdivision in Accomack County, Virginia. The subdivision is located in Greenbackville off of State Route 679. The Utility supplies drinking water to the residential development from supply wells. The Utility also operates a wastewater treatment plant which serves a portion of the development. The development also includes lots which utilize drainfields for wastewater management.

Water Saving Plumbing and Processes

All new service connections (new construction) are required to incorporate the use of water saving fixtures as required in the Uniform Statewide Building Code. In addition, existing customers requesting service termination for plumbing renovations will be informed of the requirement that all plumbing modifications made shall incorporate the use of water saving fixtures as provided in the Uniform Statewide Building Code.

Captains Cove Utility will also encourage the use of low-flow plumbing devices and water fixtures to their existing customers. Replacing older showerheads with low-flow fixtures, installing faucet aerators in older baths and kitchens, and water saving flappers in older toilet tanks can reduce household water use by approximately 10 to 15 percent.

Water Loss Reduction

Water loss or unaccounted-for water is the difference between water produced and the quantity of water paid for by final consumers. Because individual residential connections are not currently metered, water loss is difficult to measure. Water use is routinely monitored at each source. This allows for routine assessment of water usage and can be used to gauge potential water losses based upon facility water use records. Excessive water use is investigated when demand in excess of that anticipated is recorded. In addition, all supply system leaks are repaired when detected and the volume of water utilized in system maintenance flushing operations is kept to the minimum required for acceptable system operation.

In the near future, Captains Cove plans on requiring all new hook-ups to be metered and will implement a program to install meters on all existing connections. This will allow better auditing of unaccounted for water and quicker detection of leaks. Once the system is metered, a program of periodic water audits and leak detection measures will be used to reduce water loss and produce more effective water conservation efforts. The goal of the water utility is to reduce unaccounted for water to between 10-15 percent or less of average daily water use. If unaccounted for water is greater than 15 percent, then the follow actions will be taken.

Unaccounted for Water Analysis

The water distribution will be tested for leaks using the comparison of system water meters and the pump house master meter; thus, an unaccounted for water analysis will show any major leaks or discrepancies. For the purposes of this plan, the unaccounted for water analysis will occur annually at a minimum to establish the system base line for error within metering equipment. In addition, potential discrepancies between the amount of water produced and the amount sold to customers will be reviewed on a monthly to bimonthly basis once the majority of homes are metered. The current billing system will be modified and upgraded to assist in analyzing water usage and detecting possible leaks. Utility operators will also be able to detect leaks on the basis of daily and weekly review of water use data including well pump operational logs and wellhead meter readings which can detect possible leaks by a general comparison to typical seasonal water use. More frequent reviews may be possible as new technologies are implemented within the meter reading systems.

Water System Leak Detection And Repair

If a leak in the system occurs, it will be fixed within 24 hours. If the usage data or unaccounted for water analysis indicates a water leak which cannot be visually located, the system must be searched for leaks. Additionally, exceptionally high usage at customer's meters must be also be reviewed from billing department data. The location of leaks in the distribution system and the success of a repair program depend on the following factors:

- Pipe age and material;
- System operating pressures;
- Soil Type;
- Soil pH; and
- Pipeline depth

Generally, the initial searches for leaks include walking the system lines and looking for puddles or wet areas that could hint of a leak. For subsurface leaks in well drained soils, electronic equipment can be employed to triangulate the leak location by sophisticated listening equipment which is analyzed by a computer.

Employees shall inspect all pump station piping for leaks each visit which cause water to be wasted and employees shall notify management of any leaks observed in the pump station or in the distribution system in a timely manner.

The entire distribution system will be visually inspected on each meter reading cycle by walking and driving the system and reviewing the meter locations and searching for apparent leaks. Upon bill generation for customer bills, high usage bills will be reviewed carefully and may be re-read to verify the usage and look for customer leaks.

Upon notification that a leak exists in the pump station or on the distribution system, the leak(s) shall be repaired in a timely manner. Customers are responsible for home plumbing leaks and water usage may be discontinued by the Utility until the repair is made if sufficient water is being wasted, the customer is not responsive, or the home is abandoned.

Customer Leak Detection And Repair

Employees shall observe customers piping which exists in and adjacent to the Utility's facilities during meter reading for leaks on the customers plumbing. Employees shall make note of any leaks observed and report the leaks to the Billing Department of the Utility. The Billing Department shall notify the customer in timely manner that a leak has been observed on their plumbing. The Billing Department will also notify a customer in a timely manner if abnormally high usage is indicated on the account which could indicate a possible leak.

Water Use Reduction through Future Rate Structures

Water billing can be used as a means to disseminate water conservation information to water users and to provide incentives to customers to use water efficiently. Once the system is metered, the Utility will adapt conservation-based water rate structures to further promote water conservation. Conservation-based rate structures such as flat rates, increasing block rates, seasonal rates, or quantity-based surcharges encourage water conservation and discourage wasteful water use. Increasing rate structures are most effective and allow for average water use at a reasonable rate. However, above an allowable amount of normal household water usage, the rates become higher per unit of water used. Residents who use large amounts of water each month for irrigation would pay substantially more than residents who do not.

Water Use Reduction through Water Use Education

A comprehensive public education program serves to inform the community of the many benefits of water conservation and will increase the effectiveness of the water conservation program. The Captain's Cove Homeowners Association will be provided with information regarding water use and water conservation. The Utility will periodically provide an education program encouraging conservation practices at regularly scheduled meetings. Consumers will be encouraged to minimize the use of water. In addition, water bills will routinely include inserts regarding water conservation practices. The goal of the water use education program will be to make the customer understand their water sources, the costs of supplying the water to the customer, the problems associated with supplying water, and how changes in consumer behavior can lower the cost of supplying water and result in a lower water bill for the customer.

Outdoor Water Use

Outdoor water use increases significantly during the summer months primarily due to increased seasonal population and lawn and garden irrigation. The Utility has to build excess source and storage capacity and infrastructure to meet peak summertime demand. As part of the water use education program and through conservation-based rate structures, the Utility will help reduce excessive outdoor water use and promote better conservation and management practices by the customers. Developing proper grass watering practices and encouraging the use of drought tolerant landscaping can greatly reduce irrigation demands. Watering less frequently can better establish root systems, which make grass and shrubs more drought tolerant.

In addition, Captain's Cove has restrictive covenants which prevent individual home owners from installing wells on their lots for non-potable outdoor uses such as lawn watering and car washing.

WATER REUSE EVALUATION

All of the wastewater generated by this residential development is "returned" to the groundwater onsite through treatment and disposal at individual domestic septic systems or through a centralized wastewater treatment system and infiltration basins. As part of the new wastewater treatment expansion, Captain's Cove will evaluate the reuse of high quality treated wastewater. The wastewater generated may be able to be used for irrigation purposes on the golf course, if the ground surface can be irrigated without runoff to the bay or tributaries.

MANDATORY USE REDUCTIONS

During periods of water shortage emergencies, declared by the local governing body, DEQ Director, or Captain's Cove Utility Co., Inc., customers will be notified in writing that there is a water shortage emergency and that water use reductions or restrictions are mandatory. Captain's Cove Utility Co., Inc. will be responsible for enforcing penalties, such as imposing fines to customers using water for restricted purposes during water shortage emergencies. Requirements for mandatory use reductions during local or regional water shortage emergencies typically involve local ordinances, which detail restrictions and penalties that may be applied during a declared water shortage emergency.

In the event a water shortage and an emergency is declared by the local governing body or the director of DEQ, all water usage shall be ceased except for sanitary and human consumptive uses.

Emergency Use Procedures

Use restrictions are conservation measures that are employed to produce short-term water demand reductions during water supply emergencies. These are instituted to create immediate reductions in water usage and carry either a long-term or short-term cost to customers. When restrictions are removed, habits formed tend to linger for a time and, to some extent, can have a lasting impact on water use.

Use restrictions must be clearly differentiated from normal conservation programs. While use restrictions are considered a form of conservation because they result in demand reductions, they are addressed separately from normal conservation because they are only implemented during periods when the water supply is threatened. As a result, the savings associated with the implementation of use restrictions should not be incorporated into the planning of future water supplies. Rather, such restrictions are reserved as contingency measures for emergencies (e.g., drought) and are more severe than those used to determine the long-term water supply deficit.

Use restrictions are commonly implemented using the following tiered approach. Tier 1 is activated during the initial stages of a water shortage. Voluntary use restrictions are encouraged by the water utility, but compliance is not required.

When water supplies become further stressed, Tier 2 restrictions are implemented. At this tier level, mandatory use restrictions are implemented according to local ordinances. Restrictions are enforced and penalties for violations are incurred. The final tier, Tier 3, is implemented only under the most serious water shortages and employees water rationing.

The conditions that warrant implementation of each tier are normally related to specific storage levels in the raw water system. Once the tier levels are developed, an ordinance would be required to define use limits and to specify enforcement of the restrictions.

The following types of use restrictions are examples that could be employed during each of the three tiers to ensure an adequate level of protection during water shortages.

Tier 1 – Voluntary Use Restrictions (Drought Watch)

Voluntary use restrictions are employed as a first stage in reducing water demands during a potential water shortage. These constraints are designed to limit water use for a potential water shortage. These constraints are designed to limit water use for nonessential uses, such as outdoor water uses, (e.g., car washing and lawn watering).

Several different measures can be used to minimize outdoor water use. Odd-even watering is a common water use restriction. This measure requires that only those homes with even-numbered street addresses may irrigate their lawn on even-numbered calendar days, while the same rationale applies to odd-numbered addresses. Another alternative is to limit the hours during the day that irrigation is allowed, such as early morning or late evening hours when less water is lost. Time restrictions may be placed on other outdoor water uses as well, such as car washing.

The restriction of water use through voluntary action has been widely employed. Most localities that have established conservation programs encourage reduced water use during peak demand periods and when supply levels begin to fall. Tier 1 restrictions are likely to be accepted by only that portion of the public that understands the purpose and necessity of the restrictions. Therefore, a well-planned public education program must accompany implementation of Tier 1 use restrictions.

Tier 2 – Mandatory Use Restrictions (Drought Warning)

When implementation of Tier 1 does not reduce demands efficiently and water availability declines further, mandatory restrictions are put into effect. Mandatory use restriction programs would include the same measures that are encouraged under Tier 1. The difference is that in Tier 2, compliance is mandated by an ordinance and the restrictions are enforced with penalties.

Tier 2 restrictions would go into effect when the Utility determines that the severity of the situation warrants mandatory restrictions. During a Tier 2 situation, outdoor water use may be restricted or banned as the water supply becomes further threatened. If a particular user has consistently violated the use restrictions, the Utility may discontinue service. With an efficient public education program, the public can be encouraged to report violations of the regulations. This practice helps to enforce the regulations and achieve the program goals.

Limiting the number of new hookups to the system is an alternative form of mandatory restrictions used when growth is threatening the reliability of existing water supplies. Under severe drought conditions, the Utility may be unable to provide efficient service to additional customers. In these cases, the Utility may be unable to provide efficient service to additional customers. In these cases, the Utility prohibits the connection of new construction to the system until additional water supply is available. A drought emergency is not always a prerequisite for implementing these use restrictions. If normal demands threaten to exhaust available supplies prior to the development of new or expansion of existing supplies, a moratorium on new connections may be put into effect.

Many water departments across the Country employ outdoor water codes, both voluntary and mandatory. Virginia's Drought Assessment and Response Plan The first step to the program consisted of mandatory restrictions that banned the use of nonessential uses of water. Nonessential uses were defined to include the following:

- Watering of shrubbery, trees, lawns, grass, plants, or other vegetation, except from a watering can or other container not exceeded three gallons in capacity.
- Washing of automobiles, trucks, trailers, or any other type of mobile equipment, except in facilities operating with a water recycling system approved by the City, or except from a bucket or other container not exceeding three gallons in capacity; provided, further, that any facility operating with an approved water recycling system must prominently display, in public view, a sign stating that such a recycling system is in operation.

- Washing of sidewalks, streets, driveways, parking areas, service station aprons, exteriors of homes, apartments, commercial or industrial buildings or any other outdoor surface, except from a bucket or other container not exceeding three (3) gallons in capacity.
- The operation of any ornamental fountain or other structure making a similar use of water.
- The filling of swimming or wading pools or the refilling of swimming or wading pools which were drained after the effective date of the order.
- The use of water from fire hydrants for any purpose other than necessary governmental operations.
- The serving of drinking water in restaurants, cafeterias, or any other establishments, unless requested to do so by the individual being serviced.

These restrictions are brought into effect when the locality is suffering from a water supply emergency and the restrictions are printed in any newspaper or general circulation in the County, or broadcast upon any radio or television station serving the area. Included in the restrictions is the prohibition of flushing new water mains at constructions sites. Flushing is required following construction to remove debris from the lines before potable water can be delivered. This measure effectively places a moratorium on new water hookups in newly constructed subdivisions.

Tier 3 – Water Rationing (Drought Emergency)

Under severe drought conditions, under authority by DEQ or other governmental body, water rationing can be used as a method to further reduce water usage. With water rationing, the local water utility specifies a per capita amount of water that is allowed for use at the current billing rate. If this amount is exceeded, a surcharge is issued for water used above the allotted amount. This method is implemented if voluntary and mandatory restrictions are unable to reduce demands sufficiently or if water availability declines further. The surcharge applied to water use above the allotment is significant. Because the surcharge is very high, it is a strong deterrent against exceeding the allotment value. Again, a strong public education program is required along with implementation of water rationing. Water rationing is an unpopular alternative for both localities and consumers. It places extreme restrictions on consumer water use and provides a very strong negative incentive for maintaining water usage below the allotted level. The program is not likely to be supported by the consumer because of the high fees incurred for exceeding water limits. However, the program is usually successful at reducing demands if ordinances are in place to enforce the goals.

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: February 16, 2009

WATERWORKS NAME:	Captain's Cove Subdivision	CERTIFIED CLASS: V
COUNTY/CITY:	Accomack County	TYPE: Community
LOCATION:	Captain's Cove Subdivision is located south of State Route 679, approximately 1/2 miles east of the intersection of Virginia State Route 679 and Maryland State Route 12.	
OWNER:	Captains Cove Utility Company, Inc. 2512 Captains Corridor Greenbackville, Virginia 23356 Phone (410) 641-0550 Fax (410) 629-1271	 Phone (757) 824-5995 Fax (757) 824-5134
OPERATOR:	Licensed Class V Operator required	
PERMIT NO.:	3001100	
DATE ISSUED:	February 16, 2009	
TYPE OF TREATMENT:	Hypochlorination	
SOURCE:	3 Wells	
PERMITTED CAPACITY:	226,080 gpd	

DESCRIPTION OF THE WATERWORKS

This system consists of three wells, two 5,000 gallon (each) hydropneumatic tanks, and one 500,000 gallon elevated tank. Hypochlorination facilities are located at each well/entry point.

Well # 1: This well is located inside a well house off the Crows Nest Road. It was originally named as well # 5, and it was used for irrigation of golf course. In 1991, the well was converted from an irrigation well to a public water supply well. The well was drilled starting on April 2, 1972, and was completed on April 30, 1972, to a total depth of 290 feet. The well casing is 6 inches in diameter and extends to 257 feet, extending to 272 feet 6 inches diameter screen. The casing is grouted to 50 feet, but the material of grout and material of casing is unknown from the completion report. The well is equipped with a submersible pump rated at 205 gpm (unknown TDH {was not noted if pumping to the pressure tank or to atmosphere} and motor size). The well has a tested yield of 180 gpm, over a 24-hour period, with the water level dropping from 11 feet (static condition) to 150 feet (dynamic condition). The depth of intake is 239 feet.

Well # 2: This well is located inside an above ground concrete vault in the golf course. The well was drilled starting on July 10, 1970, and was completed on July 24, 1970, to a total depth of 200 feet. The well casing is 6 inches in diameter and extends to 168 feet, extending to 180 feet with 6 inches diameter screen. The casing is grouted with cement to 50 feet. The well is equipped with a submersible pump rated at 60 gpm (unknown TDH and motor size). The well has a tested yield of 63 gpm, over a 24-hour period, with the water level dropping from 8 feet (static condition) to 160 feet (dynamic condition). The depth of intake is 160 feet.

Well # 3: This well is located inside a well house off the Captain's Corridor. The well was drilled starting on May 8, 1971, and was completed on June 10, 1971, to a total depth of 410 feet. The well casing is 6 inches in diameter and extends to 255 feet, extending to 270 feet with 6 inches diameter screen. Rest of the bore-hole (270-410 feet) is filled with gravel. The casing is grouted with cement to 50 feet. The well is equipped with a submersible pump rated at 60 gpm (at unknown TDH {was not noted if pumping to the pressure tank or to atmosphere} and unknown motor size). The well has a tested yield of 93 gpm, over a 24-hour period, with the water level dropping from 22 feet (static condition) to 252 feet (dynamic condition). The depth of intake is 260 feet.

Storage Facilities: The storage facilities consist of a 500,000 gallon elevated tank and two 5000 gallon (each) hydropneumatic tanks. The two hydropneumatic tanks are located at Wells 1 and 3. Well 2 pumps directly into the distribution system. The elevated tank floats on the system and is located in the middle of the three wells.

Treatment Facilities: A hypochlorination system is provided for each well and it consists of a metering pump (10 gpd) and a 30 gallon solution crock. At Wells 1 and 3 hypochlorite solution is injected in the well discharge lines leading to the hydropneumatic tanks. This treatment does not limit the capacity of the system and is not used for evaluation of the system capacity.

Currently the waterworks does not have a groundwater withdrawal permit issued by the Department of Environmental Quality. Since the waterworks is producing more than 300,000 gallons of water per month and is located in the groundwater management area, a groundwater withdrawal permit is required. An aquifer test plan has been developed as part of the groundwater withdrawal permit application.

CAPACITY EVALUATION OF THE WATERWORKS

This system is evaluated on the basis of equivalent residential connections (ERCs). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

1. Source Capacity

Well No.	Well Yield (gpd) {gpm/(0.5 gpm/ERC) * 400 gpd/ERC}		Well Pump (gpd) [1] {gpm * 1440 min/day}		Limiting Capacity (gpd)
1	180 gpm	144,000 gpd	200 gpm	288,000 gpd	144,000 gpd
2	63 gpm	50,400 gpd	50 gpm	72,000 gpd	50,400 gpd
3	93 gpm	74,400 gpd	22 gpm	31,680 gpd	31,680 gpd
Total	338 gpm	268,800 gpd	272 gpm	391,680 gpd	226,080 gpd

[1] From field observations in 2007

2. Storage Capacity

$$\text{Effective Storage} = \frac{5{,}000 + 5{,}000}{3} + 500{,}000 = 503{,}333 \text{ gallons}$$

$$\text{Storage Capacity} = \frac{503{,}333 \text{ gallons}}{200 \text{ gallons/ERC}} = 2{,}517 \text{ ERC}$$

Storage Equivalent = 2,517 ERC * 400 gpd/ERC = 1,006,666 gpd

Conclusion: This waterworks is limited to a capacity of 226,080 gpd due to a combination of limited well yield and well pump capacity. This permit does not suspend, minimize, or otherwise alter this owner's obligation to comply with applicable federal, state, or local laws and regulations or permits.

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: January 6, 2009

WATERWORKS NAME: Captain's Cove Subdivision CERTIFIED CLASS: V

COUNTY/CITY: Accomack County TYPE: Community

LOCATION: Captain's Cove Subdivision is located south of State Route 679, approximately 1/2 miles east of the intersection of Virginia State Route 679 and Maryland State Route 12.

OWNER: Captains Cove Utility Company, Inc.
2512 Captains Corridor
Greenbackville, Virginia 23356
Phone (410) 641-0550 Phone (757) 824-5995
Fax (410) 629-1271 Fax (757) 824-5134

OPERATOR: Class V Operator required

PERMIT NO.: 3001100

DATE ISSUED: January 6, 2008

TYPE OF TREATMENT: Hypochlorination

SOURCE: 6 Wells

PERMITTED CAPACITY: 227,380 gpd

DESCRIPTION OF SYSTEM

This system consists of six wells, two 5,000 gallon (each) hydropneumatic tanks, and one 500,000 gallon elevated tank. Hypo chlorination facilities are located at each well/entry point.

Well # 1: This well is located inside a well house off the Crows Nest Road. It was originally named as well # 5, and it was used for irrigation of golf course. In 1991, the well was converted from an irrigation well to a public water supply well. The well was drilled starting on April 2, 1972, and was completed on April 30, 1972, to a total depth of 290 feet. The well casing is 6 inches in diameter and extends to 257 feet, extending to 272 feet 6 inches diameter screen. The casing is grouted to 50 feet, but the material of grout and material of casing is unknown from the completion report. The well is equipped with a submersible pump rated at 205 gpm (unknown TDH {was not noted if pumping to the pressure tank or to atmosphere} and motor size). The well has a tested yield of 180 gpm, over a 24-hour period, with the water level dropping from 11 feet (static condition) to 150 feet (dynamic condition). The depth of intake is 239 feet.

Well # 2: This well is located inside an above ground concrete vault in the golf course. The well was drilled starting on July 10, 1970, and was completed on July 24, 1970, to a total depth of 200 feet. The well casing is 6 inches in diameter and extends to 168 feet, extending to 180 feet with 6 inches diameter screen. The casing is grouted with cement to 50 feet. The well is equipped with a submersible pump rated at 60 gpm (unknown TDH and motor size). The well has a tested yield of 63 gpm, over a 24-hour period, with the water level dropping from 8 feet (static condition) to 160 feet (dynamic condition). The depth of intake is 160 feet.

Well # 3: This well is located inside a well house off the Captain's Corridor. The well was drilled starting on May 8, 1971, and was completed on June 10, 1971, to a total depth of 410 feet. The well casing is 6 inches in diameter and extends to 255 feet, extending to 270 feet with 6 inches diameter screen. Rest of the bore-hole (270-410 feet) is filled with gravel. The casing is grouted with cement to 50 feet. The well is equipped with a submersible pump rated at 60 gpm (at unknown TDH {was not noted if pumping to the pressure tank or to atmosphere} and unknown motor size). The well has a tested yield of 93 gpm, over a 24-hour period, with the water level dropping from 22 feet (static condition) to 252 feet (dynamic condition). The depth of intake is 260 feet.

Well 3U (Upper Yorktown Eastover formation) (also known as DEQ Well # 100-1072) was drilled starting on December 19, 2005**,** and was completed on December 22, 2005. The well bore is 217 feet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 6 – inches in diameter and extends from above the ground to 140 feet below the surface, there is a stainless steel 6-inch casing from 160 to 202 and from 212 to 217 feet below the surface, stainless steel 0.030 slot, 6-inch screens are set from 140 to 160 feet below grade and from 202 to 212 feet below grade. Gravel pack is installed from 130 feet to 217 feet. The well is equipped with a submersible pump rated at 68 gpm at 264 feet TDH) driven by a 7.5 HP motor. The pump intake is set at 120 feet. The well has a tested yield of 60 gpm over a 48-hour period (July 25, 2006 through July 27, 2006), with the water level dropping from 25.13 feet (static) to 109.8 feet (dynamic).

Well 4 (also known as DEQ Well 3 100-1020) was drilled starting on March 7, 2005**,** and was completed on March 15, 2005. The well bore is 295 feet deep, with cement grout extending from the surface to 110 feet. The steel well casing is 8 – inches in diameter and extends to 255 feet (with a five foot tail piece from 290 to 295 feet below grade), extending from 255 to 290 feet is 8-inch, 0.030 slot stainless steel screen. Gravel pack is installed from 230 feet to 295 feet. The well is equipped with a submersible pump (rated at 125 gpm at 394 feet TDH) driven by a 25 HP motor. The pump intake is set at 252 feet. The well has a tested yield of 130 gpm over a 48-hour period (June 14, 2005 – June 16, 2005), with the water level dropping from 13 feet (static) to 240 feet (dynamic).

Well 4U (also known as DEQ Well 3 100-1073) was drilled starting on January 16, 2006**,** and was completed on January 19, 2006. The well bore is 215 **f**eet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 6 – inches in diameter and extends from above the ground to 135 feet below the surface, there is a stainless steel 6-inch casing from 155 to 200 and from 210 to 215 feet below, stainless steel 0.030 slot, 6-inch screens are set from 135 to 155 feet below grade and from 200 to 210 feet below grade. Gravel pack is installed from 130 feet to 215 feet. The well is equipped with a submersible pump rated at 68 gpm at 264 feet. The pump intake is set at 120 feet

Storage Facilities: The storage facilities consist of a 500,000 elevated tank and two 5000 gallon (each) hydropneumatic tanks. The two hydropneumatic are located at Wells 1, 3 and 3U. Wells 2, 4 and 4U pumps directly into the distribution system. The elevated tank floats on the system and is located in the middle of the three wells.

Treatment Facilities: A hypochlorination system is provided for each well or well pair and consists of a metering pump (10 gpd/ 36 gpd) and 30 / 35 gallon solution crocks. Hypochlorite solution is injected in the well discharge lines. This treatment does not limit the capacity of the system and is not used for evaluation of the system capacity.

Currently the waterworks does not have a groundwater withdrawal permit issued by the Department of Environmental Quality. Since the waterworks is producing more than 300,000 gallons of water per month and is located in the groundwater management area, a groundwater withdrawal permit is required. An aquifer test plan has been developed as part of the groundwater withdrawal permit application.

EVALUATION OF SYSTEM

This system is evaluated on the basis of equivalent residential connections (ERCs). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

1. Source Capacity

Well No.	Well Yield (gpd) {gpm/(0.5 gpm/ERC) * 400 gpd/ERC}		Well Pump (gpd) {gpm * 1440 min/day}		Limiting Capacity (gpd)
1	182 gpm	145,600 gpd	205 gpm	295,200 gpd	145,600 gpd
2	63 gpm	50,400 gpd	60 gpm	86,400 gpd	50,400 gpd
3	93 gpm	74,400 gpd	60 gpm	86,400 gpd	74,400 gpd
3U	60 gpm	48,000 gpd	68 gpm	97,920 gpd	48,000 gpd
4	130 gpm	104,000 gpd	125 gpm	180,000 gpd	104,000 gpd
4U	68 gpm	54,400 gpd	68 gpm	97,920 gpd	54,400 gpd
Total					476,800 gpd

Well No.	Well Yield (gpd) {gpm/(0.5 gpm/ERC) * 400 gpd/ERC}		Well Pump (gpd) [1] {gpm * 1440 min/day}		Limiting Capacity (gpd)
1	182 gpm	145,600 gpd	200 gpm	288,000 gpd	145,600 gpd
2	63 gpm	50,400 gpd	50 gpm	72,000 gpd	50,400 gpd
3	93 gpm	74,400 gpd	22 gpm	31,680 gpd	31,680 gpd
3U	60 gpm	48,000 gpd	68 gpm	97,920 gpd	48,000 gpd
4	130 gpm	104,000 gpd	125 gpm	180,000 gpd	104,000 gpd
4U	68 gpm	54,400 gpd	68 gpm	97,920 gpd	54,400 gpd
Total	596 gpm	476,800 gpd	533 gpm	767,520 gpd	434,080 gpd

[1] From field observations in 2007of wells 1, 3 and 3.

2. Storage Capacity

$$\text{Effective Storage} = \frac{5{,}000 + 5{,}000}{3} + 500{,}000 = 503{,}333 \text{ gallons}$$

$$\text{Storage Capacity} = \frac{503{,}333 \text{ gallons}}{200 \text{ gallons/ERC}} = 2{,}517 \text{ ERCs}$$

Storage Equivalent = 2,517 ERC * 400 gpd/ERC = 1,006,666 gpd

Conclusion: This waterworks is limited to a capacity of 434,080 gpd due to a combination of limited well yield and well pump capacity.

Town of Chincoteague

3100-001 / NEW

PERMIT PART 5
JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

June 2000

1.0 INTRODUCTION

The Town of Chincoteague operates a potable water system with a capacity rated by the Virginia Department of Health (VDH) of 1.0 MGD based on the capacity of the existing iron treatment system. The Department of Environmental Quality (DEQ) has issued a permitted annual average withdrawal 1.34 MGD for the Town under permit number ES-061. This permit was issued December 11, 1986, and DEQ will re-issue a new permit with complies with the current Groundwater Withdrawal Regulations. The new permitted withdrawal amount will be based on the historical use over a 5 year period between 1987 and 1992, which is expected to be approximately 194.8 MG/year and 25.2 MG/month. Groundwater use since 1996 has exceeded these historical amounts, with a maximum annual total of 198.5 MG and a maximum month total of 28.5 MG over this period.

The Service Area includes the entire incorporated limits of the Town as well as some outlining areas. This water system consists of six production wells screened in the confined Yorktown aquifer, three shallow production wells screened in the unconfined Columbia aquifer, and nine shallow production wells connected to a common header screened in the Columiba aquifer. The six confined wells and 3 water table wells serve as the primary production wells and the nine shallow wells are currently inactive. Three of the Yorktown aquifer wells (7a, 7b, and 7c) are screened in the upper Yorktown aquifer and are powered by 5 HP submersible pumps with rated capacities of 62 gpm. Well 7c is currently out of service and the remaining two wells (7a and 7b) are not normally used due to the low yield. The other three Yorktown aquifer wells (4, 5, and 6) are screened in the middle Yorktown aquifer and are powered by vertical turbine pumps with rated capacities ranging from 200 gpm to 300 gpm. The three wells screened in the water table aquifer (Well 3A through 3C) are screened at depths between 40 and 60 feet below ground surface (BGS) and are powered by submersible pumps with rated capacities between 100 gpm and 121 gpm. The 9 wells connected to a common header system are currently out-of-service and will not be used as a source of potable water supply in the future.

During the summer months, the system is often operated at capacity, and maintenance problems with any of the production wells have the potential to result in water shortages. Additionally one of the production wells (Well 5) is screened near the base of the middle Yorktown aquifer, where the groundwater quality is slightly brackish. As a consequence, the chloride levels approach the VDH Water Quality Standard of 250 mg/L.

PERMIT PART 5

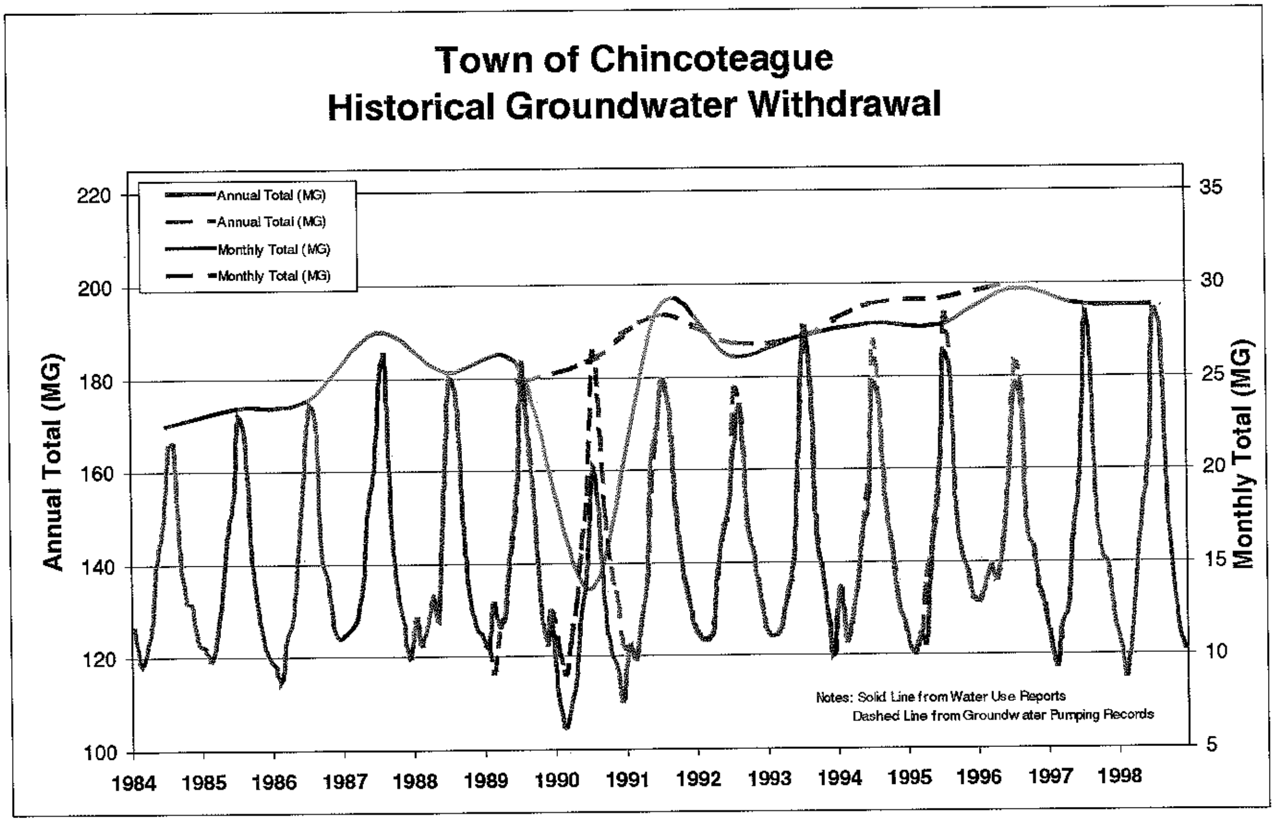
June 2000

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

In order to provide sufficient supply for the Town over the next 10-year period and to provide needed redundancy to the existing well field system, the Town is applying for a major modification to the existing Permit. This modification includes an increase in the Annual Total and Maximum Month withdrawal over the projected historical based amount, the additional of another primary production well, abandonment of the shallow water table wells, and use of Well 5 only as a backup well for maintenance.

2.0 HISTORICAL WITHDRAWAL

The Town of Chincoteague has been submitting Groundwater Use records to VDEQ since 1974 and monthly records since 1984 (see Figure below). Over this period, annual groundwater use has increased steadily at a rate of approximately 1.86 MG/year. The only exception to this trend is a decrease by approximately 50 MG in annual groundwater use in 1990. This same decrease was not reported in the Water Use Reports submitted to DEQ under 9VAC25 Ch. 200 ("Reg 11" reporting). This decrease is most likely due to reporting



error, and the annual water use report for this period is most likely a more accurate represenation of water use during this period. The following year, 1991 groundwater demand returned levels consistent with the historical trend.

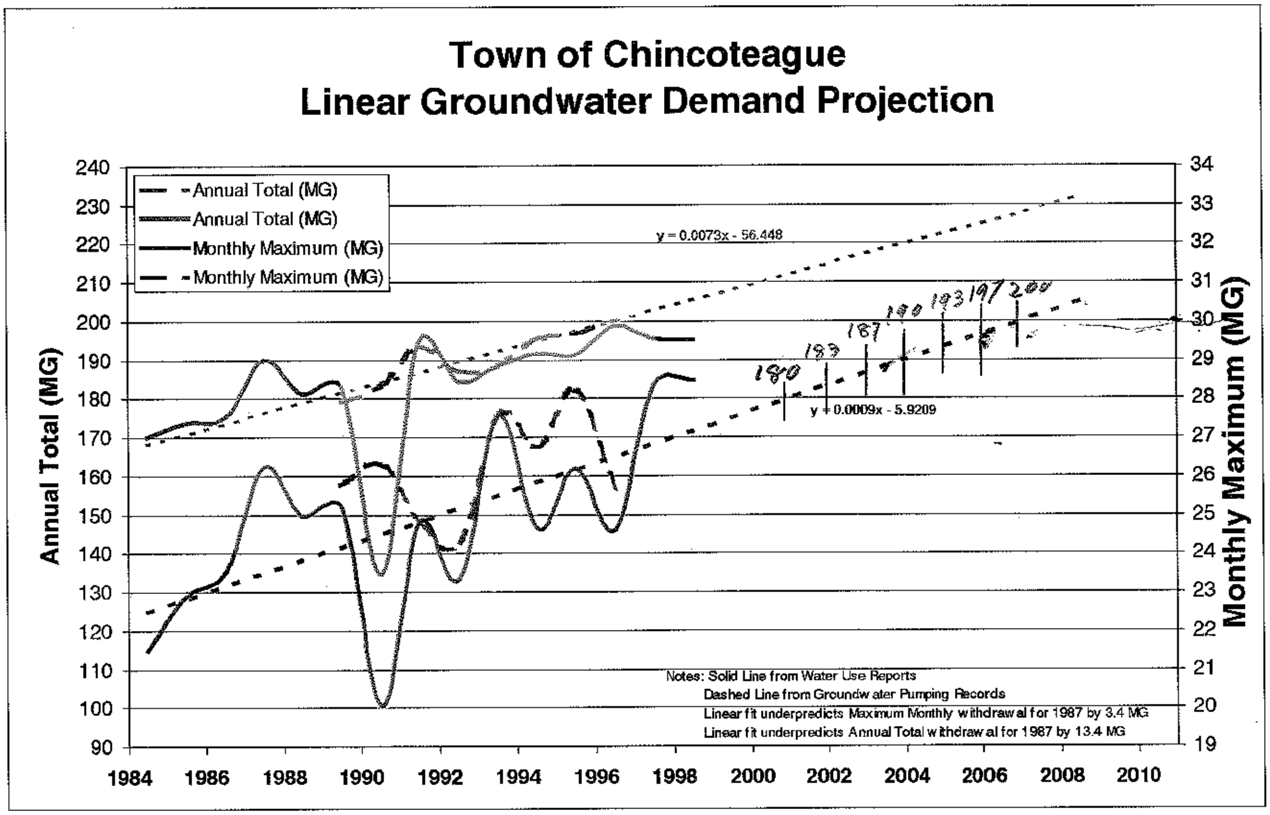
Monthly groundwater use varies significantly as the result of seasonal tourism demand, with the peak month demand occurring in August and the lowest demand occurring in February. The monthly historical demand is also increasing, though at a lower rate than the annual amount. Historical monthly increase in groundwater demand is approximately 0.33 MG/year.

3.0 PROJECTED DEMAND

Water demand over the next 10 year permit period (from 2000 to 2010) was estimated by extrapolating historical demand. This method is appropriate for the Town of Chincoteague in that the water demand over the past 15 year period has increased at approximately the same rate, and there is no indication that the observed growth will decrease in the future. To project demand through the year 2010, a best-fit line was selected for the historical demand. For both annual and monthly, the best-fit line was linear (see Figure below).

Groundwater demand for annual consumption increased at a rate of approximately 1.86 MG/year over the 15-year period. Extrapolating this demand over the next 10 year period yields an average annual demand of 206 MG/year by the year 2010. To adjust the average annual demand to a maximum annual total for the Permit, the maximum positive deviation from the linear regression line (13.4 MG/year) was added to the average annual demand. Based on this extrapolation, maximum annual total groundwater demand over the next 10 year permit period, ending in 2010, will be 219.4 MG/year.

The same method used for calculating the maximum annual demand was used to estimate maximum monthly demand. The best line linear fit was calculated over the 15-year historical maximum monthly groundwater use. Based on the linear fit, maximum monthly demand is increasing at a rate of 0.33 MG/year. Extrapolating this rate over the 10-year permit period, average for the maximum monthly demand by the year 2010 will be 30.7 MG/month. The actual maximum month demand deviated from the regression line by 3.4 MG/month in 1987. Adding this maximum deviation to the average demand of 30.7 MG/month yields a projected maximum month demand of 34.1 MG by the year 2010.



3.0 SUMMARY

The Town of Chincoteague requires additional groundwater over the historical amount to meet projected demands before the year 2010. Based on the historical groundwater use, the new permitted withdrawal amount is expected to be approximately 194.8 MG/year and 25.2 MG/month. Groundwater use since 1996 has already exceeded these historical amounts, with a maximum annual total of 198.5 MG and a maximum month total of 25.2 MG over this period. Groundwater use has increased linearly over the 15-year period of record, with recent demand increasing at the same rate as demand in the 1980's. Extrapolating this demand over the next 10-year period, to the year 2010, annual total demand is projected to reach 219.4 MG/year and maximum month demand is projected to reach 34.1 MG/month.

June 2000

Permit Part 13
Water Conservation Management Plan

1.0 Introduction

1.1 Need For Conservation

Water conservation involves both an increase in efficiency of water use and a reduction of water losses. The net result is a decrease in demand for treated water that can defer development of new resources and reduce the cost of future water service. Each gallon of water conserved is one less requiring storage, treatment, and distribution. It may also represent one less gallon that has to be heated for washing or bathing, thus saving energy costs, or that must pass through a wastewater conveyance system and treatment before it is returned to the environment.

Conservation is an important complement to new supply sources. In some cases, conservation may eliminate the need for new sources of supply. Fresh water, like other natural resources, is a limited commodity which must be managed wisely to preserve the well-being of future generations. Efforts to conserve existing supplies and efficient allocation of water resources are important during each stage of the water supply planning process.

The Town of Chincoteague recognizes the need to conserve and effectively manage its water resources. Only by optimizing water use efficiency and reducing water loss can the Town satisfy its projected water demands over the next five to ten years. While additional long-term supplies are required, every effort will be made to efficiently use currently available supplies.

1.2 Regulatory Requirements

The Groundwater Management Act of 1992 (House Bill 488) was approved in April 1992. It requires a Groundwater Withdrawal Permit (GWP) for certain groundwater withdrawals within declared Groundwater Management Areas (GMAs). Groundwater Withdrawal Regulations adopted in June 1993 (VR 680-13-07) require that applications for new GWPs within GMAs include a water conservation plan approved by the Virginia Department of Environmental Quality, Division of Water (DOW). An approved conservation program must include:

- Use of water-saving plumbing and processes including, where appropriate, the use of water-saving fixtures in new and renovated plumbing as provided under the Uniform Statewide Building Code (USBC).
- A water loss reduction program.
- A water use education program.
- An evaluation of potential water reuse options.
- Requirements for mandatory use reductions during water shortage emergencies, including, where appropriate, ordinances prohibiting the waste of water generally.

1.3 PLAN OBJECTIVES

The primary objectives of this ***Water Conservation and Management Plan*** are to provide a documented, effective conservation strategy designed to reduce demand within the Town of Chincoteague and to demonstrate compliance with the Groundwater Management Act of 1992. This Plan will provide methods by which water use efficiency can be increased as well as procedures to guide the Town and its customers through water supply emergencies. Updates of this Plan are anticipated to be performed on an annual basis to document accomplishments and changes in individual conservation programs. A copy of the annual updates will be provided to the Department of Environmental Quality upon request.

Section 2.0 of this plan describes the use of water-saving plumbing and processes within the service area. Water loss reduction, economic incentives, water use education, and water reuse are discussed in Sections 3.0 through 6.0. The final section of this report describes the Use Restrictions Plan for the Town of Chincoteague.

2.0 WATER-SAVING PLUMBING AND PROCESSES

2.1 UNIFORM STATEWIDE BUILDING CODE (USBC)

The Building Officials and Code Administrators (BOCA) organization is a nonprofit organization which develops a series of performance-oriented model codes (BOCA, 1990). These codes were adopted by the Commonwealth of Virginia as part of the Uniform Statewide Building Code (USBC) (DHCD, 1987). These codes directly specify the use of water conservation fixtures in commercial and residential applications.

The USBC applies to all new construction and some remodeling of existing structures. The USBC requires that:

> *When reconstruction, renovation, or repair of existing buildings is undertaken, existing materials and equipment may be replaced with materials and equipment of similar kind or replaced with greater capacity equipment in the same location when not considered a hazard; however, when new systems, materials, and equipment that were not part of the original existing building are added, the new systems, materials, and equipment shall be subject to the edition of the USBC in effect at the time of their installation. Existing parts of such buildings not being reconstructed, renovated, or repaired need not be brought into compliance with the current edition of the USBC.*

The International Plumbing Code (IPC) sets maximum flow standards (Section 605.4) for a variety of fixtures and appliances. These standards are presented in the following table.

Plumbing Fixture or Fixture Setting	Maximum Flow Rate or Quantity [1]
Water Closet	1.6 gallons per flushing cycle
Urinal	1.0 gallon per flushing cycle
Shower head	2.5 gpm at 80 psi

Lavatory, private	2.5 gpm at 80 psi
Lavatory, public	0.5 gpm at 80 psi
Lavatory, public, metering or self-closing	0.25 gallon per metering cycle
Sink faucet	2.5 gpm at 60 psi

1 gpm - gallons per minute

The current standards set a maximum limit of 2.5 gallons per minute (gpm) at 80 pounds per square inch (psi) for showers and private lavatories. Water closets are limited to 1.6 gallons per flushing cycle, and urinals are limited to 1.0 gallons per cycle. In addition, lavatories in public facilities are limited to 0.5 gpm for those with standard valve or spring faucets and 0.25 gallons per cycle for self-closing metering valves (IPC, 1996).

The USBC in Virginia was adopted from the International Plumbing Code. States are permitted to develop plumbing codes that implement stricter measures than those imposed by the National Plumbing Code. However, localities in Virginia must obtain State authorization to develop a stricter code.

2.2 COMPLIANCE WITH USBC

The Town of Chincoteague currently enforces the 1996 regulations. The Town will also evaluate incentive programs to encourage existing households to retrofit their homes with low flow devices. An additional requirement will apply to car washes.

3.0 WATER LOSS REDUCTION PROGRAM

3.1 WATER LOSS AUDIT

At the beginning of each fiscal year (July 1), a water loss audit will be conducted by the Town of Chincoteague to determine the volume and nature of lost and unaccounted-for water within the Town's water supply system. The purpose of this audit is to identify sources of demand that would normally escape detection by the metering system. This type of demand includes:

1. Fire Fighting. The Fire Department will submit an estimate of all water used on a monthly basis including water used for fire-fighting and for hydrant flushing.

2. Main Flushing. All main flushing performed by the Town will require the submittal of a water consumption estimate.

3. Theft. Any observed theft will be reported to the Town and the appropriate action will be taken. An estimate of the volume of water stolen will be submitted as part of the annual water loss audit.

4. Main Breaks. All main breaks will require the reporting by Town personnel of the estimated volume of water lost.

5. Tank Drainage. All draining of storage tanks in the main distribution system will be reported.

6. Unmetered Services. Every effort will be made to install meters on any portion of the system that is not yet metered as soon as funding becomes available. Grants will be solicited to provide funding.

7. Leaks. Upon completion of the first water loss audit, the Town will develop a leak detection program which will have as its goal the complete survey of all distribution pipes and mains within the Town, to be phased in over the next five years.

8. Meter Errors. The Town will replace meters at a rate such that a complete Town-wide meter turnover takes place every fifteen years, which is the typical warranty

period for water meters. The size of meters requested by commercial and industrial customers will be evaluated and the developer will be consulted to help in determining the appropriate meter size for a particular site based on water use and the anticipated demand. Preventing the installation of oversized meters minimizes unwarranted waste of water.

9. Equipment Calibration. All meters at the well heads will be calibrated on an annual basis. There will be service to check and replace inaccurate meters. Large customer meters that are accessible will be field calibrated yearly. An on-going maintenance program will be implemented to locate and repair plant pipe leaks at the water treatment facilities.

All forms for reporting leaks and unaccounted-for water loss will be maintained by the Town. These forms will be reviewed by Town personnel on a daily basis so that measures can be taken to reduce unaccounted-for water loss.

3.2 LEAK REPAIR PROGRAM

The owner of any residential unit, commercial establishment, or industrial establishment who is found, based on the water loss audit or by other methods, to be an excessive user of water due to leakage from water lines or plumbing fixtures on the premises will be notified by the Town. These owners will be required to repair and stop such leakage within a reasonable period of time or will be subject to financial penalties.

4.0 ECONOMIC INCENTIVES PROGRAM

4.1 EXISTING PROGRAM ELEMENTS

Bills are currently issued bi-monthly by the Town._ Bi-monthly billing allows more frequent and timely distribution of water conservation educational brochures to customers. It also helps customers become aware of leaks more quickly and recognize the cost of high seasonal water use. In addition, bi-monthly billing is useful in providing feedback on customer conservation efforts.

A one-block rate schedule has been implemented. This schedule encourages conservation by not providing a lower rate to high volume water users. By charging large and small water users the same rate, large users have a greater incentive to conserve.

4.2 PLANNED PROGRAM ELEMENTS

The Town will analyze its water rates annually. Rate setting goals will be as follows:

- Perpetuating Public Utilities self-sufficiency while maintaining the highest water quality standards.
- Recommending appropriate rates for water usage and special service charges that are equitable to all customers.
- Continuing a comprehensive water conservation policy by using public information and charges which will discourage nonessential use of water.

5.0 WATER USE EDUCATION PROGRAM

5.1 PLANNED PROGRAM ELEMENTS

Public education concerning the importance of water conservation is a key factor in reducing excessive water use. Education programs should include information about how drinking water is produced and why it is important to conserve. Providing consumers with a better understanding of the reasons conservation is necessary allows them to better appreciate and participate in conservation activities.

The public education program planned by the Town will include the following components:

1. Billing Inserts. Inserts will be included with water bills. The inserts will include information concerning water conservation techniques and leak detection strategies.
2. Brochures. Water conservation brochures and pamphlets will be made available to the public at Town government buildings and at exhibits set up during public events.

3. Video Tapes. A variety of water conservation video tapes will be available from the Town free of charge. They will be available to the general public, to schools for classroom instruction, and for public meetings. The videos will also be provided to cable television companies for showing on government channels.

4. Water Conservation Hot Line. A telephone number will be available through which residents can have their conservation questions answered by a knowledgeable Town employee. In addition, requests for information on various water conservation topics, speakers, or other personal contacts will be coordinated through this telephone line.

5. News Releases. News releases to the print media, radio, and television will keep the public informed. This process will be used not only during emergencies but also on a regular basis to keep the public informed about conservation-related issues.

6. School Education. Programs will be available for presentation by Town staff at local schools. Programs will be targeted to specific age groups. Assistance will be made available for teachers who wish to develop their own water awareness programs.

7. Speakers. Town staff will be available for speaking engagements or personal contacts. These individuals will work with local clubs and organizations to develop public awareness concerning the need to conserve water along with other topics related to the water supply industry.

8. Support of groundwater wells for irrigation of lawns and landscaping by residents, businesses and industries within the service area. The use of well water for these activities helps to minimize the use of potable drinking water for uses which do not require it.

6.0 WATER REUSE OPTIONS

Water reuse may be either direct or indirect and for potable or non-potable uses. Direct reuse involves introducing highly treated, reclaimed water directly to a potable water distribution system, while indirect reuse involves returning treated wastewater to the environment for dilution and natural purification, and subsequent withdrawal for water supply. Potable reuse (which is referred to as recycle by the Virginia Department of Health (VDH)) is the specific use of treated wastewater as a drinking water source.

Indirect potable reuse occurs widely in the United States, each time treated wastewater effluent is discharged to a natural waterway upstream of a water supply intake. In most cases, it is unintentional. Past experience indicates that indirect reuse was acceptable because the application of water and wastewater treatment techniques, the near-universal use of some form of disinfectant, and the natural dilution and purification that occurs in natural waterways adequately treated the water. However, in recent years the effectiveness of these measures in protecting against viral and trace organic contaminants has come under increasing scrutiny.

Unplanned and unintentional reuse of this type is classified as uncontrolled potable reuse, and represents the overwhelming majority of cases of indirect potable reuse.

6.1 PLANNED PROGRAM ELEMENTS

6.1.1 Potable Reuse

The Virginia Department of Health has prepared a ***Recycle Issues*** paper dated November 24, 1992. The VDH stated its opposition to both direct and indirect potable reuse projects when naturally occurring sources of water are available. The VDH insists that the highest quality, best source of water be selected when alternatives are available. The VDH also listed several other requirements which would apply to a potable reuse project, pertaining to independent monitoring, dilution, liability, removal of biological hazards and toxics, and utilization of natural purification processes. Given the current position of the VDH, reuse of wastewater treatment plant effluent for potable purposes is not deemed a practicable reuse alternative to conserve water.

6.1.2 Non-potable Reuse

Many industrial water demands are for non-potable uses. One method of reducing demands on potable water sources is to supply non-potable demands using treated wastewater plant effluent. Detailed regulations for implementation of a water reuse project do not exist in the

Commonwealth of Virginia. Permitting of a water reuse project would most likely involve both the VDH and the Virginia Department of Environmental Quality (VDEQ). In addition, a Virginia Pollution Discharge Elimination System (VPDES) Permit would be required for discharge to State waters if the flow is not contaminated during its use; if it is contaminated, the approval of VDH and/or VDEQ would be required.

Several states including California, Arizona, Texas, Utah, and Florida have developed regulations and state statutes that specify the required minimum quality of reclaimed water, depending on the intended use of the water. In general, the requirements become more stringent as the likelihood of public contact increases. In California, if treated reclaimed water for industrial use meets the state's standards for full body contact recreation, workers are not required to avoid contact with the water or to wear protective clothing. However, precautions are required should the treated reclaimed water fail to meet these criteria. With the approval of State and local health departments, reclaimed water can be used for soil compaction, dust control, and other construction purposes.

As mentioned previously, recycling will be required in all new car washes and existing car washes will be required to be retrofitted. In addition, required recycling systems are being considered for all new construction and all repair or replacement of continuous flow devices, including any water connector, device, or appliance which requires a continuous flow of 5 gallons per minute or more.

Typically, non-potable markets for reused water include irrigation uses, industrial uses, and creation of recreational lakes. Many factors affect the market for reused water, including:

- Size and location of demand.
- Water quality requirements.
- Degree of treatment required for discharge.
- Cost of reclaimed water.

- Cost and availability of alternative supplies.

It is likely that additional reuse methodologies will be evaluated in the future. Industries within the service area that use large quantities of water are continually evaluating their processes and looking for ways to lower production costs. For these industries, water represents one of their greatest operating expenses. It is in the best interest of these industries to stay abreast of the latest reuse technologies and employ them whenever feasible.

6.2 FUTURE PROGRAM ELEMENTS

The Public Utilities will evaluate its water conservation programs on a continual basis. As part of this process, new water reuse technologies will be researched and evaluated to determine their applicability in the service area. Continued communication with large water users will create possibilities for more efficient use of water resources.

7.0 WATER USE RESTRICTIONS

7.1 EMERGENCY USE RESTRICTION PLAN

Emergency situations, such as severe drought, may threaten the regional water supply. During these times, the implementation of use restrictions is necessary to protect the water supply from further depletion. Use restrictions are considered a form of conservation because they result in demand reductions, but they are implemented only during periods when the regional water supply is threatened. Such restrictions are reserved as contingency measures for emergency situations and are more restrictive than normal conservation measures which are used continually to reduce demands. Use restrictions are commonly implemented using a tiered approach and are activated in relation to specific storage levels of a system's raw water supply.

The Town of Chincoteague will use a four tiered use restriction plan. When the Town Council finds that the immediate potential for a water shortage exists, the Water Commissioner is authorized to implement conservation measures. Manadatory water use restrictions with penalties will also be implemented during water shortage emergencies declared by the Director of DEQ. The four tiers of use restrictions are as follows:

- Tier 1 - Voluntary Use Restrictions: Voluntary Use Restrictions are employed as a first stage in reducing water demands during a potential water shortage. These restrictions are encouraged by the water utility but compliance is not required. When Tier 1 is in effect, the public will be asked to employ restraint in water usage and to conserve water voluntarily by whatever methods available.

- Tier 2 - Mandatory Use Restrictions: Mandatory Use Restrictions are put into effect when very limited supplies of water are available. These restrictions focus on the elimination of outdoor, non-essential uses of water. In Tier 2, compliance is mandated by a local ordinance and the restrictions are enforced with penalties for violations.

- Tier 3 - Mandatory Reductions: Mandatory reductions in water use will be used to further reduce water usage under the most severe drought conditions. Non-residential users will be allotted a percentage reduction based on their average monthly and/or previous bimonthly consumption. Residential customers will be limited to a specific volume or percentage reduction of water per quarter. A surcharge of ten dollars for every 100 cubic feet of water consumed above the allotted volume will be applied.

- Tier 4 - Water Rationing: When only crucial supplies of water are available, Public Utilities will restrict water use to the purposes that are essential to life, health, and safety.

When determining the level of use restriction to be implemented, the Public Utilities Director will consider water levels, available storage, drawdown rates, projected supply capability, system purification and pumping capacity, daily and projected water consumption, prevailing and forecasted weather conditions, fire service requirements, pipeline conditions, supplementary source data, estimates of minimum essential supplies to preserve public health and safety, and other pertinent data. The restrictions do not apply to any governmental activity, institution, business, or industry which is declared by the Public Utilities Director to be necessary for public health, safety, and welfare or on which the restrictions would place severe economic hardship or cause substantial loss of employment.

7.2 ENFORCEMENT

No enforcement or penalties are involved with Tier 1 because compliance with this tier is strictly voluntary. A violation of Tiers 2, 3, or 4 will result in a fine not to exceed five hundred dollars in addition to any additional charges that apply to the violation. Each day of a continued violation will be considered a separate offense. In addition, the Public Utilities Director can suspend water service to any person violating the use restrictions. If water service is terminated, a reconnection fee of fifty dollars plus all outstanding fees and fines must be paid before service is restored.

8.0 SUMMARY OF CONSERVATION PLAN

The Conservation Management Plan will aid the Town in meeting its water supply needs over the next decade. The conservation plan includes a variety of elements to be implemented on a regular basis. Water saving plumbing, as described in the USBC, will be required. Economic incentives will encourage conservation. Annual water loss audits and a leak reduction program will reduce water loss. An education program will help the public to understand the importance of conservation and methods by which conservation can be achieved. Evaluation of the potential for reuse of treated wastewater, especially for industry, will be completed for all new facilities. In addition, a four-tiered approach to reducing water consumption during emergency conditions will protect the Town's water supplies.

A combination of the water conservation measures to be implemented under normal conditions and the emergency use restrictions described in this document will reduce finished water demand. Through a combination of new supply sources and water conservation, the Town will be able to supply predicted water demands into the future.

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: September 16, 1977
Revised April 18, 1984
Revised March 3, 1988
Revised January 24, 1996

WATERWORKS NAME:	Town of Chincoteague	CERTIFIED CLASS: III
COUNTY/CITY:	Accomack County	TYPE: Community

LOCATION: The wells and chemical addition plant are located on the mainland on State Route 175, 5 miles west of Chincoteague Island. The iron removal and storage facilities are located on the Island.

OWNER: Town of Chincoteague
Mr. T. Stewart Baker, Town Manager
4026 Main Street
Chincoteague, Virginia 23336
Phone (804) 336-6519
FAX (804) 336-1965

OPERATOR: Mr. A.J. Bowden, Waterworks Supervisor (Class II)
Town of Chincoteague
4026 Main Street
Chincoteague, Virginia 23336
Phone (804) 336-3366
FAX (804) 336-1965

PERMIT NO.: 3001175

DATE ISSUED: April 18, 1984

TYPE OF TREATMENT: Chlorination and Iron Removal

SOURCE: 8 Wells

DESIGN CAPACITY: 1,000,000 gpd

DESCRIPTION OF SYSTEM

The system consists of eight wells, chlorination system , a ground storage tank, an elevated storage tank, iron removal facility, high service pumps, and the distribution system. Wells 3A, 3B, 3C, 4, 5, and 6 discharge to a 16-inch main and Wells 7A and 7B discharge to an 8-inch main. Both mains converge on the Island prior to entering the filter plant.

Well No. 3A was drilled starting on March 30, 1989, and was completed on March 31, 1989. The well bore is 55 feet deep, with cement grout extending from the surface to 35 feet. The steel well casing is 6-inches in diameter and extends to 42 feet, extending to 55 feet of stainless steel screen (.020 slot). Gravel pack is installed from 35 feet to 55 feet. The well is equipped with a submersible pump rated at gpm at feet TDH driven by a 5 H.P. motor. The pump intake is set at feet. The well has a tested yield of 65 gpm, over a 48-hour period from April 11, 1989 to April 13, 1989, with the water level dropping from 19.5 feet (static condition) to 33 feet 8 inches (dynamic condition).

Well No. 3B was drilled starting on March 31, 1989, and was completed on April 4, 1989. The well bore is 59 feet deep, with cement grout extending from the surface to 39 feet. The steel well casing is 6-inches in diameter and extends to 44 feet, extending to 59 feet of stainless steel screen (.020 slot). Gravel pack is installed from 39 feet to 59 feet. The well is equipped with a submersible pump rated at gpm at feet TDH driven by a 5 H.P. motor. The pump intake is set at feet. The well has a tested yield of 81 gpm, over a 48-hour period from April 18, 1989 to April 20, 1989, with the water level dropping from 20.5 feet (static condition) to 31.5 feet (dynamic condition).

Well No. 3C was drilled starting on April 4, 1989, and was completed on April 5, 1989. The well bore is 60 feet deep, with cement grout extending from the surface to 40 feet. The steel well casing is 6-inches in diameter and extends to 45 feet, extending to 60 feet of stainless steel screen (.020 slot). Gravel pack is installed from 40 feet to 60 feet. The well is equipped with a submersible pump rated at gpm at feet TDH driven by a 5 H.P. motor. The pump intake is set at feet. The well has a tested yield of 72 gpm, over a 48-hour period from April 25, 1989 to April 27, 1989, with the water level dropping from 15 feet 10 inches (static condition) to 32 feet 3 inches feet (dynamic condition).

Well No. 4 was completed in September 1964. The well bore is 245 feet deep, with cement grout extending from the surface to 86 feet. The outer well casing is 16-inches in diameter and extends to 86 feet. The inner steel well casing is 8-inches in diameter and extends to 217 feet extending to 245 feet of stainless steel screen (#15 slot from 217 feet to 223 feet, and #30 slot from 223 feet to 245 feet). The well is equipped with a vertical turbine pump rated at 245 gpm at 276 feet TDH driven by a 25 H.P. motor. The pump intake is set at 140 feet. The well has a tested yield of 300 gpm, over an unknown time period, with the water level dropping from 15 feet (static condition) to 115 feet (dynamic condition).

Well No. 5 was completed in January 1972. The well bore is 256 feet deep, with cement grout extending from the surface to 101 feet. The outer steel well casing is 16-inches in diameter and extends to 10 feet. The inner steel well casing is 8-inches in diameter and extends to 223 feet extending to 256 feet of stainless steel screen (#304 slot). The well is equipped with a vertical turbine pump rated at 200 gpm at 322 feet TDH driven by a 30 H.P. motor. The pump intake is set at 160 feet. The well has a tested yield of 118 gpm, over a 10-hour period on January 8, 1972, with the water level dropping from 16 feet (static condition) to 90 feet (dynamic condition).

Well No. 6 was drilled starting on November 15, 1977, and was completed on November 18, 1977. The well bore is 238 feet deep, with cement grout extending from the surface to 140 feet. The well casing is 6-inches in diameter and extends to 154 feet. Six-inch stainless steel screens (.020 slot) are set at 154 to 159 feet; 180 to 185 feet; 192 to 197 feet; and 210 to 225 feet. Gravel pack is installed from 140 feet to 228 feet. The well is equipped with a vertical turbine pump rated at 200 gpm at 204 feet TDH driven by a 20 H.P. motor. The pump intake is set at 135 feet. The well has a tested yield of 201 gpm, over a 24-hour period from November 22, 1977 to November 23, 1977, with the water level dropping from 16 feet (static condition) to 87.5 feet (dynamic condition).

Well No. 7A was drilled starting on September 9, 1983, and was completed on September 15, 1983. The well bore is 107 feet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 6-inches in diameter and extends to 97 feet, extending to 107 feet of stainless steel screen (.012 mesh). The well is equipped with a submersible pump rated at 100 gpm at 90 feet TDH driven by a 5 H.P. motor. The pump intake is set at 90 feet. The well has a tested yield of 62 gpm, over a 48-hour period, with the water level dropping from 22 feet (static condition) to 80 feet (dynamic condition).

Well No. 7B was drilled starting on September 5, 1983, and was completed on September 9, 1983. The well bore is 106 feet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 6-inches in diameter and extends to 96 feet, extending to 106 feet of stainless steel screen (.012 mesh). The well is equipped with a submersible pump rated at 100 gpm at 90 feet TDH driven by a 5 H.P. motor. The pump intake is set at 90 feet. The well has a tested yield of 32 gpm, over a 48-hour period, with the water level dropping from 22 feet (static condition) to 80 feet (dynamic condition).

Manifold Piping: Water from the eight wells is pumped through four different pipes to a "Manifold Building" and then to either the 16-inch main or the 8-inch main. Wells No. 3A, 3B, 3C, and 5 discharge through one pipe to the 16-inch main. Wells No. 4 and 6 also discharge to the 16-inch main through separate pipes. Wells 7A and 7B discharge through the fourth pipe to the 8-inch main. The four water inlet pipes are valved and metered. The two mains are valved so that the water supply to either pipe can be shut off. The two mains continue to a building referred to as the "Chart Building".

Chart Building: The "Chart Building" is used for metering and chemical feed. The 16-inch and 8-inch water mains pass straight through the building after leaving the Manifold Building. Metering is accomplished by two flow meters with recording receivers which electrically regulate the flow of chlorine added to the water.

Chlorination: The chemical addition building is located approximately 50 feet from the Chart Building. The chemical building houses the chlorinator, chlorine cylinders, booster pump, and feeder controls. Chlorination is provided by a solution-feed vacuum-type chlorination system. The chlorine is pumped into the transmission line by a centrifugal pump. Chlorine is injected into the 16-inch main located in the Chart Building.

Water Transfer: Water is pumped from the Chart Building to the iron removal plant, located on Chincoteague Island, using the discharge head from the eight wells. The water flows from the mainland to Chincoteague through approximately five miles of parallel 8-inch and 16-inch mains, located along Route 175. Both of the transmission main lines converge together prior to entering the iron removal plant building located in Chincoteague near the junction of Routes 2120 and 2105.

Iron Removal Facilities: The iron removal building houses two pressure filter iron removal units, backwash controller, flow meters, gauges, rate of flow control equipment, and valves. Filter construction includes multimedia filter material, underdrains, backwash piping and rate of flow controllers. Inlet and discharge gauges indicate the head losses through the filters. The iron removal units are backwashed with water from the adjacent elevated storage tank through an 8-inch main with lows rates controlled by a pressure reducing and flow control valve. Filter backwash water is discharged to a concrete storage basin for settling prior to discharge to the Chincoteague Channel.

Storage Tanks: The 200,000 gallon elevated storage tank and the 1,000,000 gallon ground storage tank are located on opposite side of the iron removal plant building. Water flows under well head pressure from the iron removal plant to the 1.0 MG ground storage tank and is pumped from that tank to the elevated tank with high service pumps.

High Service Pumps: Four high service pumps, finished water meter, pump controls, piping and valves, and a small laboratory are located in the high service pump building adjacent to the 1.0 MG ground storage tank. Pumps operate automatically in a range of 45 to 55 psi. There are two pump controllers that receive pressure signals through pressure lines connected to the tank side of the pump discharge piping. The operator can switch operation of the two controllers manually for summer vs. winter operation. All pumps are arranged with inlet and discharge shutoff valves and check valves. The pumps can deliver water directly to the distribution system or to the elevated tank, or both.

EVALUATION OF SYSTEM

This system is evaluated on the basis of equivalent residential connections (ERC). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

I. Source Capacity

A. Source Yield

1. Number of Sources

a. Required = 1 up to 49 ERC, more than 1 for 50 or more ERC
b. Provided = 8 wells

2. Yield:

	Well			Pump
Well 3A:	65	gpm		
Well 3B:	81	gpm		
Well 3C:	72	gpm		
Well 4:	300	gpm		245
Well 5:	118	gpm		200
Well 6:	201	gpm		200
Well 7A:	62	gpm		100
Well 7B:	32	gpm		100
Total Well Yield	931	gpm	Total Pump Yield	

B. Production Capacity

$$\frac{931 \text{ gpm}}{0.5 \text{ gpm/ERC}} = 1862 \text{ ERC}$$

II. Treatment System Capacity:

A. Iron Removal Units - Total Area - 173.2 sf

B. Treatment Capacity = 173.2 x 4 gpm/sf = 693 gpm = 997,920 gpd

$$\text{Capacity} = \frac{693\ (1440)}{400 \text{ gpd/ERC}} = 2495 \text{ ERC}$$

III. High Service Pump Capacity:

A. Total Pumping Capacity = 210 + 210 + 400 + 450 = 1270 gpm

B. Capacity = $\dfrac{1270\ (1440)}{400\ \text{gpd/ERC}}$ = 4572 ERC

IV. Storage Capacity

A. Total Storage = 1,000,000 + 200,000 = 1,200,000 gpd

B. Storage Capacity

$\dfrac{1{,}200{,}000\ \text{gal}}{200\ \text{gal./ERC}}$ = 6000 ERC

V. Limiting Case

A. Source Capacity = 1862 ERC

B. Capacity Equivalent = 1862 ERC x 400 gpd/ERC = 744,800 gpd

C. Based on the ERC values shown above the limiting system capacity is that of the source supply and is 1862 ERC. The actual system water production rate is limited by the iron removal plant capacity of 1,000,000 gpd.

D. The permit was previously issued for 1.0 MGD, based on treatment capacity and source yield at the time. Therefore, the permitted system capacity remains at 1,000,000 gpd or 2500 ERC.

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: April 18, 2008

WATERWORKS NAME:	Town of Chincoteague	WATERWORKS CLASS: III
COUNTY/CITY:	Accomack County	TYPE: Community

LOCATION: The source water wells and gas chlorination facilities are located on NASA-Wallops Flight Facility on both sides of State Route 175, and the storage tanks and other treatment facilities are located on Willow Street in the Town of Chincoteague.

OWNER: Town of Chincoteague
Mr. Michael Cosby, Director, Public Works
6150 Community Drive
Chincoteague, Virginia 23336
Phone: (757) 336-3366

OPERATOR: Licensed Class III

PERMIT NO.: 3001175

DATE ISSUED: April 18, 2008

TYPE OF TREATMENT: Iron and manganese removal, pre gas chlorination, post hypochlorite corrosion control, and pH adjustment

SOURCE: 9 Wells

PERMITTED CAPACITY: 812,000 gallons per day

DESCRIPTION OF WATERWORKS

The waterworks consists of ten wells, chlorination, iron and manganese removal, corrosion control treatment, pH adjustment, a ground storage tank, an elevated storage tank, high service pumps, and the distribution system. Wells 3A, 3B, 3C, and 5, discharge into a 6-inch raw water header; Wells 4 and 6 discharge to separate 6-inch raw water mains and Wells 7A, 7B and 8 discharge to an 8-inch raw water header. All the raw water mains meet at the Manifold Building (metering). The flow is then diverted into either a 16-inch or an 8-inch raw water transmission main and chlorinated. The mains converge prior to entering the filter plant.

<u>Well No. 3A</u> was drilled starting on March 30, 1989, and was completed on March 31, 1989. The well bore is 55 feet deep, with cement grout extending from the surface to 35 feet. The steel well casing is 6-inches in diameter and extends to 42 feet, extending to 55 feet of stainless steel screen (.020 slot). Gravel pack is installed from 35 feet to 55 feet. The well is equipped with a submersible pump rated at 70 gpm at 10 psi TDH driven by a 5 H.P. motor. The well has a tested yield of 65 gpm, over a 48-hour period from

April 11, 1989 to April 13, 1989, with the water level dropping from 18 feet (static condition) to 33 feet 8 inches (dynamic condition).

Well No. 3B was drilled starting on March 31, 1989, and was completed on April 4, 1989. The well bore is 59 feet deep, with cement grout extending from the surface to 39 feet. The steel well casing is 6-inches in diameter and extends to 44 feet, extending to 59 feet of stainless steel screen (.020 slot). Gravel pack is installed from 39 feet to 59 feet. The well is equipped with a submersible pump rated at 70 gpm at 10 psi TDH driven by a 5 H.P. motor. The well has a tested yield of 81 gpm, over a 48-hour period from April 18, 1989 to April 20, 1989, with the water level dropping from 20.5 feet (static condition) to 31.5 feet (dynamic condition).

Well No. 3C was drilled starting on April 4, 1989, and was completed on April 5, 1989. The well bore is 60 feet deep, with cement grout extending from the surface to 40 feet. The steel well casing is 6-inches in diameter and extends to 45 feet, extending to 60 feet of stainless steel screen (.020 slot). Gravel pack is installed from 40 feet to 60 feet. The well is equipped with a submersible pump rated at 70 gpm at 10 psi TDH driven by a 5 H.P. motor. The well has a tested yield of 72 gpm, over a 48-hour period from April 25, 1989 to April 27, 1989, with the water level dropping from 15 feet 10 inches (static condition) to 32 feet 3 inches feet (dynamic condition).

Well No. 4 was completed in September 1964. The well bore is 245 feet deep, with cement grout extending from the surface to 86 feet. The outer well casing is 16-inches in diameter and extends to 86 feet. The inner steel well casing is 8-inches in diameter and extends to 217 feet extending to 245 feet of stainless steel screen (#15 slot from 217 feet to 223 feet, and #30 slot from 223 feet to 245 feet). The well is equipped with a vertical turbine pump rated at 245 gpm at 276 feet TDH driven by a 25 H.P. motor. The pump intake is set at 140 feet. The well has a tested yield of 300 gpm, over an unknown time period, with the water level dropping from 15 feet (static condition) to 115 feet (dynamic condition).

Well No. 5 was completed in January 1972. The well bore is 256 feet deep, with cement grout extending from the surface to 101 feet. The outer steel well casing is 16-inches in diameter and extends to 10 feet. The inner steel well casing is 8-inches in diameter and extends to 223 feet extending to 256 feet of stainless steel screen (#304 slot). The well is equipped with a vertical turbine pump rated at 200 gpm at 322 feet TDH driven by a 30 H.P. motor. The pump intake is set at 160 feet. The well has a tested yield of 118 gpm, over a 10-hour period on January 8, 1972, with the water level dropping from 16 feet (static condition) to 90 feet (dynamic condition).

Well No. 6 was drilled starting on November 15, 1977, and was completed on November 18, 1977. The well bore is 238 feet deep, with cement grout extending from the surface to 140 feet. The well casing is 6-inches in diameter and extends to 154 feet. Six-inch stainless steel screens (.020 slot) are set at 154 to 159 feet; 180 to 185 feet; 192 to 197 feet; and 210 to 225 feet. Gravel pack is installed from 140 feet to 228 feet. The well is equipped with a vertical turbine pump rated at 200 gpm at 204 feet TDH driven by a 20 H.P. motor. The pump intake is set at 135 feet. The well has a tested yield of 201 gpm, over a 24-hour period from November 22, 1977 to November 23, 1977, with the water level dropping from 16 feet (static condition) to 87.5 feet (dynamic condition).

Well No. 7A was drilled starting on September 9, 1983, and was completed on September 15, 1983. The well bore is 107 feet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 6-inches in diameter and extends to 97 feet, extending to 107 feet of stainless steel screen (.012 mesh). The well is equipped with a submersible pump rated at 100 gpm at 90 feet TDH driven by a 5 H.P. motor. The pump intake is set at 90 feet. The well has a tested yield of 62 gpm, over a 48-hour period, with the water level dropping from 22 feet (static condition) to 80 feet (dynamic condition). This well is no longer in operation.

Well No. 7B was drilled starting on September 5, 1983, and was completed on September 9, 1983. The well bore is 106 feet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 6-inches in diameter and extends to 96 feet, extending to 106 feet of stainless steel screen (.012 mesh). The well is equipped with a submersible pump rated at 100 gpm at 90 feet TDH driven by a 5 H.P. motor. The pump intake is set at 90 feet. The well has a tested yield of 32 gpm, over a 48-hour period, with the water level dropping from 22 feet (static condition) to 80 feet (dynamic condition).

Well No. 8 was drilled starting on April 2, 2004 and completed on April 8, 2004. The well bore is 255 feet deep, with cement grout extending from the surface to 190 feet below grade. The steel well casing is 8 – inches in diameter and extends to 215 feet. Below the casing is 40 feet of 0.020 6-inch stainless steel well screen (215 to 255 feet). The well is equipped with a submersible pump rated at 250 gpm at 200 feet TDH driven by a 20 HP motor. The pump intake is set at 200 feet. The well has a tested yield of 215 gpm over a 72 hour period, with the water dropping from 43.44 feet (static condition) to 143.98 feet (dynamic condition) (drawdown of 100.54 feet).

Manifold Piping: Water from the active eight wells (3A, 3B, 3C, 4, 5, 6, 7B and 8) is pumped through four different pipes to a "Manifold Building" and then to either the 16-inch main or the 8-inch main. The wells can be manifolded to either the 8-inch or 16-inch lines after metering in the Manifold Building. The flow is metered again in the 8-inch and 16-inch lines to pace the chlorine feed. The four water inlet pipes are valved and metered. The two mains are valved so that the water supply to either pipe can be shut off.

Chart Building: The "Chart Building" is used for metering and chemical feed. The 16-inch and 8-inch water mains pass straight through the building after leaving the Manifold Building. Metering is accomplished by two flow meters with recording receivers which electrically regulate the flow of chlorine added to the water.

Chlorination: The chemical addition building is located approximately 50 feet from the Chart Building. The chemical building houses the chlorinator, chlorine cylinders, booster pump, and feeder controls. Chlorination is provided by a solution-feed vacuum-type chlorination system. The chlorine is pumped into the transmission line by a centrifugal pump. Chlorine is injected into the 16-inch main located in the Chart Building. Chlorine facilities are also available to boost residual at the water treatment plant on the Chincoteague Island.

Water Transfer: After leaving the Chart Building the water flows from the mainland to Chincoteague Island through approximately five miles of parallel 8-inch and 16-inch mains, located along Route 175. Both of the transmission main lines converge together prior to entering the iron removal plant building located in Chincoteague near the junction of Routes 2120 and 2105.

Iron Removal Facilities: The iron removal building houses two pressure filter iron removal units, backwash controller, flow meters, gauges, rate of flow control equipment, and valves. Filter construction includes multimedia filter material, underdrains, backwash piping, and rate of flow controllers. Inlet and discharge gauges indicate the head losses through the filters. The iron removal units are backwashed with water from the adjacent elevated storage tank through an 8-inch main with low rates controlled by a pressure reducing and flow control valve. Filter backwash water is discharged to a concrete storage basin for settling prior to discharge to the Chincoteague Channel.

Corrosion Control Treatment: The corrosion control treatment consists of a metering pump (0-14 gpd capacity) with a flow pacing interface signal and other appurtenances for feeding zinc orthophosphate. The capacity of the treatment is evaluated based on the pure chemical (containing zinc orthophosphate) at the maximum design feed rate of 3 mg/l.

Storage Tanks: The 200,000 gallon capacity elevated storage tank and the 1,000,000 gallon ground storage tank are located on the opposite side of the iron removal plant building. Water flows are under well head pressure from the iron removal plant to the 1.0 MG ground storage tank and are pumped from that tank to the elevated tank with high service pumps.

High Service Pumps: Four high service pumps, finished water meter, pump controls, piping and valves, and a small laboratory are located in the high service pump building adjacent to the 1.0 MG ground storage tank. Pumps operate automatically in a range of 45 to 55 psi. There are two pump controllers that receive pressure signals through pressure lines connected to the tank side of the pump discharge piping. The operator can switch operation of the two controllers manually for summer vs. winter operation. All pumps are arranged with inlet and discharge shutoff valves and check valves. The pumps can deliver water directly to the distribution system or to the elevated tank, or both. The stated capacities of the pumps are: two at 210 gpm, 210, one at 400 gpm and one at 450 gpm.

EVALUATION OF SYSTEM

This system is evaluated on the basis of equivalent residential connections (ERC). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

I. Source Capacity

A. Source Yield

1. Number of Sources
   a. Required = 1 up to 49 connections, more than 1 for 50 or more connections
   b. Provided = 9 wells

2.

Yield:	Well		Pump	
Well 3A:	65*	gpm	70	gpm
Well 3B:	81	gpm	70*	gpm
Well 3C:	72	gpm	70*	gpm
Well 4:	300	gpm	245*	gpm
Well 5:	118*	gpm	200	gpm
Well 6:	201	gpm	200*	gpm
Well 7A:	--	gpm	No Pump	
Well 7B:	32*	gpm	100	gpm
Well 8	215*	gpm	250	gpm
Total Yield	1084	gpm	1,205	gpm
(* limiting)				

B. Production Capacity

$$\frac{1{,}015 \text{ gpm}}{0.5 \text{ gpm/ERC}} = 2{,}030 \text{ ERC}$$

II. Treatment System Capacity:

A. Iron Removal Units - Total Area - 173.2 sf

B. Treatment Capacity = 173.2 x 4 gpm/sf = 693 gpm = 997,920 gpd

Capacity = $\frac{693 (1440)}{400 \text{ gpd/ERC}}$ = 2,495 ERC

C. Corrosion Control Treatment Capacity

$$\frac{14 \text{ gpd x } 8.34 \text{ lbpg x } 1.6 \text{ (sp. gravity of chemical)}}{8.34 \text{ (conversion factor) x } 3 \text{ mg/l (max. dose)}} = 7.5 \text{ MGD}$$

Capacity = 7.5 x 1,000,000 gpd/400 gpd/ERC = 18,750 ERCs

III. High Service Pump Capacity:

A. Total Pumping Capacity = 210 + 210 + 400 + 450 = 1,270 gpm

B. Capacity = $Q = 11.4\ N^{0.544}$

$1{,}270 \text{ gpm} = 11.4\ N^{0.544}$

N= 5,780 ERC

IV. Storage Capacity

A. Total Storage = 1,000,000 + 200,000 = 1,200,000 gpd

B. Storage Capacity

$$\frac{1{,}200{,}000 \text{ gal.}}{200 \text{ gal./ERC}} = 6{,}000 \text{ ERC}$$

V. Limiting Case

A. Source Capacity = 2,030 ERC

B. Capacity Equivalent = 2,030 ERC x 400 gpd/ERC = 812,000 gpd

Based on the ERC values shown above, the limiting system capacity is that of the source supply and is 812,000 ERC.

DWT/ssd

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Dreamland Homes

3100-001 / NEW

ATTACHMENT 1

5. <u>Justification for the Amount of Withdrawal Requested</u>

Documentation of Beneficial Use:

Water meters are installed on all the wells and records are available for each well beginning February 2008 through January 2009. Attached is a compilation of meter readings from the 15 wells for the 12 month period. These readings show the total monthly water use and total water use for the 12 month period.

The total water use for the 13 months is 10,119,471 gallons. The average daily use for 12 months is 27,719 gpd. Based on the average use the projected yearly average use will be 10,585,000 gallons. Also, based on monthly meter readings, the high and low daily amounts are 38,427 gpd and 19,284 gpd, as shown in the attachment.

The owners have been taking steps to reduce the water usage in the park. Since they began metering the wells, they have removed all washing machines from the trailers and have been replacing faucets and shower heads with low water use fixtures. This is an ongoing project and they intend to replace as many as possible. They have also been informing the tenants that they need to take steps towards water conservation.

The owners will prepare a written notice that will be given to each tenant informing them of the need to be careful about wasting water.

<u>Water Demand Projections</u>

The requested maximum withdrawal amount of 12,000,000 gallons yearly and 1,100,000 gallons monthly should be reasonable for the ten year permit period. The trailer park is currently at capacity and the owner has no plans for expansion of the park. Therefore, additional water users should not be a factor for the ten year period of the permit.

<u>Apportionment of Withdrawal to Individuals</u>

There is no operational pumping schedule for the wells. There are 15 wells and each well serves 6 connections as indicated on the attached plat of the park. This means that each well is operable on a 24 hour period. As you can see in the attached water use tabulation, each of the wells are on demand and provide different volumes of water during the day. All of the wells are at the same depth and in the same location and are drawing from the same aquifer. There is no particular frequency of water use and pumping for the wells. They provide potable water for residential use and the pumps operate when required by pressure drop in the particular system.

The owner recognizes that mandatory water use restrictions could be declared by the Director of DEQ or the local governing body and that penalties could be levied during water shortage emergencies.

ATTACHMENT I

SHORE ENGINEERING CO., INC.
P.O. Box 354
MELFA, VIRGINIA 23410
(757) 787-2773

JOB DREAMLAND HOMES
SHEET NO. 1 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE WATER USE

					GPD
FEB	436,120 + 449,600	=	885,720	(28)	31,633
MAR	558,610 + 449,600	=	1,008,210	(31)	32,523
APR	297,450 + 329,590	=	627,040	(30)	20,901
MAY	548,500 + 540,810	=	1,089,310	(31)	35,139
JUN	573,660 + 382,900	=	956,560	(30)	31,885
JUL	556,650 + 472,810	=	1,029,460	(31)	33,208
AUG	408,630 + 369,640	=	778,270	(31)	25,105
SEP	355,360 + 321,790	=	677,150	(30)	22,572
OCT	320,511 + 308,390	=	628,901	(31)	20,287
NOV	384,400 + 265,390	=	649,790	(30)	21,660
DEC	347,260 + 250,550	=	597,810	(31)	19,284
JAN 09	658,970 + 532,280	=	1,191,250	(31)	38,427

TOTAL USE FEB 08 – JAN 09 = 10,119,471

HIGH DAILY USE = 38,427
AVERAGE " " = 27,719
LOW " " = 19,284

ATTACHMENT &

SHORE ENGINEERING CO., INC.
P.O. Box 354
MELFA, VIRGINIA 23410
(757) 787-2773

JOB DREAMLAND HOMES
SHEET NO. 2 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE WATER USE

WELL NO.	1	2	3	4	5	6	7	8		TOTAL
FEB 08.	120,780	30,490	29,540	45,730	43,880	43,410	28,870	93,920	—	436,120
MAR	130,170	31,280	38,090	41,260	48,130	45,910	34,720	189,050	—	558,610
APR	55,350	17,430	24,700	20,630	27,430	26,900	22,920	120,710	—	297,450
MAY	131,100	29,330	41,410	54,440	37,240	48,360	39,380	178,260	—	548,500
JUN	167,800	25,430	86,960	66,060	33,320	35,590	29,640	128,860	—	573,660
JUL	61,570	30,940	91,700	52,790	49,470	43,480	28,800	197,960	—	556,650
AUG	55,040	26,210	35,220	46,460	35,300	44,360	24,030	142,010	—	408,680
SEP	33,200	23,330	33,430	45,320	33,310	48,560	23,010	128,200	—	355,360
	755,010	214,440	381,050	372,690	308,080	326,670	230,850	1,164,970		

WELL NO.	9	10	11	12	13	14	15		TOTAL
FEB	99,570	134,040	47,300	34,240	42,030	46,300	46,120	—	449,600
MAR	77,360	160,230	51,090	37,210	54,940	48,320	58,170	—	449,600
APR	31,780	115,980	39,700	26,090	48,960	35,780	31,300	—	329,590
MAY	68,330	182,710	78,200	29,880	68,480	54,400	58,810	—	540,810
JUN	36,490	143,420	43,700	28,180	49,170	41,970	39,970	—	382,900
JUL	50,440	181,250	52,230	31,430	65,590	48,270	43,600	—	472,810
AUG	53,010	132,420	32,120	25,430	50,110	41,120	35,430	—	369,640
SEPT	34,060	123,400	31,200	23,240	48,010	38,270	34,610	—	321,790
	451,040	1,173,450	375,540	235,700	421,290	349,430	348,010		

SHORE ENGINEERING CO., INC.
P.O. Box 354
MELFA, VIRGINIA 23410
(757) 787-2773

JOB DREAMLAND HOMES
SHEET NO. 3 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE WATER USE

WELL NO.	1	2	3	4	5	6	7	8	
OCT. 08	49,120	32,410	39,530	57,920	40,340	51,260	31,170	18,761	— 320,511
NOV	51,720	31,070	30,600	15,430	40,130	54,070	21,300	140,080	— 384,400
DEC	43,150	25,020	28,070	13,210	38,870	52,700	20,030	132,210	— 347,260
JAN 09	149,520	85,410	40,080	45,000	43,400	102,370	32,130	161,060	— 658,970
	293,510	173,910	138,280	131,560	156,400	260,400	104,630	333,111	

	9	10	11	12	13	14	15	
OCT 08	57,260	73,200	25,810	25,160	43,840	41,630	31,490	— 308,390
NOV	63,380	39,550	21,100	27,020	40,000	42,010	32,330	— 265,390
DEC	61,410	40,120	19,410	25,370	32,500	40,200	31,540	— 250,550
JAN 09	195,710	48,600	52,150	65,020	61,220	62,810	46,770	— 532,280
	377,760	201,470	118,470	152,570	177,560	186,650	142,130	

10. Local Areawide Planning Requirement (See Attachment 3)

Certification by Steven B. Miner, Accomack County Administrator attached.

11. Evaluation of the Lowest Quality Water Needed

The water is used for public water supply and needs to be of quality for human consumption and should meet drinking water standards.

12. Evaluation of Sources of Water Supply other than Ground Water

There is no other source of water supply for this system. Surface water supplies are not available on the Eastern Shore. The nearest public water supply would be the Town of Onancock, which is several miles south of the Dreamland Homes site.

13. Water Conservation and Management Plan

Water for this project, consisting of 90 trailer units with approximately 400 tenants, is supplied potable water from 15 wells. Each well serves 6 units. The water use during the period February 2008 thru January 2009 (12 months) was 10,119,471 gallons. The average use was 27,719 gallons per day.

Water Saving Plumbing Features

The owner has taken steps over the past year to attempt to reduce water use by removing all washing machines and replacing faucets and shower heads with lower water use fixtures. This is an ongoing project and they intend to replace all of them.

Water Use Reduction Program

There are, essentially 15 separate water supplies for this project, with each well supplying water to 6 units. Visual inspections of the well sites are made routinely. Also, inspection of the grounds for obvious pipe leaks at hook up points is an ongoing process. They expect the tenants to report any leaks inside the trailers.

Dreamland has maintenance personnel tools and materials so that most repairs can be made right away. For major repairs they have an outside contractor available on short notice.

Water Use Education Program

There is no formal water use education program in place for this project. However, the maintenance personnel are advised to keep close watch on all components of the water system.

Also, the owner representative advises the tenants of the need to conserve water and to report any leaks they see.

Water Reuse Options

At the present time there are no options for water reuse in the trailer park. Sewage presently is the only wastewater and it goes to septic tank, drainfield system.

Water Use Contingency Plan

In the event of required reductions in ground water withdrawals at Dreamland Homes, the following measures could be taken:

1. Provide written instructions to the tenants regarding the measures to reduce water use.
2. Institute a ban on washing vehicles and watering lawns.
3. Pressure switches could be lowered to have less pressure at the system.
4. Throttling valves could be cut back to provide less water to the system.
5. Provide bottled water for drinking purposes.
6. Truck in water from off site for storage so tenants can have water for flushing toilets and bathing.

14. Area of Impact of the Withdrawal

To be determined by the DEQ.

15. Mitigation Plan

See Attachment 4

16. Evaluation of 80% Drawdown Criteria

To be evaluated by DEQ.

17. Additional Information Required by the Board

To be determined by DEQ.

NASA Wallops Island

3100-001 / NEW

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: March 24, 1997
Revised:

WATERWORKS NAME:	NASA - Wallops Flight Center Main Base	CERTIFIED CLASS: IV
COUNTY/CITY:	Accomack County	TYPE: Community
LOCATION:	Three miles east of Wattsville, on State Route 798, west of Chincoteague.	
OWNER:	National Aeronautics and Space Administration NASA/GSFC/WFF Building N-161 Wallops Flight Center Wallops Island, Virginia 23337 Phone (757) 824-1209	
OPERATOR:	Mr. Clifford Taylor (Class IV, License #: 1904000331, exp. 02/28/05) Bldg. D-50 Utilities Section Wallops Flight Center Wallops Island, Virginia 23337 Phone (757) 824-1083	
PERMIT NO.:	3001500	
DATE ISSUED:	March 24, 1997	
TYPE OF TREATMENT:	Chlorination, Corrosion control	
SOURCE:	Five Wells	
DESIGN CAPACITY:	700,000 gpd	

DESCRIPTION OF SYSTEM

The system consists of five wells, a gas chlorinator, a 500,000 gallon ground storage tank, three 600 gpm high service pumps, three fire service pumps, one 100,000 gallon elevated storage tank, and the distribution system. The five well pumps are automatically alternated every 20,000 gallons.

Well #1 was drilled starting on August 22, 1992, and was completed on September 24, 1992. The well bore is 260 feet deep. An 18-inch steel casing extends from the surface to a depth of 90 feet, and an 8-inch steel casing extends from the surface to a depth of 187 feet. Type 304 8-inch stainless steel casing extends from 187 to 190 feet, 200 to 210 feet, 220 to 230 feet, and 255 to 260 feet. Type 304 8-inch stainless steel screen (30 slot) extends from 190 to 200 feet, 210 to 220 feet, and 230 to 255 feet. The well is grouted to a depth of 140 feet. The well is equipped with a submersible pump rated at 171 gpm at 193.5 feet TDH driven by a 15 H.P. motor. The pump intake is set at 200 feet. The well has a tested yield of 225 gpm, over a 48-hour period from September 28, 1992 to September 30, 1992, with the water level dropping from 38.83 feet (static condition) to 181.83 feet (dynamic condition).

Well #2 was drilled starting on December 2, 1992, and was completed on March 17, 1993. The well bore is 150 feet deep. An 18-inch steel casing extends from the surface to a depth of 78 feet, and an 8-inch steel casing extends from the surface to a depth of 97 feet. Type 304 8-inch stainless steel casing extends from 97 to 100 feet, and from 145 to 150 feet. Type 304 8-inch stainless steel screen (30 slot) extends from 100 to 145 feet. The well is grouted to a depth of 78 feet. The well is equipped with a submersible pump rated at 55 gpm at 130 feet TDH driven by a 3 H.P. motor. The pump intake is set at 120 feet. The well has a tested yield of 50 gpm, over a 48-hour period from May 4, 1993 to May 6, 1993, with the water level dropping from 27.25 feet (static condition) to 107.25 feet (dynamic condition).

Well #3 was drilled starting on July 22, 1992, and was completed on August 13, 1992. The well bore is 253 feet deep. An 18-inch steel casing extends from the surface to a depth of 90 feet, and an 8-inch steel casing extends from the surface to a depth of 195 feet. Type 304 8-inch stainless steel casing extends from 195 to 198 feet, 218 to 223 feet, and from 248 to 253 feet. Type 304 8-inch stainless steel screen (30 slot) extends from 198 to 218 feet, and from 223 to 248 feet. Gravel pack is installed from 150 feet to 253 feet. The well is grouted to a depth of 153 feet. The well is equipped with a submersible pump rated at 214 gpm at 197 feet TDH driven by a 15 H.P. motor. The pump intake is set at 200 feet. The well has a tested yield of 250 gpm, over a 48-hour period from August 18, 1992 to August 20, 1992, with the water level dropping from 38.83 feet (static condition) to 145.08 feet (dynamic condition).

Well #4 was drilled starting on October 6, 1992, and was completed on November 16, 1992. The well bore is 265 feet deep. An 18-inch steel casing extends from the surface to a depth of 90 feet, and an 8-inch steel casing extends from the surface to a depth of 217 feet. Type 304 8-inch stainless steel casing extends from 217 to 220 feet, and from 260 to 265 feet. An 8-inch screen (30 slot) extends from 220 to 260 feet. Gravel pack is installed from 180 feet to 265 feet. The well is grouted to a depth of 175 feet. The well is equipped with a submersible pump rated at 163 gpm at 202 feet TDH driven by a 15 H.P. motor. The pump intake is set at 220 feet. The well has a tested yield of 200 gpm, over a 48-hour period from November 17, 1992 to November 19, 1992, with the water level dropping from 38.5 feet (static condition) to 188.4 feet (dynamic condition).

Well #5 (H-115) was drilled starting on February 10, 1990, and was completed on February 14, 1990. The well bore is 260 feet deep. An 8-inch steel casing extends from the surface to a depth of 190 feet, and from 250 feet to a depth of 260 feet. An 8-inch stainless steel screen (.030 mesh) extends from 190 to 250 feet. Gravel pack is installed from 180 feet to 260 feet. The well is grouted to a depth of 50 feet. The well is equipped with a submersible pump rated at 167 gpm at 225 feet TDH driven by a 10 H.P. motor. The pump intake is set at 175 feet. The well has a tested yield of 150 gpm, over a 48-hour period from March 5, 1990 to March 7, 1990, with the water level dropping from 29.88 feet (static condition) to 84.38 feet (dynamic condition).

Gaseous chlorination facilities consist of an automatic switchover direct cylinder-mounted gas chlorinator with a vacuum-operated regulator with a maximum capacity of 100 pounds per day (ppd), a digital dual chlorine cylinder scales, an autoflow gas proportioner, and a gas leak detector with automatic exterior alarm. Chlorine injection is flow-paced, based on the raw water flow from the wells. The injector is mounted on the raw water feed line connecting the five production wells to the 500,000 gallon ground water storage tank and is located in the chlorine injection pit. The pit is equipped with a sump pump.

The corrosion control treatment at the well house consists of a 10 GPD capacity metering pump and associated appurtenances to feed zinc orthophosphate solution from a 30 gallon drum. The feed point is located on the discharge line of the main booster pumps. A second feed pump is provided to feed the chemical during operation of the bypass pump.

The three high service pumps are horizontal centrifugal pumps, size 8” x 4” driven by 40 HP, 1750 rpm, 3 ph., 230 V motors with a rated capacity of 600 gpm each at 150 feet TDH. The pumps are controlled by the elevated storage tank water level. The level controller at the elevated storage tank signals the pump controls via telemetry. The two main pumps operate alternately and are set at a cut on level of 17.5 feet and cut off level at 19.5 feet. The third pump is set to cut on at 15.0 feet during periods of high demand.

There are three horizontal, split-case, centrifugal fire service pumps. The pumps are each 10” x 8” and rated at 2,500 gpm at 250 feet TDH. Each pump is connected to a standby diesel engine rated at 100 HP at 1,750 rpm. The discharge of each pump is connected to the distribution system and to a suppressor tank to reduce water surges. The suppressor tanks are 120 gallons each with vessels designed for 275 psi.

The Department of Environmental Quality has issued a Permit to Withdraw Ground Water (No. ES0038900) dated June 24, 1991 for this system at a rate of 8,153,000 gallons per month. NASA - Flight Center Main Base is entrusted with resource use responsibilities via that permit, and is advised to be aware of any compliance requirements of that permit.

EVALUATION OF SYSTEM

This system is evaluated on the basis of equivalent residential connections (ERCs). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

I. Source Capacity

A. Source Yield

1. Number of Sources

a. Required = 1 up to 49 ERCs, more than 1 for 50 or more ERCs
b. Provided = 5 wells

2. Yield:

Well Number	Well Yield (gpm)	Pump Yield (gpm)
1	225	171
2	50	55
3	250	214
4	200	163
5 (H-115)	150	167
	Total = 875 gpm	Total = 769 gpm

B. Production Capacity

1. Well Yield: 875 gpm / 0.5 gpm/ERC = 1750 ERC
1750 ERC * 400 gpm/ERC = 700,000 gpd

2. Pump Yield: 769 gpm * 1440 min/day = 1,107,360 gpd (1.1 MGD)

II. Treatment Capacity

A. Chlorination

Maximum Chlorinator Capacity = 100 lbs/day (@ 2 mg/L dosage)
Total Capacity = 100 lbs/day / (2 mg/L * 8.34 lbs/gal) = <u>6.0 MGD</u> or 15,000 ERCs

B. Corrosion Control

Maximum Delivery Capacity = 118 lbs/day
Total Capacity = 118 lbs/day / (1 mg/L * 8.34 lbs/gal) = <u>14.1 MGD</u> or 35,250 ERCs

III. High Service Pump Capacity

A. Total Pumping Capacity = 600 + 600 + 600 = 1,800 gpm

B. Capacity: 1,200 gpm * 1440 min/day = <u>1,728,000 gpd</u>

IV. Storage Capacity

A. Total Storage = 500,000 gal. + 100,000 gal. = 600,000 gallons

B. Storage Capacity = 600,000 gallons / 200 gal/ERC = 3,000 ERCs
3,000 ERCs * 400 gpd/ERC = <u>1,200,000 gpd</u> (1.2 MGD)

Based on the calculations above, this waterworks is limited to a capacity of 700,000 gpd, or 1750 ERCs, due to limited well yield.

Town of Onancock

3100-001 / NEW

5. Justification For The Amount Of Withdrawal Requested

The amount requested for domestic, wastewater treatment, and fire protection purposes 80,615,000 Gallons per year, represents a very realistic 10-year demand projection for the proposed beneficial use of providing potable water to a public water system for human sanitary and consumptive uses, for fire protection purposes, and for the beneficial use of wastewater treatment.

For domestic purposes (residential/commercial/unmetered/system losses), a total of 75,913,000 Gallons (47,166,000 + 21,494,000 + 936,000 + 6,317,000; from Table II) per year is requested which is based on existing usage with projected increases over the next 10 years.

For fire protection, a total of 650,000 gallons per year are requested based on estimates of average usage over the last several years.

For wastewater treatment, a total of 4,054,000 gallons per year are requested based on required activities at the WWTP.

EXISTING USAGE

The following table shows the total water production of the Town's water system the last several years.

TABLE I

Water System Production (Gallons per Year)

2002	2003	2004
59,400,000	62,542,000	59,874,000

The highest usage over a 12 month period during the last several years was 64,713,000 Gallons between 4/03 and 4/04.

The breakdown of the usage, based on billing records, estimates of fire protection usage, estimates of unmetered usage, and estimates of usage at the WWTP between these dates is presented in Table 1A. Appendix A includes details of the estimates of the unmetered usage and Appendix B includes details of the fire department usage estimates.

TABLE IA

1993/1994 Usage (Gallons per Year)

Residential Domestic Usage	35,079,000
Commercial Domestic Usage	17,679,000
Fire Protection Usage	648,000
WWTP Usage	4,054,000
Other Unmetered Usage	936,000
Unaccounted for Usage	6,317,000
Total	64,713,000

Based on the estimates of water used for fire protection, wastewater treatment, and unmetered purposes, the amount of unaccounted for water, or system losses, is approximately 9.7% (6,317,000/64,713,000; from Table IA) of the total water production. This is within average values for the size and age of the system.

PROJECTED NUMBER OF CONNECTIONS

The growth rate from 1990 to 2000 in Accomac County and the Town of Onancock on the eastern shore was 6% (census data) and the Eastern Shore Planning District Commission has projected that rate (0.6%/Year) to continue for the region. The growth of the Town is expected to exceed the average growth rate for the County due to new regulations on individual septic systems on the Eastern Shore. The limitations on individual septic systems is anticipated to cause most of the county's growth to be in areas served by a central wastewater treatment facility. While the Town's wastewater treatment facility is currently limited in capacity, it is in the preliminary stages of being upgraded/replaced. For the purpose of the study, the wastewater treatment plant is anticipated to be upgraded by the year 2007.

Since the effect of the new septic system regulations on the growth of the entire area as well as the Town cannot be predicted, the base growth rate of 0.6% is used to project the increases in the number of residential and commercial connections other than the planned developments and the planned service area expansion.

A 20 lot subdivision is in the planning stages and is anticipated to be fully developed by the year 2007 and the waterline improvement project underway will expand the service area to include 30 potential residential customers.

The total projected increase in the number of residential connections served by the system is based on the projected population increase (.6% per year), the addition of the 20 new homes in the planned subdivision within 2 years, and the addition of 24 of the 30 homes which will have new watermains installed in front of their house within 10 years. Based on common waterline extensions, an estimated 40% of the houses (42 Conns x .4 = 12 Conns) are expected to connect when the distribution system is constructed (at a reduced connection fee), and 40% are expected to connect within 10 years due to failing wells. The private wells in Town are very old with a high chance of failure. The other twenty percent are not expected to connect within 10 years.

To estimate the ultimate usage by the residential connections, the connections are divided between Pre-1993 and Post-1993 connections. Homes built after 1993 should have low flow fixtures and should have lower usages. The number of Pre-1993 connections are based on the number of connections on the system in 1993 and an estimated one-half of the connections added between 1993 and 2004. The existing houses connected as part of the service area expansion are also added to the Pre-1993 connections.

The Post-1993 connections include one-half of the connections added between 1993 and 2004, the projected new connections, and the planned subdivision connections.

Table II presents the projected number of connections and Appendix F includes the calculations for Table II.

PROJECTED USAGE

The usage per connection has been increasing over the last five years. The residential usage per connection has increased from 124 GPD/Connection (from 1999 billing records) to 161 GPD/Connection (from 2003/2004 billing records) for residential connections over the last 5 years. This represents an increase of 6% ((161 – 124/124) x 100) per year. The commercial usage has increased from 367 GPD/Connection (from production records) to 387 GPD/Connection (from production records) for commercial connections over the same period. This represents an increase of 1% ((387-367/367) x 100) per year.

The current usage per capita is approximately 66 GPCD (gallons per capita per day) based on an average household size of 2.45 (2000 Census; Accomack County). The effect of younger population and higher (more normal) pressures are expected to continue to increase the usage. The storage tank project, which is being done to improve fire flows throughout Town, will increase the average system pressure from 52 PSI to 60 PSI, an increase of 15% ((60-52/52) x 100).

The usage per capita for Pre-1993 connections is expected to continue increasing towards an average of 80 GPCD for systems serving older residences. The effect of water conservation planning, including plumbing retrofits to low flow fixtures, and higher water rates are anticipated to reduce the per capita usage to 77 GPCD which has been used as a per capita usage for previous applications for systems with Pre-1993 homes. This equates to a per connection usage increase of approximately 17% ((77 GPCD- 66 GPCD)/66 GPCD) over the 10 year period.

The Post-1993 connection usage is estimated as 67 GPCD, a common water conservation goal. This goal was adopted by the Hampton Roads Planning District Commission Regional Raw Water Study Group.
The usage per connection for commercial connections (Pre 1993 and Post 1993), which is less impacted by the age of the buildings, is projected to continue increasing at 1% per year for a total increase of 10% in 10 years. This continued increase allows for increases in business.

Table II presents the projected usages per connection and Appendix F includes the calculations for Table II.

The amount of water required for fire protection for the Town and nearby localities, the amount of water required for the existing/renovated/new wastewater treatment plant, and the amount of water used by the other unmetered connections are anticipated to be consistent over the next 10 years. The unaccounted-for water, which includes system losses and distribution flushing activities is also expected to remain constant. While fewer leaks should occur, flushing activities may increase to maintain water quality in the larger lines. Based on the above, the amount of water projected for these purposes is the maximum amount used the last several years, or 11,955,060 Gallons (648,000 + 4,054,000 + 936,000 + 6,317,000; from table above) per year.

Table II presents the projected water usage by the Town. Table II also includes the amount of water estimated to be required by the construction projects underway which should be completed in 2006. Appendix D includes details of the estimates of water required for the projects and Appendix F includes the calculations for Table II.

Table II

Flow /Pre1993 Residential Conn (GPD)	161	164	170	176	182	188	194
Number of Post 1993 Residential Conn.	21	25	48	55	63	70	77
Flow/Post 1993 Residential Conn(GPD)	161	164	164	164	164	164	164
Total Annual Residential Flow (MG)	35.141	36.036	39.421	41.387	43.430	45.431	47.166
No. of Commercial Connections	125	126	128	130	132	134	136
Flow/Commercial Connection (GPD)	388	392	400	408	416	424	433
Total Annual Commercial Flow (MG)	17.703	18.028	18.688	19.360	20.043	20.738	21.494
Total Annual Fire Protection Usage (MG)	0.648	0.648	0.648	0.648	0.648	0.648	0.648
Total Annual WWTP Usage (MG)	4.054	4.054	4.054	4.054	4.054	4.054	4.054
Total Annual Unmetered Usage (MG)	0.936	0.936	0.936	0.936	0.936	0.936	0.936
Unaccounted For (MG)	6.317	6.317	6.317	6.317	6.317	6.317	6.317
Total Annual Construction Usage (MG)		0.69					
Total Annual Flow (MG)	64.799	66.709	70.064	72.701	75.428	78.124	80.615

PROJECTED PEAK MONTH USAGE

The peak month daily usage between the years of 1999 and 2004 ranged from 1.11 to 1.25 times the yearly average. An average peak month factor of 1.18 is used to estimate the peak monthly usage in the year 2015.

Estimated 2015 Annual Average	80,615,000 Gallons/365 days = 220,863 GPD
Estimated 2015 Peak Month	220,863 GPD x 1.18 x 31 days = 8,079,169 Gallons

A peak month amount of 8,079,169 Gallons per month is expected to be required within the next 10 years.

GPD/Connection for residential connections over the last 5 years and from 367 GPD/Connection to 387 GPD/Connection for commercial connections over the same period. The storage tank project, which is being done to improve fire flows throughout Town, will increase the average system pressure from 52 PSI to 60 PSI. The usage per connection for residences is projected to increase calc approximately 25% to 200 GPD/connection over the next 10 years which equates to 80 GPD/person and an average household size of 2.5 persons. This usage is still below average for this size system and is well below water conservation goals. The usage per connection for commercial connections is calc projected to increase approximately 15% from 387 GPD/connection to 445 GPD/connection over the 10 year period.

The amount of water required for fire protection for the Town and nearby localities, the amount of water required for the existing/renovated/new wastewater treatment plant, and the amount of water used by the other unmetered connections are anticipated to be consistent over the next 10 years. The unaccounted-for water, which includes system losses and distribution flushing activities is also expected to remain constant. While fewer leaks should occur, flushing activities may increase to maintain water quality in the larger lines. Based on the above, the amount of water projected for these purposes is calc the maximum amount used the last several years, or 11,955,060 Gallons per year.

Table II presents the projected water usage by the Town. Table II also includes the amount of water estimated to be required by the construction projects underway which should be completed in 2005. Appendix C includes details of the estimates of water required for the projects.

Table II

	2003/2004	2005	2007	2009	2011	2013	2015
Number of Residential Connections	598	603	608	623	638	653	668
+4.2%/yr Flow/Residential Connection (GPD)	161	168	175	182	188	194	200
Total Annual Residential Flow (MG)	35.14	36.98	38.84	41.39	43.78	46.24	48.76
Commercial Connections	125	126	127	130	133	136	139
Flow/Commercial Connection (GPD)	388	398	408	418	427	436	445
Total Annual Commercial Flow (MG)	17.703	18.304	18.913	19.834	20.729	21.643	22.577
Total Annual Fire Protection Usage (MG)	0.648	0.648	0.648	0.648	0.648	0.648	0.648
Total Annual WWTP Usage (MG)	4.054	4.054	4.054	4.054	4.054	4.054	4.054
Total Annual Unmetered Usage (MG)	0.936	0.936	0.936	0.936	0.936	0.936	0.936
Unaccounted For (MG)	6.317	6.317	6.317	6.317	6.317	6.317	6.317
Total Annual Construction Usage (MG)		0.635					
Total Annual Flow (MG)	64.799	67.870	69.704	73.175	76.463	79.837	83.296

The 1993 peak month daily usage was approximately 11% above the annual average usage (peaking factor of 1.11) which is low. A peak month factor of 1.25 is used to estimate the peak monthly usage in the year 2015.

July '03	6,125,000 Gallons/31 days = 197,580 GPD
'03 Annual Average	64,713,000 Gallons/365 days = 177,296 GPD
Estimated '15 Annual Average	83,296,000 Gallons/365 days = 228,208 GPD
Estimated '15 Peak Month	228, 208 GPD x 1.25 x 31 days = 8,843,060 Gallons

A peak month amount of 8,843,060 Gallons per month is expected to be required within the next 10 years.

Water Conservation and Water Shortage Management Plan

Town of Onancock
Accomack County, Virginia

I. Water Conservation Plan

A. Introduction

Inadequate public water supplies with respect to projected population growth have raised public awareness in the State of Virginia. The quality and quantity of the surface water and groundwater resources have always been a pressing matter in the region. The adequacy of groundwater and surface water supplies to meet current and projected demands during drought conditions is a major area of concern. Based on these and other reasons, this Water Conservation and Water Shortage Management Plan for the Town of Onancock has been developed as a long–range strategy for water management.

Since the Town and surrounding areas have a limited source of available water supply, it is imperative to understand that by adopting the Conservation Policy, the finite water supply sources can be extended rather inexpensively compared with the costs of increasing the available sources. Conservation should mitigate some of the effects of future growth by extending this limited resource. The Town residences and other customers benefit directly from less costly water service. Water conservation can also lessen the risk of disruptive shortages.

The water conservation program goals are as follows:

1. The limited water supplies are protected by reducing future demands.
2. Seasonal peak water demands are reduced.
3. Water conservation is fully integrated into long-range resource planning and management and land use planning and development.

B. Conservation Measures

1. Public Information and Education

Proper information and education shall be provided to the Public for their better understanding of the Conservation Program. The primary goals of the education program are the following:

a. Local water supply issues and problems shall be brought to their attention so that they become aware of the situation in their community.

b. Inform the Public of the benefits of water conservation, which include:

    1. Optimal usage of available water supplies
    2. Cost savings by not expanding the existing utility system
    3. No increment to the utility cost to customers
    4. Reduces risk of severe water supply shortages
    5. Protects the economic viability of the area

c. The citizens shall be educated in efficient water use measures, such as water efficient landscaping and low flow fixtures.

Target groups for education are identified as the following groups which include most citizens and water users in the Town:

Industrial and commercial establishments
Farmers
Students and teachers
Community leaders and influential citizens
Professionals and tradesmen
Industries and businesses with high water use

The education plan will be focused on the resources available in the Town. The effectiveness of the plan will depend on how well each institution, organization, or group is approached. Potential public education "forums" are as follows:

a. Meetings of local government boards or commissions
b. Media releases
c. Billing inserts
d. Meetings of property owners associations
e. School meetings
f. Social club meetings

To make the education program effective, the Town will do the following:

a. An ongoing education program will be established.

b. Criteria will be developed to measure the effectiveness of the education program at regular intervals.

c. The program will be adequately funded.

2. **Plumbing Code Requirements**

One of the major ways to conserve water supplies is to improve the end use efficiency for interior demands.

There are two basic categories of increasing interior water-use efficiency. The first is code standards for new construction and the second is the retrofitting of existing structures. The potential water savings for each category is similar.

The current Uniform Statewide Building Code (USBC), 2000 Edition, as adopted in 1993, references the 2000 International Plumbing Code which requires the installation of low-flow shower heads (2.5 gpm) and sinks (2.2 gpm), and low-volume toilets (1.6 gallons per flush).

The Town will rigorously enforce the codes as part of the building permit process.

3. **Water Conservation Retrofit Program**

Because more than half of the structures in Town predate the 1982 building code, the Town may have to implement a more active program than a voluntary retrofit program to realize the decreasing per capita water-consumption rates.

A wide range of options are available for implementing a retrofit program. The Town will consider the general types of retrofit programs described below.

a. Voluntary Retrofit Programs

By this Program, Property owners are encouraged to retrofit existing structures at their own expense. Overall program effectiveness, is likely to be low since this type of program requires significant educational and promotional effort about the need for and the benefits of the retrofits.

b. Mandatory Retrofit Programs

By this Program, Property owners are required by government ordinances to retrofit all existing structures according to prescribed standards. The ordinances could require compliance by prescribed dates or at a point-of-sale. This option requires inspections to ensure compliance. The overall effectiveness of this program is likely to be high if public resistance can be overcome.

c. Utility-Sponsored Retrofit Programs

By this Program, the water purveyor purchases and distributes retrofit "kits" to property owners, free of charge or sold to them at or below cost. Some programs also offer assistance with the purchase and installation of water-conserving plumbing fixtures. This option would also require inspection to ensure compliance and proper installation. The overall effectiveness of this program varies, depending on the type of devices provided and the distribution method.

The public education program will emphasize the benefits of and the technologies for water-conserving retrofits to motivate individuals to undertake such retrofits voluntarily. This material will focus on low- and moderate-cost "do-it-yourself" retrofits and underscore their favorable cost payback.

4. Water Conservation Oriented Rate Structure

Conservation pricing and marginal cost pricing are the key issues that must be addressed to achieve demand reductions through the rate structure.

a. Conservation Pricing

Water price and usage is inversely proportional. Studies show that water use within the home, for example, is less responsive to price increases than exterior water use.

Estimates of the price elasticity in water demand from other areas vary widely. Estimates for residential use range form -.01 to -.60, and estimates for sprinkler use range from -.27 to -.70. A price elasticity of -.02 means water use would decrease 2 percent with a 100 percent increase in price. The studies indicate consumer behavior can be modified with price, but permanent behavioral adjustment may take several years.

b. Marginal Cost Pricing

In the past, utilities have set water rates to reflect the average cost of water. Research showed that water rates should reflect the cost of the next unit of water to be obtained by the utility, or the marginal cost. The charge for water from a new and expensive source should reflect that additional cost even if it is greater than the average cost. Rates based on these marginal costs would reflect the increasing scarcity and cost of new water supplies.

The Town will evaluate the following measures for attaining the conservation goals in their water demand projections.

a. Rates: The Town currently has a single block rate structure with a surcharge on consumption above the average usage. Other rate options that will be implemented if needed are replacing the single block rate with increasing block rates.

b. Incentives: A variety of incentives may be introduced to encourage and promote water conservation. The Town may offer lower hook-up fees for remodeling, renovation, or expansion of existing structures when existing fixtures that would not otherwise be replaced are replaced with fixtures that meet the requirements of the "advanced" plumbing code.

The Town also may offer a reduction or rebate of fees in return for implementation of commercial or industrial reuse/recycle operations.

Another incentive might be a revolving loan program for financing water-saving appliances and fixtures or water-reuse programs, e.g., graywater irrigation systems.

5. Universal Metering and Meter Repair and Replacement

By providing meters for individual entities, unauthorized usage of water can be minimized. Metering is also an aid to detect leaks on both sides of the meter. Studies show that metering results in lower water use because customers become cautious to the amount of water used through the effect it has on the water bill. It is essential to have maintenance programs for water meters ensuring that an accurate measure of system integrity is being obtained. Under-registration by meters may result in a significant percentage of unaccounted-for water and loss of revenue.

The Town is also considering a program for routine maintenance and replacement of the meters. At the present time, the meters are calibrated and repaired by special request for a customer or on the basis of irregular readings if they are found to be in error by 3 percent or greater.

6. Water Efficient Landscaping

Irrigation of lawns and other landscaping can create seasonal peak water demands. Because use of irrigation is largely dependent on weather conditions, large variations in peak demand occur between wet, normal, and dry years. Drought conditions typically result in an overall increase in total water use and peak water demands. If the seasonal peak water demands can be reduced then the potential for optimal sizing of water treatment and distribution facilities, increases significantly.

One method of reducing the seasonal peak demand for irrigation is to promote and encourage water efficient landscaping. The fundamentals of water efficient landscaping are the following:

a. Planning and designing the landscape to increase water efficiency.

b. Replacing turf with mulch or groundcover.

c. Improving the soil to ensure water-holding capacity, absorption properties, and nutrients for plant growth.

d. Mulching areas to cool the soil, reduce weed growth, minimize evaporation, and slow erosion.

e. Using native and other adapted water efficient plants.

f. Irrigating at the most effective times and applying proper amounts.

g. Using water efficient practices such as drip irrigation.

h. Properly maintaining the water efficient landscaping to maximize the effectiveness of a well planned and well installed landscape.

The acceptance and use of the water efficient landscape concept by the majority of the customers is necessary for the long term success of this conservation plan. To achieve widespread use of water efficient landscape fundamentals, the Town will do the following:

a. Use all available educational resources to ensure public awareness of the fundamentals, long-term benefits, and cost-effectiveness of the concept.

b. Install and properly maintain demonstration landscapes in highly visible areas within town.

c. Recommend and encourage builders, developers, and owners to install landscaping using water efficient landscaping fundamentals.

7. Leak Detection and Water Audits

The most effective ways to minimize leaks are to use high quality materials to construct the water system, ensure that they are properly installed, and maintain all of the components in good operating condition. Therefore, standards for constructing durable, reliable water systems and a program for replacing water mains in areas where leaks are recurrent should result in a low level of system losses from water systems.

The Town is considering adopting standards and creating an active program for leak detection and repair.

Water audits are a means to identify and eliminate system losses. Water purveyors routinely compare the metered amount of water they produce with the metered usage of their customers to determine the amount and percentage of unaccounted-for water in their system. The last audit of the Town water system was done in 2003/2004 and the conclusion was that the unaccounted-for water, which included water used by unmetered public connections, equaled 10 percent of the total water system production. Based on estimates of the unmetered usage, the amount attributed to system losses was estimated to be 7 percent. This percentage is very favorable when compared with a national average that ranges from 10 to 15 percent.

The Town will audit the water system during the first two years of the permit. The results of the audit will be used to identify study areas for the Town's leak detection and repair program.

8. Wastewater Reuse and Recycling as a Conservation Measure

"Wastewater reuse" is a general term applied to any process in which a wastewater stream is utilized for any beneficial use. Wastewater recycling is a subclass of wastewater reuse and refers to a situation where the same water is used over and over to satisfy the same demand. For this discussion, wastewater reuse is defined as a deliberate strategy of directly reusing wastewater effluent, treated to a degree appropriate for the intended reuse, to satisfy nonpotable demands.

Other areas have evaluated wastewater reuse as a long-term alternative supply. Due to strong opposition to this alternative from the Virginia Department of Health (VDH), it is not likely that the Commonwealth of Virginia would approve a wastewater reuse project for potable use. It was determined, however, that wastewater reuse to meet non-potable demands, such as industrial cooling, irrigation, and car washing, is more viable.

Sewage treatment in the area is provided by the town wastewater treatment plant. The need for large amounts of non-potable water in the area is not sufficient for consideration of wastewater reuse.

II. Water Shortage Contingency Plan

A. Water System Background

The Town draws water from wells located in Town. Three (3) new wells are in the process of replacing four (4) older wells. The wells provide water to an elevated tank, which is also in the process of being replaced.

The system currently serves approximately 600 residential connections, 125 commercial/business connections, 25 un-metered connections, and the WWTP.

The system is expected to serve 668 residential connections and 139 commercial/ business connections by the year 2015.

B. System Capacity/Demands and Well Water Levels

The system demand is expected to be approximately 83 MG per year by the year 2015. The system improvements should, when completed, be permitted for .6 MGD which is more than an adequate supply for the required demand.

Fire flow at any point in the distribution system is to be at least 500 GPM based on the water system improvements underway.

The static water levels in the new wells at the time of construction were approximately 15 feet below ground. The well pumps will be set approximately 140 feet below ground surface, at the top of the aquifer being withdrawn from.

C. Water Shortage Municipal Ordinance

A water shortage ordinance, or ordinances, will be ratified as soon as possible to give the Town standby emergency powers. The ordinance(s) will provide for the following:

1. Affirmation of a water shortage situation, identified by stage.

2. Enforcement capabilities with penalties for usage above identified amounts and incentives for lower water usage as defined in each stage of conservation.

3. Stiffer penalties for non-compliance of conservation directives as listed above after adequate public notice. Similar restrictions, penalties, and incentives will also be imposed upon all industrial and commercial users within town.

E. Parameters for Water Shortage Declaration

Stage I: A water shortage declaration will be issued when the average daily production of the water system exceeds 75 percent of the VDH operating permit capacity for 30 consecutive days or the pumping levels in the water supply wells drop to 40% of the allowable drawdown. The allowable drawdown is defined as the difference between the static water level at the time the wells were drilled and a level approximately 10 feet above the well pumps. The declaration is described in Section IV, "Water Shortage Declaration," and will be carried out in accordance with that section. The Stage I emergency plan will be initiated as outlined in Section G, "Emergency Actions."

Stage II: Emergency actions will start when the average daily production exceeds 80 percent of the VDH operating permit for 60 consecutive days or the pumping levels in the water supply wells drop to 60% of the allowable drawdown.. The Stage II emergency plan will then be initiated as outlined in Section G, "Emergency Actions."

Stage III: Emergency actions will start when the average daily production exceeds 85 percent of the VDH operating permit for 30 days, Stage II has been in effect for 30 days, and the demand has not stabilized at the Stage II trigger level, or the pumping levels in the water supply wells drop to 80% of the allowable drawdown.. The Stage III emergency plans will then be initiated as outlined in Section G, "Emergency Actions."

Stage IV: Emergency actions will start when the average daily production exceeds 90 percent of the VDH operating permit for 30 days, Stage III has been in effect for 30 days and the demand has not stabilized at the Stage III trigger level, or the pumping levels in the water supply wells drop to 90% of the allowable drawdown.. The Stage IV emergency plans, which are additional restrictions as deemed necessary by the Town Council, will then be initiated.

F. Water Shortage Declaration

Once the parameters for water shortage determination are met as listed in Section V above, or the Director of DEQ declares a water shortage emergency, the Town will issue an emergency declaration that will initiate the appropriate conservation measures as defined below. The declaration will be issued to the public and to commercial and industrial customers through local newspapers and radio and will state specific conservation efforts to be taken. The VDH and the Virginia Department of Environmental Quality will also be advised of any actions taken. The Town Council will be apprised of the status of water demands and asked to approve the declaration of all stages of the water shortage contingency plan.

G. Emergency Actions

1. Stage I

Once a water shortage declaration has been issued, the following emergency actions for Stage I will be put into effect.

a. Voluntary water conservation measures will be encouraged.

b. A public awareness and information process will be implemented to distribute additional water conservation information and other special notices to customers. Industrial and commercial users will be asked to initiate in-house water conservation plans for their respective facilities.

c. A plan will be established to reward customers who reduce usage. The plan will be based on normal consumption records and will offer financial incentives per 1,000 gallons of water saved.

d. A water system leak survey will be initiated to identify and repair additional system losses.

e. Hydrants and water mains will not be flushed.

2. Stage II

If Stage I fails to adequately reduce the system water production, or when the parameter described in Section V for Stage II has been reached, Stage II will be put into effect.

a. Mandatory water conservation of at least 10 percent for each household and 25 percent for industrial and commercial users unless exempt by the Town Manager or his/her designee will be implemented. Increased charges will be applied for water used in excess of the conservation goals.

b. Nonessential uses of potable water (such as lawn watering; car washing; flushing of sewer lines under construction; construction-related activities, such as dust control and hydro seeding; and other such uses) will not be permitted, and the prohibition will be enforced through local ordinance.

c. Serving water in restaurants except upon request of customers will not be permitted.

d. Leaks found in the survey in Stage I and not yet repaired will be repaired.

e. No new water service connections will be sold, and permits for installing private wells will not be issued except for replacement of failed private domestic wells.

3. Stage III

If Stage II fails to reduce the system production sufficiently, or when the parameter described in Section V for Stage III has been reached, Stage III will be put into effect. The following will occur in Stage III:

a. Mandatory reduction of domestic water consumption by 25 gallons per person per day.

b. Mandatory reduction of industrial, commercial and school use of water to 25 percent of normal consumption.

c. Suspension of installation new water service connections.

d. Retrofitting of public buildings with low usage fixtures.

e. Application for appropriate state or federal drought emergency grants.

3. Stage IV

If Stage III fails to reduce the system production sufficiently, or when the parameter described in Section V for Stage IV has been reached, Stage IV will be put into effect. The Town Council may implement such additional restrictions deemed to be necessary.

H. Emergency Equipment and Manpower

Emergency manpower shall be available to operate the system wells to ensure that fire flows are provided when needed.

I. Revocation of Water Shortage Declaration

When the average daily water production of the system has declined to below the trigger level(s) and /or the well water levels have increased above the trigger level(s) for 30 consecutive days, or the Director of DEQ declares that the water shortage emergency is no longer is effect, the water shortage management requirements for that stage will be lifted. All customers will be notified in accordance with Section F. It should be emphasized that personal conservation efforts shall be maintained to avert other water shortage situations.

III. Water Shortage Ordinance

Section 1: Authority to Declare a Potential Shortage of Water and to Impose Water Conservation Measures

The Town Manager is authorized to take special measure for prudent management to prevent a critical shortage when a potential shortage of water and/or emergency water conditions exists in the Town of Onancock.

Section 2: Conditions for the Declaration of Potential Shortage of Water

Upon a determination by the Town Manager of the existence of the following conditions, the Town Manager shall take the following actions:

Stage I: When moderate but limited supplies of water are available, the Town Manager shall, through appropriate means, call upon the general population to employ prudent restraint in water usage and to conserve water voluntarily by whatever methods are available.

Stage II: When very limited supplies of water are available, the Town Manager shall order curtailment of less essential usages of water, including, but not limited to, one or more of the following:

- The watering of shrubbery, trees, lawns, grass. Plants, or any other vegetation, except indoor plantings, greenhouse or nursery stocks and except watering by commercial nurseries of freshly planted plants upon planting once a week for five weeks following planting.

- The washing of automobiles, trucks, trailers, boats, airplanes, or any other types of mobile equipment, excepting in facilities operating with a water recycling system approved by the Town, or except from a bucket or other container not exceeding three (3) gallons in capacity; provided, however, that any facility operating with an approved water recycling system shall prominently display in public view a notice stating that such recycling system is in operation. In lieu of the provisions hereof the Town Manager may curtail the hours of operation of commercial enterprises offering such services or washing their own equipment.

- The washing of streets, driveways, parking lots, service station aprons, office buildings, exteriors of homes or apartments, or other outdoor surfaces, except by commercial washing/cleaning services or except from a bucket or other container not exceeding three (3) gallons of capacity.

- The operation of any ornamental fountain or other such structure making similar use of water.

- The filling of swimming and/or wading pools, or the refilling of swimming and/or wading pools which were drained after the effective date of the order.

- The use of water from fire hydrants for any purpose other than fire suppression or other emergency except as authorized by the Town Manager.

- The serving of drinking water in restaurants, cafeterias or any food establishment unless requested by the individual.

- The Town Manager or his designee may authorize exceptions to the restrictions imposed by Stages I and II.

Stage III: When supplies of water are critically limited, the Town Manager shall institute mandatory restrictions on each customer which include those restrictions applicable to Stage II as well as reductions of water to each customer as follows:

- At the Town Manager's or his designee's discretion, allocations of water to customers shall be based on a twenty-five percent reduction of either their average consumption of the last twelve months billing or water consumption data available from similar activities of equal intensity.

- The amount of water allocated for consumption shall not be less then fifty (50) gallons per person per day per household.

- If the monthly, bi-monthly, or quarterly usage of water as established above is exceeded, the customer shall be charged, in addition to the regular rate, the following charges for excess water use:

    - Any water use over the allocated amount will be billed at 300% (three hundred percent) of the current effective rate.

- The above additional charges for excess water usage shall be applicable to bills for service periods beginning on or after the declaration that a potential shortage of water exists.

Stage IV: When supplies of water are drastically limited, the Board of Supervisors may implement such additional restrictions as are determined necessary.

Section 3: Violation of Stage IV Water Restrictions

Upon implementation of Stage IV, the Town Council may impose appropriate fines and penalties for excess water usage.

Section 4: Notice to the Public

The determination of Stages II, III, and IV by the Town Council, Town Manager, or his/her designee shall be accompanied by a written report which shall set out the criteria utilized and data relied upon in making such determination including a narrative summary reporting the determination. Each report shall be promptly filed with the Town Clerk who shall make the same available for public inspection. The Town Clerk shall transmit a copy of each report to the Town Council.

Section 5: Appeals

An appeals review board shall be established upon declaration of Stage III. It shall be composed of three members appointed by the Town Council. One of the three members shall be a representative of the Town. The appeals board shall hear appeals from the determinations as to allocation of water and additional charges of excess usage and shall have the power by the vote of two members to approve, modify, or revoke such determinations. The action of the appeals review board shall be final.

Section 6: Repeal of Other Town Ordinances

All other town ordinances inconsistent with this ordinance are hereby repealed; provided, however, that no enforcement action or prosecution of any sort now pending shall be abated because of the adoption of this ordinance.

Section 7: Effective Date

This Ordinance shall be effective on and after ____________________.

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: March 20, 2009

WATERWORKS NAME: Town of Onancock **WATERWORKS CLASS:** III

COUNTY/CITY: Accomack **TYPE:** Community

LOCATION: The water system is located at the western end of state route 126 in Accomack County. The well field is located south of Market Street, between Hartman and Hill Streets.

OWNER: Town of Onancock
Contact: Ms. Sandy Manter (Interim Town Manager)
15 North Street
Onancock, VA 23417
Phone: 757-787-3363

OPERATOR: Licensed Class III Operator Required

PERMIT NUMBER: 3001620

EFFECTIVE DATE: March 20, 2009

TYPE OF TREATMENT: Chlorination (hypochlorite) and fluoridation

SOURCE: Three groundwater wells

DESIGN CAPACITY: 377,600 gpd

DESCRIPTION OF THE WATERWORKS

This system consists of three Class IIB wells, one 300,000 gallon elevated tank, chlorination, fluoridation and distribution.

Well 7 (AKA PW-1 or DEQ #100-1015) was drilled starting on November 9, 2004, and was completed on December 5, 2004. The well bore is 220 feet deep, with neat cement grout extending from the surface to 62 feet. The PVC well casing is 8-inches in diameter and extends to 165 feet, extending to 30 feet of screen (20 slot). There is an 8 inch diameter 10 foot long stainless steel tail piece extending to 208 feet. Gravel pack is installed from 156 feet to 209 feet. The well is equipped with a submersible pump (rated at 145 gpm at 280 feet TDH) driven by a 15 HP motor. The pump intake is set at 143 feet. The well has a tested yield of 157 gpm over a 48-hour period (February 17, 2005 to February 18, 2005), with the water level dropping from 12 feet (static) to 114 feet (dynamic).

Well 8 (AKA PW-2 or DEQ #100-1016) was drilled starting on December 5, 2004, and was completed on January 7, 2005. The well bore is 220 feet deep, with neat cement grout extending from the surface to 62 feet. The PVC well casing is 8-inches in diameter and extends to 167 feet, extending to 30 feet of screen (20 slot). There is an 8 inch diameter 10 foot long stainless steel tail piece extending to 208 feet. Gravel pack is installed from 155 feet to 220 feet. The well is equipped with a submersible pump (rated at 100 gpm at 280 feet TDH) driven by a 10 HP motor. The pump intake is set at 140 feet. The well has a tested yield of 122 gpm over a 48-hour period (February 17, 2005 to February 18, 2005), with the water level dropping from 18 feet (static) to 110 feet (dynamic).

Well 9 (AKA PW-3 or DEQ #100-1017) was drilled starting on January 7, 2005, and was completed on January 24, 2005. The well bore is 220 feet deep, with neat cement grout extending from the surface to 63 feet. The PVC well casing is 8-inches in diameter and extends to 167 feet, extending to 30 feet of screen (20 slot). There is an 8 inch diameter 10 foot long stainless steel tail piece extending to 208 feet. Gravel pack is installed from 155 feet to 210 feet. The well is equipped with a submersible pump (rated at 175 gpm at 280 feet TDH) driven by a 15 HP motor. The pump intake is set at 139 feet. The well has a tested yield of 193 gpm over a 48-hour period (February 17, 2005 to February 18, 2005), with the water level dropping from 17 feet (static) to 107 feet (dynamic).

The chlorination facilities consist of a separate building which houses two 55 gallon hypochlorite storage containers and the three metering pumps. There is one 10 gallon per day metering pump for each well.

The fluoridation facilities are housed in the main meter building and consist of a fluoride saturator and dedicated metering pumps for each well. A water softener is also located in the building to supply the fluoridation equipment.

The 300,000 gallon elevated tank is 155 feet tall with the overflow at 150 feet and the outlet at 118 feet. The maximum diameter of the spherical section is 46.3 feet. The working volume is between 147 and 150 feet.

OTHER PERMITS

This waterworks was issued a Groundwater Withdrawal Permit (No. GW0049200) from the Department of Environmental Quality on March 1, 2008. This permit limits this waterworks to a withdrawal of 80,615,000 gallons per year (220,863 gpd). It also limits this waterworks to withdraw no more than 8,079,200 gallons each month (260,619 gpd).

Compliance with the conditions and requirements of the Groundwater Withdrawal Permit shall not limit the authority of the Health Department to assign a capacity to the waterworks, based on the evaluation as follows.

CAPACITY EVALUATION OF THE WATERWORKS

Design Basis: This system is evaluated on the basis of equivalent residential connections (ERCs). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

1. Estimated Water Demand: (720 connections)(400 gpd/ERC) = 288,000 gpd

2. Source Capacity:

Well #	Well Yield, gpd = gpm/(0.5 gpm/ERC)*400 gpd/ERC)		Well Pump, gpd = gpm*1440 min/day		Limiting Capacity, gpd
7	157 gpm	125,600 gpd	145 gpm	208,800 gpd	125,600 gpd
8	122 gpm	97,600 gpd	100 gpm	144,000 gpd	97,600 gpd
9	193 gpm	154,400 gpd	175 gpm	252,000 gpd	154,400 gpd
Total	-	-	-	-	377,600 gpd

3. Storage Capacity: Effective storage = 300,000 gallons
300,000 gal / 200 gal/ERC = 1,500 ERC
1,500 ERC * 400 gpd/ERC = 600,000 gpd

Conclusion: This waterworks is limited to a design capacity of 377,600 gpd due to limited source capacity. This permit does not suspend, minimize, or otherwise alter this owner's obligation to comply with applicable federal, state, or local laws and regulations or permits.

LMA/DWT/ssd

Town of Parksley

3100-001 / NEW

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT
TOWN OF PARKSLEY, ACCOMACK, VIRGINIA

ATTACHMENT (Section 5).

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Nature of Activity Utilizing Water and Documentation of Beneficial Use

The Town Of Parksley, located Accomack County, Virginia has been in providing water to the town for over 50 years. The utilities sole operation is to provide potable quality water to the citizens and commercial connections within the corporate limits of the town.

This facility has withdrawn water at a fairly consistent rate for about 20 years. Water used in this town primarily supports numerous small business and residential connections. The primary beneficial need of water is for potable and domestic consumption. Some incidental uses such as fire suppression water do occur. The facility withdrawals its potable water from two wells located in Middle Yorktown-Eastover Aquifer (Well #5 (100-1126) and Well #6 (100-1161)). Supplemental fire suppression water is derived from Well #4 (100-898) located in a the upper Yorktown-Eastover aquifer.

This community water system provides water to many small businesses and residences. A total of 513 connections exist currently with planned expansion of an additional 68 residential connections. Currently there are a total of 48 commercial connections that account for approximately 8 percent of the towns withdrawal. The remaining 92 percent is attributed to 465 residential-type connections. The residential connections will be expanded to a 533 connections within ten years.

During the past five years the town has only lost one significant user of groundwater: the abandoned "Shirt Factory". This site could have the potential to be expanded into more residential connections in the future. Currently there are no plans to redevelop this site. However, some room exists to expand the towns water use further.

Description of Users

The towns water users can be further subdivided to illustrate the types of connections currently in place. Of the towns 48 business connections there are three restaurants, one grocery store, and one fork lift repair facility. The remaining 43 connections are small businesses and offices. The town has one elementary school that services the region. The remaining 465 connections are residential connections. Of the top five consumers of water in the town, no one user withdrawals more than 1% of the total. The following are the top five users based on third quarter Account balances. #1The Elementary School (0.89%), #2 Parksley Taqueria (0.59%), #3 the grocery store (0.50%), #4 The Club Car Restaurant (0.48%), and dentist office (0.31%).

Consumption

While The volume of water used per residential connection varies (based on the number of occupants per connection) there can be no mathematically valid standardized rate per connection (gallons/widget). However, the significant historical use data has allowed reasonable apportionment to be estimated. As mentioned above there are currently 48 business connections and 465 residential connections. Projected withdrawals for the next permit period can be based off the anticipated increases in these two types of connections as the facility is expanding its capability to accommodate increased connections.

The Town of Parksley has a long record of withdrawals. The town has nearly remained flat in terms of population growth. However, business within the town has changed throughout the years causing differences in water consumption. Generally the water use since 1995 has remained flat. Using the previous ten year withdrawal period (1998 - 2007) as a comparative baseline, the month-over-month average withdrawal is 2.36 million gallons per month. The year-over-year average is 28.34 million gallons per year. The highest annual withdrawal was 30.6 millions gallons (2002).

From the beginning of 2005 there have been no unusual water consumptions (significant fires, leaks, etc) documented or observed. As such, the current maximums do model a realistic trend of consumption based on the town withdrawing at its maximum capacity. As the town has had no significant changes in population it is reasonable to determine the likely withdrawal based on the historical maximums. These values will represent the highest withdrawal expected.

Planned Expansion

The town has completed its construction of an improved central sewage collection system in order to enhance the towns capacity to support and develop more business infrastructure. For many years, the town's ability to support the current capacity and proposed future capacity has been limited by an antiquated waste management system. In recent history, many of the buildings within the central district were not fully utilized and or occupied because of waste management limitations. In order to promote this growth, the Town Council had elected to construct a "Central Business District" sewage management system. This system services the central business area and allows full occupancy of <u>already existing</u> structures and currently unoccupied spaces.

As the system has expanded the towns waste management capacity, the central business area will be able to become fully occupied due to previously suppressed redevelopment efforts. The existing business previously occupied are now able to operate with out sewage constraints. An additional five businesses (3 restaurants, a beauty parlor, and business office), and an additional 28 apartments/condominiums plan to be built from previously existing structures within the towns central business district. Previously, these unoccupied spaces could not support occupation because there were no means of managing the waste that would have been produced by those spaces. The town fully intends on the completion of these redevelopment goals as they will ultimately help support the towns growth and assure a sustainable future. In addition to the central business districts redevelopment, the town has also planned an additional 68 residential connections planned outside of the central business district. This residential expansion is likely to occur during the next ten year permit term.

Calculations

In order to estimate the maximum withdrawal required by the town, the historic average values from 1998 through 2007 are used. In order to expand the withdrawal to accommodate the demand posed by the towns pending redevelopment, the increased consumption is be based on the percentage of increase anticipated by the additional consumption. An average of 28.34 million gallons per year (1998-2007) is used as the baseline for annual consumption and baseline value for computing the maximum monthly withdrawal is 3.73 million gallons per month (August 2002).

Currently, business and residential consumption accounts for 8% and 92%, respectively, of the total withdrawal.

Businesses account for 8% of the towns withdrawal:

$$8\% \times 3.73_{million\_gallons/month} = 0.298_{million\_gallons/month}$$
$$8\% \times 28.34_{million\_gallons/year} = 2.267_{million\_gallons/year}$$

The number of business are likely to expand by approximately 10% (3 restaurants, Beauty Parlor, and office space). This percentage of growth will be used to forecast future consumption. A 10% increase yields the following additional volume of water:

$$10\% \times 0.298_{million\_gallons/month} = 0.0298_{million\_gallons/month}$$
$$10\% \times 2.267_{million\_gallons/year} = 0.2267_{million\_gallons/year}$$

Residential connections currently account for 92% of the towns withdrawal:

$$92\% \times 3.73_{million\_gallons/month} = 3.431_{million\_gallons/month}$$
$$92\% \times 28.34_{million\_gallons/year} = 26.073_{million\_gallons/year}$$

The above residential values can be expanded by the anticipated 14.6% growth to forecast the likely month and annual maximums:

$$14.6\% \times 3.431_{million\_gallons/month} = 0.5009_{million\_gallons/month}$$
$$14.6\% \times 26.073_{million\_gallons/year} = 3.807_{million\_gallons/year}$$

The above calculated increases can be added to the current values to expand the volumes to the anticipated maximums:

$$0.298^{Businesses}_{million\_gallons/month} + 3.431^{Existing\ Residential}_{million\_gallons/month} + 0.0298^{ExpandedCommercial}_{million\_gallons/month} + 0.5009^{Expanded\ Residential}_{million\_gallons/month} = 4.259^{Total\_Maximum}_{million\_gallons/month}$$

$$2.267^{Businesses}_{million\_gallons/yearh} + 26.073^{Existing\ Residential}_{million\_gallons/year} + 0.2267^{Expandedcomercial}_{million\_gallons/Year} + 3.807^{Expanded\ Residential}_{million\_gallons/Year} = 32.38^{Total\_Maximum}_{million\_gallons/year}$$

Based on expansion of the historically derived withdrawals, the facility requests that the following volumes of withdrawal are granted:

A maximum Monthly withdrawal of 4.26 Million Gallons
A maximum Annual withdrawal of 32.4 Million Gallons

Apportionment of Withdrawal to Individual Wells

The permitted yield will be produced from 2 existing wells. These wells will produce all of the water consumed under this permit. The table below is not based on data as the second pumping well has not been constructed yet (11/5/2008). However, the withdrawals are anticipated to be split evenly by means of an automated flow control system that alternates withdrawals between the two wells. The data below is approximate:

[1] APPORTIONMENT OF WITHDRAWALS Schedule	Well #5 100-1126	Well #6 100-1161	Totals
January	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
February	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
March	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
April	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
May	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
June	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
July	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
August	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
September	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
October	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
November	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
December	1,245,385 Gal	1,245,385 Gal	2,490,769 Gal
Annual Estimated Usage			*~32.38 MG*

[1] Estimates of projected maximum water use in gallons. Actual use will vary.
[2] M-PRN = monthly withdrawal pumped as needed.

Town of Parksley

A Progressive Town in Which To Shop and Live

MEMORANDUM

TO: Commercial Property Owners
FROM: Fred Matthews, Zoning Administrator
DATE: June 5, 2009

Any commercial building with a second story access and sewage hookup is now eligible to become an apartment, governed by the Town of Parksley Zoning Ordinances.

If interested, please contact the Town at 665-4618 to discuss further.

18444 Dunne Avenue • P.O. Box 256 • Parksley, Virginia 23421 • 757-665-4618

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment

Accomack County Health Department
P. O. Box 177 / 23191 Front Street
Accomac, VA 23301
(757) 787-5880 Voice
(757) 787-5841 Fax

Sewage Disposal System Operation Permit

Property Owner
Town of Parksley
PO Box 256
Parksley, VA 23421

Health Dept. ID: **08-100-0861**
Tax Map: **78A3((4))5**

Locality: Accomack

Property Location
Property Address: Browne Ave.
Parksley, VA 23421
Subdivision: Expansion of Sewage System for Town Supply
Directions: Browne Avenue

==

Town of Parksley is hereby granted permission to operate a SE - Drip (GMP #107) Sewage System at the above referenced location, having a design capacity of **17,333** gallons per day maximum.

Conditions of Permit:

Adhere to the recommendations of the Operation & Maintenance Manual

Effluent Sampling Result Limits:

Total Suspended Solids- less than or equal to 30mg/l

$CBOD_5$- less than or equal to 30mg/l

Total Kjeldahl Nitrogen (TKN)- less than or equal to 5mg/l

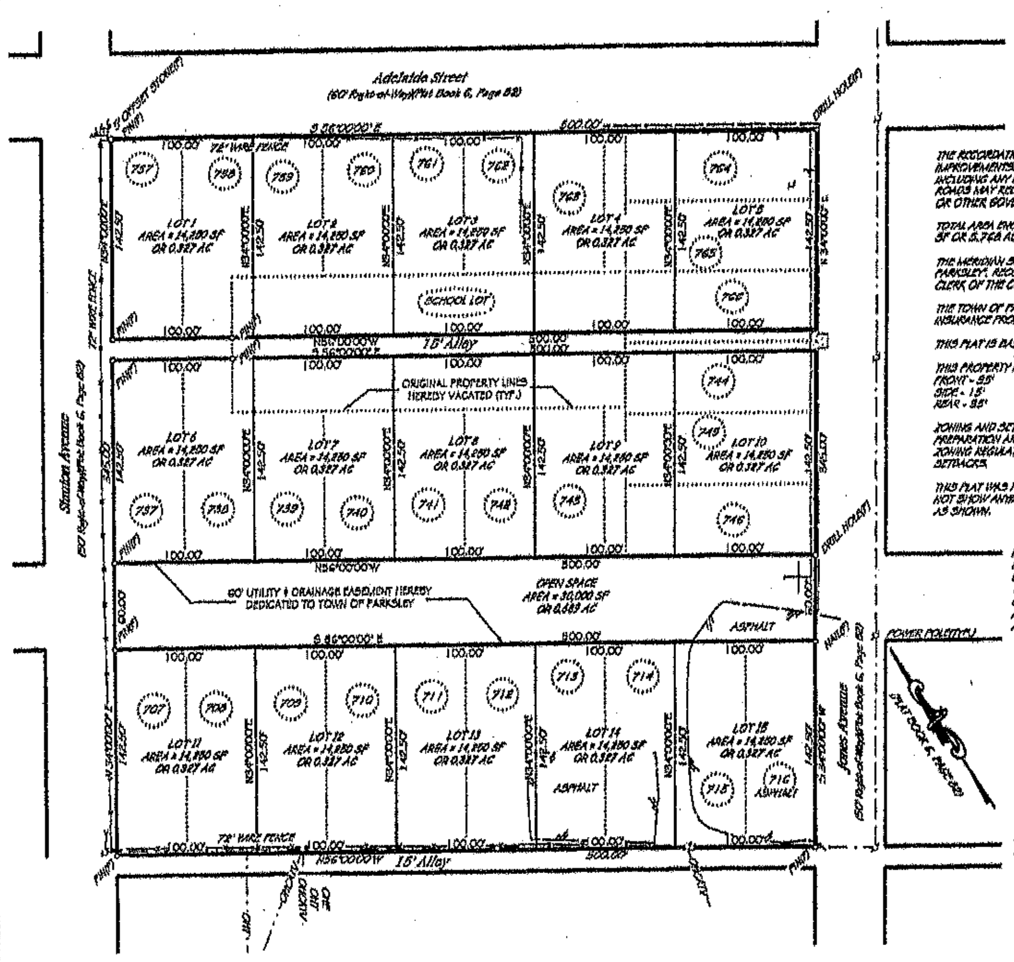
Drainfield Monitoring Wells' Nitrate Levels- less than or equal to 5mg/l

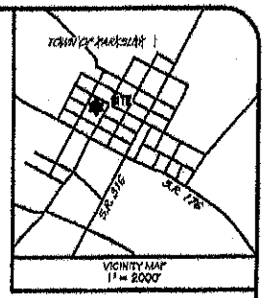
This permit is issued in accordance with the provisions of Title 32.1, Chapter 6 of the Code of Virginia as Amended, and Section 12VAC 5-610-340 of the Sewage Handling and Disposal Regulations of the Virginia Department of Health. The issuance of an operation permit does not denote or imply any guarantee by the department that the sewage disposal system will function for any specified period of time. It shall be the responsibility of the owner or any subsequent owner to maintain, repair, or replace any sewage disposal system that ceases to operate in accordance with the regulations.

March 26, 2009
Effective Date

Cathy L. Plant
EHTS

Cathy L. Plant
Signed March 26, 2009





VICINITY MAP
1" = 2000'

THE RECORDATION OF THIS PLAT BY THE COUNTY IS NOT AN APPROVAL FOR IMPROVEMENTS. FURTHER DEVELOPMENT OF THESE LOTS AND/OR ROADS, INCLUDING ANY FILLING OR PHYSICAL ALTERATIONS OF THE LOTS AND/OR ROADS MAY REQUIRE ADDITIONAL PERMITS FROM THE COUNTY OF ACCOMACK OR OTHER GOVERNMENTAL AGENCIES.

TOTAL AREA ENCOMPASSED BY THE NEW LOTS HEREBY CREATED = 251,250 SF OR 5.768 AC.

THE MERIDIAN SOURCE OF THIS PLAT IS BASED ON THE PLAT TITLED "PLAN OF PARKSLEY", RECORDED IN PLAT BOOK 6 AT PAGE 82 IN THE OFFICE OF THE CLERK OF THE COURT IN ACCOMACK COUNTY, VIRGINIA.

THE TOWN OF PARKSLEY DOES NOT PARTICIPATE IN THE NATIONAL FLOOD INSURANCE PROGRAM.

THIS PLAT IS BASED ON A CURRENT FIELD SURVEY.

THIS PROPERTY IS ZONED "R-1 S RESIDENTIAL" AND THE SETBACKS ARE:
FRONT - 35'
SIDE - 15'
REAR - 35'

ZONING AND SETBACK INFORMATION IS ACCURATE AS OF THE DATE OF PLAT PREPARATION AND ARE SHOWN FOR INFORMATIONAL PURPOSES ONLY. CURRENT ZONING REGULATIONS AT THE TIME OF CONSTURCTION SHALL GOVERN SETBACKS.

THIS PLAT WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND MAY NOT SHOW ANY/ALL EASEMENTS OR RESTRICTIONS AFFECTING SAID PROPERTY AS SHOWN.

THE PARCELS WITHIN THIS RE-SUBDIVISION ARE:
TAX PARCEL #07600A101070700
TAX PARCEL #07600A101070800
TAX PARCEL #07600A101070900
TAX PARCEL #07600A101071000
TAX PARCEL #07600A101071100
TAX PARCEL #07600A101071200
TAX PARCEL #07600A101071300
TAX PARCEL #07600A101071400
TAX PARCEL #07600A101071500
TAX PARCEL #07600A101071600
TAX PARCEL #07600A101073700
TAX PARCEL #07600A101073800
TAX PARCEL #07600A101073900
TAX PARCEL #07600A101074000
TAX PARCEL #07600A101074100
TAX PARCEL #07600A101074300
TAX PARCEL #07600A101074400
TAX PARCEL #07600A101074500
TAX PARCEL #07600A101074600
TAX PARCEL #07600A101075700
TAX PARCEL #07600A101075800
TAX PARCEL #07600A101075900
TAX PARCEL #07600A101076000
TAX PARCEL #07600A101076100
TAX PARCEL #07600A101076200
TAX PARCEL #07600A101076300
TAX PARCEL #07600A101076400
TAX PARCEL #07600A101076500
TAX PARCEL #07600A101076600
TAX PARCEL #07600A101U00000
TAX PARCEL #07600A101V00000

I, MICHAEL A. STARLING, A LICENSED LAND SURVEYOR DO HEREBY CERTIFY THAT THIS PLAT WAS MADE BY ME, THE UNDERSIGNED, AT THE DIRECTION OF THE OWNER, AND THAT THIS SUBDIVISION IS ENTIRELY WITHIN THE BOUNDARIES OF LAND COVERED BY THE DEED DESCRIBED BELOW, AND THAT IRON PINS ARE ACTUALLY IN PLACE AT POINTS MARKED THUS, "O" & "●", AND THAT THEIR LOCATIONS ARE CORRECTLY SHOWN.

COMMONWEALTH OF VIRGINIA
MICHAEL A. STARLING
Lic. No.
2858
LAND SURVEYOR

THE PROPERTY EMBRACED WITHIN THIS RE-SUBDIVISION PLAT WAS CONVEYED TO L.B.H., LLC FROM ACCOMACK COUNTY, VIRGINIA BY INSTRUMENT DATED MARCH 24, 2006 AND RECORDED IN THE CLERK OF COURTS OFFICE AT INSTRUMENT #200603100.

THE PLATTING OR DEDICATION OF THE FOLLOWING DESCRIBED LAND, "RE-SUBDIVISION PLAT OF A PORTION OF PLAN OF PARKSLEY (PLAT BOOK 6, PAGE 82)" LOCATED IN THE TOWN OF PARKSLEY, ACCOMACK COUNTY, VIRGINIA IS WITH THE FREE CONSENT AND IN ACCORDANCE WITH THE DESIRE OF THE UNDERSIGNED OWNERS, WHO CERTIFY THAT THEY ARE THE FEE SIMPLE OWNERS OF SAID LAND AND THAT THERE ARE NO ENCUMBRANCES ON THIS PROPERTY.

______________________ ________
L.B.H., LLC, DATE
BY ROBERT PRODAN, II, MANAGER

STATE OF VIRGINIA
CITY OF VIRGINIA BEACH, TO WIT:

______________________ A NOTARY PUBLIC, IN AND FOR THE CITY AND STATED AFORESAID, DO HEREBY CERTIFY THAT ROBERT PRODAN, II, MANAGER, WHOSE NAME IS SIGNED TO THE FOREGOING WRITING, BEARING DATE APRIL 30, 2006 HAS ACKNOWLEDGED THE SAME BEFORE ME IN MY COUNTY AND STATE AFORESAID.

GIVEN UNDER MY HAND THIS ____ DAY OF ______________, 2006.

____
NOTARY PUBLIC REGISTRATION # MY COMMISSION EXPIRES

RE-SUBDIVISION PLAT
OF
A PORTION OF
Plan of Parksley
(PLAT BOOK 6, PAGE 82)
TOWN OF PARKSLEY
ACCOMACK COUNTY, VIRGINIA
FOR
L.B.H., LLC
APRIL 30, 2006

Shoreline Surveyors
26379 Lankford Highway, Suite A - P.O. Box 652
Onley, Virginia 23418
PHONE (757) 789-3960 FAX (757) 789-3962

GRAPHIC SCALE
1" = 50'

SCALE: 1" = 50'
DRAWN: MAS
FIELD BOOK: 1, PAGE 68
JOB #05066
SHEET 1 OF 1

Windows Live™

cancelled

VUPS PRK901 2008/08/27 #00001 B824001371-00B NORM NEW LREQ

new

B824001386 —

From: **OCARS_Pro@vups.org**
Sent: Wed 8/27/08 2:47 PM
To: PRK901=parksleyva@hotmail.com (parksleyva@hotmail.com)

same info + include slabs from prev. bldg & trailers

```
PRK901 00001 VUPSb 08/27/08 14:47:35 B824001371-00B         NORMAL

Ticket No:  B824001371-00B                          NEW  GRID NORM LREQ
Transmit          Date: 08/27/08   Time: 02:47 PM   Op: 1FCF
Call              Date: 08/27/08   Time: 02:31 PM
Due By            Date: 09/02/08   Time: 07:00 AM
Update By         Date: 09/16/08   Time: 11:59 PM
Expires           Date: 09/19/08   Time: 07:00 AM
Old Tkt No: B824001371
Original Call     Date: 08/27/08   Time: 02:31 PM   Op: 1FCF

City/Co:ACCOMACK              Place:PARKSLEY                         State:VA
Address:                      Street: JONES AVE
Cross 1:     MARY ST

Type of Work:    LANDSCAPING
Work Done For:   SAME
Excavation area:REMOVING CONCRETE PLATFORMS/KREMOVING SIDEWALK/ BLACK TOP
                DRIVEWAY REMOVAL/CEMENT FLOORS REMOVAL/TREE REMOVAL, FROM THE
                CORNER  OF JONES AVE AND MARY STREET, MARK THE ENTIRE AREA OF
                WHERE OLD SCHOOL USE TO BE.

                THIS IS THE OLD PARKSLEY MIDDLE SCHOOL
Instructions:

Whitelined: N   Blasting: N   Boring: N

Company:          DELMARVA CONSTRUCTION COMPANY OF VA      Type: OWNR
Co. Address:      16051 SYCAMORE RD  First Time: Y
City:             LAUREL  State:DE  Zip:19956
Company Phone:    443-614-5491
Contact Name:     DAVID ELLIOTT                  Contact Phone:757-665-4420

Mapbook:
Grids:       3747D7539C

Members:
ANE901 = A & N ELECTRIC COOPERATIV(ANE) PRK901 = TOWN OF PARKSLEY (PRK)
VZN905 = VERIZON (VZN)

Seq No:    1 B
```

GROUNDWATER CONSERVATION AND MANAGEMENT PLAN

TOWN OF PARKSLEY VIRGINIA
PARKSLEY, ACCOMACK COUNTY VIRGINIA

ACCOMACK, VIRGINIA

DECEMBER 2007

Table of Contents

1.0 GENERAL INFORMATION

The Town of Parksley, herein referred to as the "the town", is a mixed residential and light commercial community located in Accomack County on Virginia's Eastern Shore. The town provides a full time potable water supply (Community System) to residential and commercial consumers within the system service area.

Typical consumption at the facility requires consumption of a virtually fixed amount of groundwater from its three-well system located within the towns corporate limits. Because this property is located within the Eastern Virginia Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the facility and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide the management of the town, who are responsible for the operation and policy management decisions of the potable water facilities. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a

plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provide guidance to implement water management and conservation measures.

2.0 WATER DEMAND

Water at this facility is utilized for a variety of purposes. This use includes, but is not limited to, water used for cooking, bathing, laundry, cleaning, and other assorted domestic purposes. The largest non-residential user is the local elementary school, which utilizes less that 1% of total production. Nearly all water that is withdrawn and distributed is for potable use. The town maintains a full-time water distribution system to support each individual tenant/connection with water for all domestic needs. Sanitary waste and domestic usage waste generated on-site is handled by several permitted septic systems located throughout the property the town.

The facility does not engage in any routine irrigation practices; however, there may be some occasional use of water for vegetable garden irrigation and/or car washing. Water withdrawal data, that was deemed reliable, was assessed. No patterns had emerged suggesting that the water usage at this facility is evenly distributed; the water demand did not remain constant from month to month during the entire assessed period. However, the change appears to be seasonal in nature with heavier use in the summer and lesser use in the winter.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the town. As there are no other municipal supply pipelines located within the town's service area, drinking water, as well as general-use water, is directly withdrawn and distributed at the facility. Due to the nature of water usage, almost all water is used for potable purposes. There are three wells that supply groundwater of adequate quality and quantity.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the relative geographic proximity of the facility. Although this region receives approximately 42 inches of precipitation per year, the town is not large enough to be able to support a precipitation collection system and cistern storage system that could supply the required volume and rate of fresh water during normal operations. During periods of peak demand, surface water resources are not reliable as a result of high rates of evapotranspiration and low inputs from precipitation.

Groundwater has been used for at this location since the mid 1940's without issues regarding quality or quantity. Due to the dynamic nature of the confined aquifer system, groundwater is naturally buffered during recharge to the aquifer. Thus, the regional, confined aquifer's groundwater is the most reliable source of quality water as opposed to any other options (surface water, sea water, etc.).

4.0 WATER CONSERVATION MEASURES

The following conservatory measures will be implemented with regard to the water supply including groundwater from the facilities' wells.

- No unnecessary groundwater withdrawal will be permitted. Bi-lingual notices will be dispatched in association with billings and or the Consumer Confidence Report notifying them that the town's wells are located within the Eastern Shore Ground Water Management Area. This notice will explain the obligation the Town of Parksley has to obtain and preserve a ground water withdrawal permit with the Virginia Department of Environmental Quality. This notice will also include highlights on how each individual household can assist in water conservation efforts.

- Facility management will regularly review water use and will implement changes when identified:
  - Well readings will be collected daily to allow for the immediate identification of unusual use and/or leaks.
  - The Management will adopt and maintain an electronic database to record and monitor the well readings collected above.

- Meter readings made at discrete connections will be evaluated monthly in order to identify excessive water consumption at individual connections. If such a pattern is identified, the party responsible for that connection will be notified that their consumption is non-normal and some form of corrective action may be required.

- In order to comply with the Unified Statewide Building Code, plumbing fixtures that are aged shall be replaced with low-flow fixtures as a condition permit.

- Some consumers do occasionally use water for irrigation purposes. Watering is typically restricted to private vegetable gardens and lawns. In the event of drought, these areas shall not be watered in order to conserve water.

- Encourage citizens to conserve water through the use of regularly posted bulletins and other conversational reminders, posters and/or notices posted in public areas. Each new bulletin will be posted in public spaces and distributed to each unit as they are issued. This will take place no less than on a quarterly basis.

- *Water Reuse Evaluation*: All water used at this facility, with the exception of occasionally used irrigation water, cannot be reused or recycled.

5.0 WATER MANAGEMENT MEASURES

The following management measures will be implemented with regard to the water supply including groundwater from the town's wells.

- Water Loss Reduction:
  - (a) The facility will conduct daily readings in order to identify excessive flow that may indicate a leak in the system or significant change in consumption.
  - (b) The town will conduct routine inspection of all above ground water piping systems and storage tanks for any indication of leaks on a weekly basis.
  - (c) The facility will conduct routine visual observations along underground potable water piping systems for indications of leaks at least once per week.
  - (d) Any leak discovered in the potable water storage/supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water.

- Mandatory water use restrictions will be implemented during water shortage emergencies declared the local governing body, the Director of DEQ, or the Governor. Non-essential uses of water, such as irrigation or washing of buildings and or vehicles will be restricted or prohibited. In addition, town personnel will be prohibited from general washing of buildings, paved surfaces, or equipment. The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.

- Water Conservation: Water conservation efforts as described in section 4.0 of this document shall be followed in order to preserve the resource and right to withdrawal water from the resource.

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: April 6, 1995 (Revised)
August 21, 2006 (Revised)

WATERWORKS NAME:	Town of Parksley Water System	CERTIFIED CLASS: IV
COUNTY/CITY:	Accomack County	TYPE: Community
LOCATION:	This system is located on the east side of Browne Street (State Route T1805) in Parksley.	
OWNER:	Town of Parksley Mr. Fred Matthews, Director of Public Works P.O. Box 256 18419 Browne Ave. Parksley, VA 23421 (804) 665-4618	
OPERATOR:	Mr. James G. Eichelberger (Class III) (804) 665-4618	
PERMIT NO.:	3001660	
DATE ISSUED:	June 24, 1977	
TYPE OF TREATMENT:	Chlorination	
SOURCE:	3 Wells (two active one standby)	
DESIGN CAPACITY:	182,000 gpd or 455 equivalent residential connections	

DESCRIPTION OF SYSTEM

This system consists of three wells, an elevated storage tank, chlorination addition equipment, and the distribution system. All three wells are interconnected with individual and combined metering and treatment prior to discharge to the 75,000 gallon elevated storage tank.

Well No. 1 is a Class IIB well drilled to a depth of 280 feet with cement and bentonite grout extending from the surface to 50 feet. The well casing is 6-inches in diameter and extends to 240 feet with a stainless steel screen extending from 240 to 280 feet. The well is equipped with a submersible pump with a rated capacity of 150 gpm at 320 feet TDH and driven by a 15-HP electric motor. The pump intake is set at 150 feet. The well has a tested yield of 200 gpm over a 24-hour period. The static water level is 25 feet and the stabilized pumping water level is at 80 feet. This well was constructed in 1990.

Well No. 3 is equipped with a 5-HP submersible pump rated at 40 gpm.

<u>Well No. 4</u> has a submersible pump rated at 160 gpm. There is a 6' x 6' concrete pad around the casing. The well is 198 feet deep, cased with 6-inch diameter casing to 198 feet, and screened from 198 feet to 218 feet deep. This well was constructed in 1980. A 48-hour yield test was performed which indicated a 160 gpm yield.

<u>Chemical Feed Facilities</u>: Chlorination is provided by means of a metering pump feed by a 330 gallon plastic solution tank. Neat hypochlorite (12% to 15% chlorine) is stored in the tank and feed neat.

EVALUATION OF SYSTEM

This system is evaluated on the basis of equivalent residential connections (ERC). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

I. Source Capacity (Groundwater)

A. Source Yield

1. Number of Sources

a. Required = 1 up to 49 ERC, more than 1 for 50 or more ERC
b. Provided = 3 wells

2. Well Yields: Based on field test performed by the Town, as per letter dated 3/3/93, capacity of Wells #1, #3, and #4 operating simultaneously is approximately 340 gpm at 130 feet TDH.

$$\text{Well Capacity} = \frac{340}{0.5} = 680 \text{ ERC}$$

3. Pump Yields: Well #1 = 150 gpm
Well #4 = 160 gpm
Well #3 = 40 gpm

B. Production Capacity 150 gpm + 40 gpm + 160 gpm = 350 gpm

$$\frac{350}{0.5} = 700 \text{ ERC}$$

II. Storage Capacity

A. Effective Storage = 75,000 gallons

B. Storage Capacity

$$\frac{75{,}000 \text{ gallons}}{200 \text{ gallons/ERC}} = 375 \text{ ERC}$$

III. Existing Situation

A. Town of Parksley - 455 connections

B. This system has served 455 connections, with no problems noted with pressure or shortages.

IV. Limiting Case

A. Existing Situation = 455 connections ('Grandfathered in ")

B. Storage Capacity = 375 ERC

C. Capacity Equivalent = 455 ERC x 400 gpd/ERC = 182,000 gpd

Therefore, based on the critical values discussed above, this waterworks is limited to a design capacity of 182,000 gpd or 455 ERC. It is stressed that the flow restrictions is the limiting factor and that the permitted number of ERC is only an indicator of when the flow restriction will be reached. Therefore, this system may exceed the permitted number of ERC as long as the flow is within the limits as indicated by proper reporting as determined by the Health Department engineers.

Rolling Acres

3100-001 / NEW

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: November 21, 1984
REVISED: June 26, 1995

WATERWORKS NAME:	Rolling Acres Subdivision	CERTIFIED CLASS: N/A
COUNTY/CITY:	Accomack County	TYPE: Community

LOCATION: State Route 676 approximately 3/4 mile west of its intersection with U.S. Route 13

OWNER: Eastern Shore Associates, Inc.
Mr. Leander S. Roberts
P.O. Box 128
23472 Church Rd.
Accomac, VA 23301
(804) 787-4876
(804) 787-5754 (W)

OPERATOR: Mr. Leander S. Roberts
P.O. Box 128
23472 Church Rd.
Accomac, VA 23301
(804) 787-4876
(804) 787-5754 (W)

PERMIT NO.: 3001745

DATE ISSUED: November 21, 1984

TYPE OF TREATMENT: None

SOURCE: 2 Wells

DESIGN CAPACITY: 17,333 gpd or 43 equivalent residential connections

DESCRIPTION OF SYSTEM

This system consists of two wells, two booster pumps, a 2,000 gallon hydropneumatic tank, an 8,000 gallon ground storage tank, and the distribution system. The wells are Class II-B wells, each 300 feet deep with 270 feet of 4-inch galvanized casing, and 50 feet of grout. The estimated yield of each well is 15 to 20 gpm. The wells are equipped with submersible pumps, each rated at 16 gpm at a TDH of 305 feet, driven be 2-H.P. electric motors.

The booster pumps are 5-H.P. with a 6-inch impeller. At full flow, each pump will produce 160 gpm at 59 ft. TDH.

The hydropneumatic tank is equipped with an access manhole, pressure controls, a drain, a pressure gauge, a sight glass, and an air compressor. There is a bypass provided around the tank. The ground storage tank is equipped with a drain, a screened overflow, an access manhole, a screened vent, a level control and a bypass.

The distribution system consists of approximately 2700 feet of 4-inch diameter PVC pipe and approximately 210 feet of 2-inch diameter PVC piping. Presently, there are 40 connections to this system.

EVALUATION OF SYSTEM

This system is evaluated on the basis of equivalent residential connections (ERC). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

I. Source Capacity (Groundwater)

A. Source Yield

1. Number of Sources

a. Required = 1 up to 49 ERC, more than 1 for 50 or more ERC
b. Provided = 2 wells

2. Well yield: estimated to be 40 gpm total

3. Pump yield: 16 gpm + 16 gpm = 32 gpm total

B. Production Capacity

$$\frac{32 \text{ gpm}}{0.5 \text{ gpm/ERC}} = 64 \text{ ERC}$$

II. Storage Capacity

A. Effective Storage
8,000 gallons + 1/3 (2,000 gallons) = 8667 gallons

B. Storage Capacity

$$\frac{8667 \text{ gallons}}{200 \text{ gallons/ERC}} = 43.3 \text{ ERC (Limiting Case)}$$

III. Booster Pump Capacities

A. Pump Capacity (Single Pump)
160 gpm at 58 feet TDH

B. Capacity Performance
(160 gpm - 50 gpm) - 1 gpm/ERC = 110 ERC

IV. Limiting Case

A. Storage Capacity = 43.3 ERC

B. Capacity Equivalent

43.3 ERC X 400 gpd/ERC = 17,333 gpd

Therefore, based on the critical values discussed above, this waterworks was issued an operations permit for a design capacity of 17,333 gallons per day or 43 ERC. It is stressed that the available storage is the limiting factor and that the permitted number of ERC is only an indicator of when the flow restriction will be reached. Therefore, this system may exceed the permitted number of ERC as long as the flow is within the limits as indicated by proper reporting as determined by the Health Department engineers.

Shore Life Care of Parksley

Virginia's
Eastern
Shore

MALCOLM
PIRNIE

3100-001 / NEW

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: June 25, 1999
Revised: August 26, 2004

WATERWORKS NAME:	Shore Life Care at Parksley	CERTIFIED CLASS: IV
COUNTY/CITY:	Accomack County	TYPE: Community

LOCATION: Located on north side of state highway 176 (Parksley Road) at its intersection with U.S. Highway 13, near the town of Parksley.

OWNER: Shore Life Care at Parksley
26181 Parksley Road
Parksley, Virginia 23421
Phone: (757) 665-5133
Attn: Tracy Turman, Administrator

OPERATOR: Mr. Maurice Chandler (Class IV, License: 1904002085, exp: 2/28/2005)
Shore Memorial Hospital
9507 Hospital Avenue
P.O. Box 17
Nassawadox, VA 23413
(757) 414-8359

PERMIT NO.: 3001031

DATE ISSUED: June 25, 1999

TYPE OF TREATMENT: Corrosion control and softening

SOURCE: One well

DESIGN CAPACITY: 29,315 gpd

DESCRIPTION OF WATERWORKS

This waterworks consists of one well, one 2,000 gallon capacity hydropneumatic tank, corrosion control treatment, a softening system and appurtenances.

The well was completed on June 26, 1969. The well bore is 142 feet deep with cement grout of unknown depth. The well casing is 6 inches in diameter and extends to 132 feet, extending to 10 feet of stainless steel screen (7 slot). The well is equipped with a submersible pump rated at 125 gpm is driven by a 15 H.P. motor. The well has a tested yield of 40 gpm over a 4 hour period with water level dropping from 18.5 feet (static condition) to 40 feet (dynamic condition).

The corrosion control treatment consists of a metering pump (maximum capacity 0.42 gph or 10 gpd) and a 35 gallon solution crock with a stirrer for mixing feed solution. Zinc orthophosphate solution is fed for corrosion control.

The softening system consists of three ion exchange water softeners which have individual meters and brine regeneration systems. Flow from the hydropneumatic tank is treated by two softeners operating in parallel, while the third softener is regenerated or out of service. Each softener is a cylindrical fiberglass tank (2.5 ft. diameter by 6 ft. sidewall) containing 3.1 ft. of ion exchange resin supported on 0.5 ft. of gravel. The brine regeneration systems each consist of a 248 gallon polyethylene tank with manual salt feed and automatic water feed system. Regeneration can be accomplished with either manual or automatic control. The brine waste is disposed via subsurface soil infiltration.

EVALUATION OF SYSTEM

This system is evaluated on the basis of equivalent residential connections (ERCs). One ERC will utilize 400 gallons per day. This system's capacity is evaluated as follows:

I. Source Capacity (Groundwater)

A. Number of Sources

1. Required = 1 up to 49 ERCs, more than 1 for 50 or more ERCs
2. Provided = 1 well
3. Limited to 49 ERCs

B. Well Yield: 40 gpm / 0.5 gpm/ERC = 80 ERCs
80 ERC * 400 gpd/ERC = <u>32,000 gpd</u>

C. Pump Capacity: 125 gpm * 1440 min/day = <u>180,000 gpd</u>

II. Treatment Capacity:

Ion Exchange:
Hydraulic Capacity: <u>105 gpm</u> = 21.4 gpm/ft^2 * 4.9 ft^2
Loading rate: 30,000 grains/ft^3 * 15 ft^3 / 9 grains/gal = 50,000 gal treated prior to regeneration (per unit)
With all three units in operation, a total of 135,000 gallons can be treated prior to regeneration.

III. Storage Equivalent: 2,000 gal / 3 = 667 gal
667 gal / 200 gallons/ERC = 3.3 ERC
3.3 ERC * 400 gpd/ERC = <u>1,320 gpd</u>

IV. Existing Conditions: 136 beds + 47 employees x 3 shifts ("Grandfathered In")

V. Limiting Case:

A. Storage = 1,320 gpd (however, system is "Grandfathered")

B. Capacity Equivalent

136 beds * 200 gallons/bed/day + 3 shifts/day * 47 employees/shift * 15 gallons/employee = 29,315 gpd

Therefore based on the critical values discussed above, this waterworks is issued an operation permit for a design capacity of 29,315 gpd or 136 patients (beds) and 141 employees and is limited to its existing facilities.

KMH/DWT/mw

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT
SHORE LIFECARE AT PARKSLEY, ACCOMACK, VIRGINIA

ATTACHMENT (Section 5).

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Nature of Activity Utilizing Water and Documentation of Beneficial Use

The Shore Lifecare at Parksley facility located in Parksley, Accomack, Virginia has been in operation as this location for over 30-years. This facility was formerly referred to as Accomac Nursing Home. The facility's' primary role is a full-time care facility for the elderly. The majority of water use at this facility is for the support of its residents and staff.

This facility has been permitted to withdrawal 6,800,000 gallons per year and no more than 800,000 gallons per month. The water at this facility is used in domestic capacities such as laundry, food preparation, sanitation, bathing and the like. The facilities water comes from two different sources. The care facilities demand and any maintenance demands are met by using water from Well #1. There is a second well that is used exclusively for irrigation. These two wells are located in different portions of the Yorktown Eastover Aquifer.

Well #1 Water use cannot accurately be separated into individual volumes for individual needs. For example, the amount of water used for whirlpools or food preparation cannot be differentiated. Water use within the building is not metered on a per-task event; individual meters do not exist. Only the main flow totalizer indicates the total use.

Water use could be separated into two different use categories: life-sustaining and general domestic. Life-sustaining use includes all water used for sanitation, bathing, food preparation, and therapeutic support.

- Sanitation use includes water used for toilets and general waste management.
- Water used for bathing includes any water used for personal hygiene.
- Water used for food preparation includes any water used to cook or prepare meals. Water for general consumption is included in this description.
- Therapeutic support water includes water used for whirlpools and therapy sessions.

General domestic water can be further sub-divided, but does not necessarily require sub-division.

- Water used to clean: in the kitchen and in general areas.
- Water used to support operations: laundry, and occasional maintenance (exterior cleaning water and general maintenance, This water would be used as needed

for cleaning areas from spilled trash or other small tasks, some water is used to clean windows on occasion for example).

Well #2 A very minor amount of water is used for on-site irrigation of lawn and associated landscape features. Irrigation water is used in some flower beds and some turf areas and accounts for an area less than one half an acre. There is no "accounting" of past irrigation practices as irrigation water has only been applied as needed during significant dry spells. The varieties of shrubs and grasses used onsite are typical for Virginia and are considered hardy.

A historical evaluation of irrigation practices can not be made. The staff has not traditionally maintained a log of the occasions that they have applied irrigation water. The practice of irrigation is minor at best and subsequently the actual consumption is minor. The best assurance that can be made is that the demand for irrigation water does not exceed 300,000 gallons per month. As such, because the irrigation well is located in a different portion of the aquifer than the primary well, and it is used for a sole beneficial use; withdrawals from this well should be monitored but not regulated in the same manner as well #1.

Proper volume projection for this well can not be accurately determined since there is no withdrawal history available to statistically analyze. The amount of water that could be used can be evaluated by assessing the flow of the system and the typical practice that is used when irrigation is deemed necessary. The well feeds directly to underground hydro-pneumatic tank and then through a pipeline of 36 pop-up spray heads that have a flow rate of 0.10gpm each. The irrigation may take up to one hour (as per interview). At this rate of usage, the facility may use up to 216 gallons of water per day. Irrigation demand would not be required daily and only during the months of April through September. This conservative estimate of irrigation demand is based on the assumption that irrigation is required once every three days between the aforementioned months. This represents a total of 52 days a year or 11,232 gallons per year:

$$52\, {}^{Days}\!/_{yr} * 216\, {}^{gallons}\!/_{day} = 11{,}232\, {}^{gallons}\!/_{year}$$

HISTORICAL JUSTIFICATION

In general terms, the facility uses water much like a single family home. Attached is data and graphical depiction of that to illustrate the relative water use on a monthly and annual basis.

18 years of usage history has been evaluated for this permit application. Average, minimum, and maximum withdrawal volumes have been calculated. Over the last 18 years the facility has averaged a withdrawal of 5,219,800 gallons. The maximum occurred in 1990 with 6,595,300 gallons whereas the minimum occurred in 1994 with 3,882,700 gallons. There does not appear to be a correlation of maximum and minimum volumes throughout the evaluated timeframe.

Effect of Conservation

Over the past six years the facility has made various improvements which do conserve water (some lower flow toilets and faucets). A detailed list of improvements can not be provided as these upgrades are not capital improvements in the operation of the facility and were not considered budgetary items. The usage chart shows a general decline in water consumption. However, a correlation of occupancy and consumption can be made. The maximum occupancy of this facility is 137 beds. Occupancy varies year to year but has averaged 124 beds since 2001. Occupancy since 2001 is reported to be normal and within the 120-130 occupied bed range. The table below illustrates the occupancy to consumption variable:

Year	Occupancy	Consumption
2001	127	5,521,000
2002	121	5,188,000
2003	121	5,270,000
2004	122	4,844,000
2005	124	4,259,000
2006	128	3,745,000
2007	128	3,795,000
AVERAGE	124.43	4,660,285

Although the facility makes conservation efforts, there is still the possibility of utilizing the requested quantity of water if the facility operates at full occupancy. The facility has no limitations in terms of reaching capacity, as such its it possible for the facility to operate at capacity within the next ten years should their services be required. As such, the average consumption above can be extrapolated further to model the demand of a fully occupied facility:

$$\frac{137^{max}_{occupants}}{124^{avg}_{occupants}} * 100\% = 110.5\%$$

$$110.5\% \times 4{,}660{,}285^{avg}_{Gal/yr} = 5{,}149{,}614^{max}_{Gal/yr}$$

As this facility has no current plans to expand its operation, the above calculated volume of 5.149 Million gallons/year is likely the ceiling of withdrawal expected at this site for the next 10 years (for potable use). Therefore the maximum annual volume of water requested is 5.149 million gallons per year (for potable use). The occupancy and operation of this facility is not affected by seasons or any other influences. The most appropriate estimate for a maximum-monthly-withdrawal is one based on the historically recorded maximum withdrawals that have been generated to date. Since 1989 the highest maximum monthly withdrawal experienced was 715,700 gallons (December, 1990). Since 2001 (the beginning of conservation efforts) the maximum monthly withdrawal has been 591,000 gallons (August, 2003). Since conservation efforts have made significant improvements in reducing unnecessary water withdrawal, the recent (Since 2001) maximum of 591,000 is believed to be a sufficient maximum withdrawal.

Shore Life Care is an assisted living facility that provides medical and living care for a specific population. Various government agencies and the local municipality regulate this facility and it operates under different permits issued by those authorities. Considering that the purpose of this facility is to provide care for persons, the "widget" in this case would be a bed; where the bed is a function of the number of persons served per day including associated staff. The number of widgets is therefore necessarily limited by the number of beds (137) and the number of beds is limited by the number of rooms at this facility (which is fixed). This facility is a for-profit organization and will be fully occupied as the market permits. There are no more assurances that the facility will reach full occupancy than there are assurances that occupancy would go below 95 beds, thereby lowering the groundwater demand to less than 300,000-gpm.

Apportionment of Withdrawal to Individual Wells

The permitted yield will be produced from 2 existing wells. These wells will produce all of the water consumed under this permit. Review the following table for more information on apportionment.

[1]APPORTIONMENT OF WITHDRAWALS Schedule	Well #1 UYE 100-00041	Well #2 MYE 100-01086	Totals
January	437,364 Gal	0 Gal	437,364 Gal
February	395,024 Gal	0 Gal	395,024 Gal
March	437,364 Gal	0 Gal	437,364 Gal
April	423,240 Gal	1,872 Gal	425,112 Gal
May	437,364 Gal	1,872 Gal	439,236 Gal
June	423,240 Gal	1,872 Gal	425,112 Gal
July	437,364 Gal	1,872 Gal	439,236 Gal
August	437,364 Gal	1,872 Gal	439,236 Gal
September	423,240 Gal	1,872 Gal	425,112 Gal
October	437,364 Gal	0 Gal	437,364 Gal
November	423,240 Gal	0 Gal	423,240 Gal
December	437,364 Gal	0 Gal	437,364 Gal
Annual Estimated Usage			*5.16 MG*

[1] Estimates of projected maximum water use in gallons. Actual use will vary.
[2] M-PRN = monthly withdrawal pumped as needed.

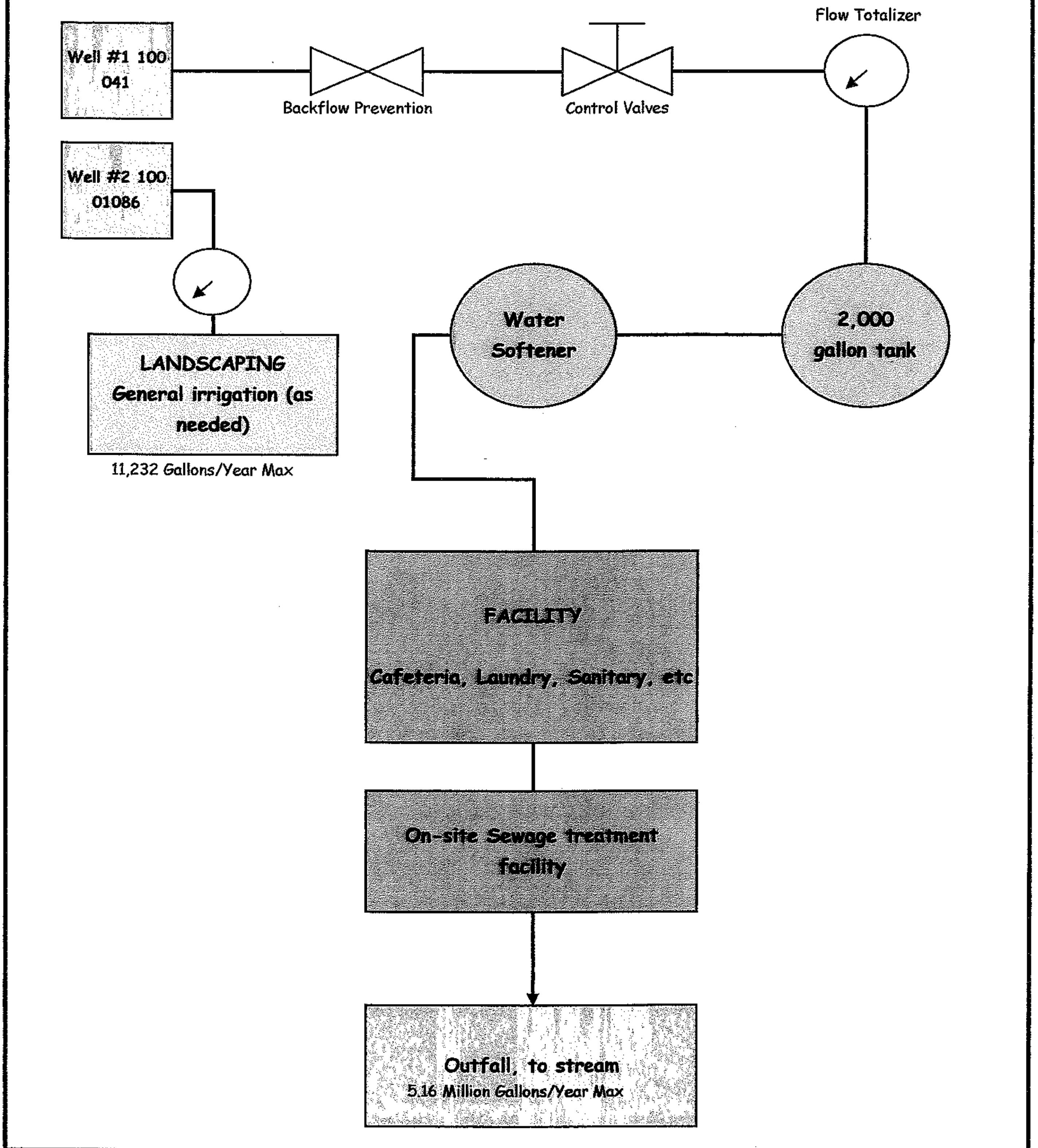


FIGURE 3. Site Schematic	MSA, P.C. ENVIRONMENTAL SCIENCES, PLANNING, SURVEYING ENGINEERING & LANDSCAPE ARCHITECTURE 5033 ROUSE DRIVE VIRGINIA BEACH, VIRGINIA 23462 (757) 490 - 9264 FAX (757) 490 - 0634 www.msaonline.com		
GROUND WATER WITHDRAW PERMIT **SHORE LIFECARE AT PARKSLEY** Parksley, Virginia	DATE: 5/10/2005	SCALE: NTS	MSA JOB #: 05726

WELL #1, WATER USE BY MONTH AND YEAR

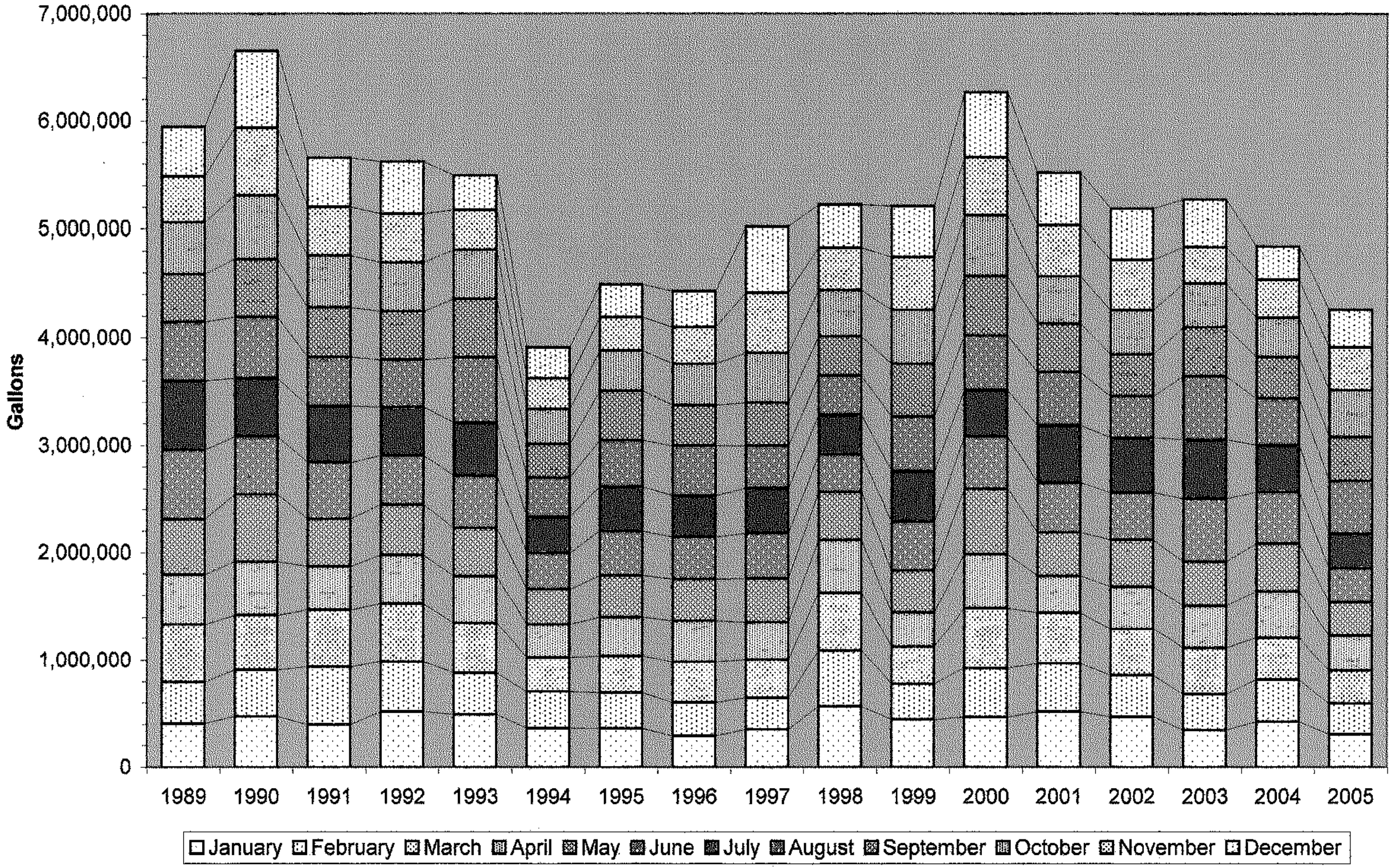
	1989	1990	1991	1992	1993	1994	1995	1996	1997
January	407,029	473,300	395,983	518,000	490,400	362,900	362,200	291,100	351,300
February	389,350	430,800	539,900	467,000	387,700	344,900	334,800	312,300	297,400
March	536,900	512,900	526,200	532,300	468,800	317,300	343,100	379,300	356,800
April	455,300	497,400	405,325	457,400	429,500	307,300	362,400	384,900	348,400
May	521,500	625,600	445,300	472,300	453,000	326,900	378,500	384,600	400,000
June	603,100	486,000	488,000	482,400	461,500	308,200	388,600	360,900	380,100
July	645,700	542,700	526,100	454,900	489,500	335,800	418,000	388,200	424,900
August	543,000	564,100	457,600	438,600	610,400	368,700	428,300	466,300	391,000
Septembe	440,663	533,900	456,200	445,800	538,000	311,600	462,800	376,800	400,200
October	470,400	582,900	479,700	449,100	454,600	325,400	372,400	385,400	465,100
November	430,600	630,000	443,300	444,800	362,400	285,700	307,700	340,200	554,800
December	459,900	715,700	454,900	487,600	320,400	288,000	300,700	332,200	602,700
Total	5,903,441	6,595,300	5,618,508	5,650,200	5,466,200	3,882,700	4,459,500	4,402,200	4,972,700

	1998	1999	2000	2001	2002	2003	2004	2005
January	564,300	445,000	465,000	515,000	468,000	345,000	422,000	305,000
February	528,600	335,000	456,000	451,000	387,000	337,000	396,000	289,000
March	533,900	345,000	555,000	470,000	432,000	432,000	384,000	307,000
April	485,000	317,000	508,000	341,000	396,000	384,000	435,000	324,000
May	452,000	384,000	614,000	407,000	432,000	416,000	445,000	309,000
June	348,000	460,000	481,000	470,000	443,000	581,000	479,000	315,000
July	371,000	473,000	435,000	530,000	511,000	555,000	441,000	323,000
August	363,000	508,000	506,000	496,000	386,000	591,000	432,000	498,000
Septembe	368,000	490,000	545,000	452,000	391,000	456,000	388,000	407,000
October	424,000	499,000	558,000	432,000	408,000	401,000	363,000	438,000
November	393,000	486,000	541,000	466,000	464,000	339,000	348,000	396,000
December	393,000	467,000	600,000	491,000	470,000	433,000	311,000	348,000
Total	5,223,800	5,209,000	6,264,000	5,521,000	5,188,000	5,270,000	4,844,000	4,259,000

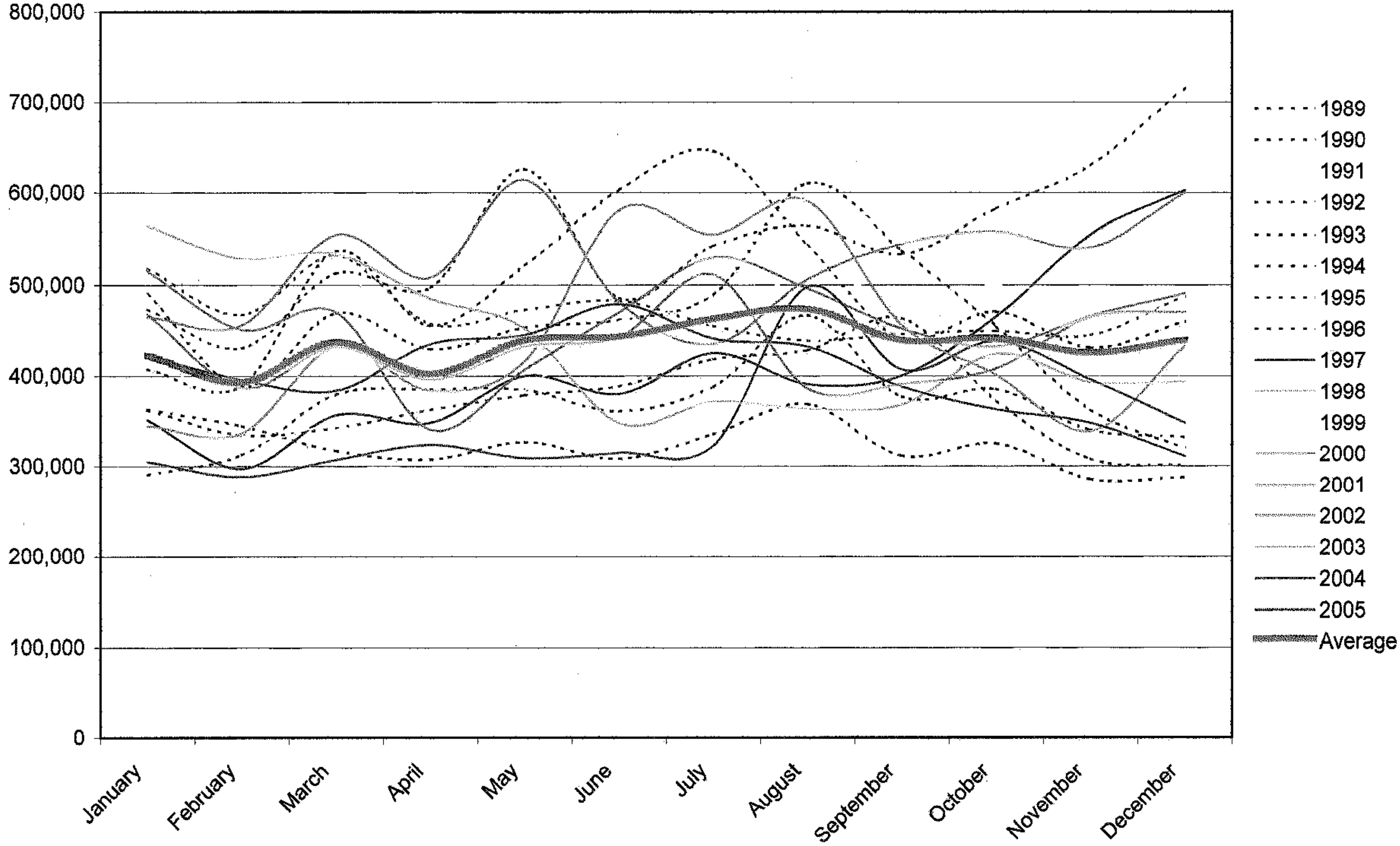
Cells marked in are averaged due to no data availability

	Average	%AVG Total	Max Year	Minimum	Maxium	Apportionment
January	422,442	8.09%	1998	291,100	564,300	534,185
February	393,162	7.53%	1991	289,000	539,900	497,160
March	437,206	8.38%	2000	307,000	555,000	552,854
April	402,231	7.71%	2000	307,300	508,000	508,628
May	439,218	8.42%	1990	309,000	625,600	555,398
June	443,282	8.49%	1989	308,200	603,100	560,538
July	462,635	8.86%	1989	323,000	645,700	585,010
August	473,412	9.07%	1993	363,000	610,400	598,637
Septembe	438,998	8.41%	2000	311,600	545,000	555,120
October	441,647	8.46%	1990	325,400	582,900	558,470
November	425,441	8.15%	1990	285,700	630,000	537,977
December	439,712	8.42%	1990	288,000	715,700	556,023
TOTAL	5,219,385	100.00%		3,708,300	7,125,600	6,600,000

Annual Withdrawal per Month



Usage by Month and Year



GROUNDWATER CONSERVATION AND MANAGEMENT PLAN

SHORE LIFECARE AT PARKSLEY
26181 PARKSLEY ROAD
PARKSLEY, ACCOMACK COUNTY VIRGINIA

ACCOMACK, VIRGINIA

FEBRUARY, 2006

Table of Contents

1.0 GENERAL INFORMATION

The Shore Lifecare at Parksley facility, herein referred to as the "facility", is a retirement home within the town limits of Parksley, Accomack, Virginia. The facility provides fulltime care for approximately 130 residents on an annual basis. Roughly 95-percent of the water is used for sustaining the welfare of the permanent residents.

Normal operation of the facility requires consumption of a virtually fixed amount of groundwater from one well located on the facilities property. Because this property is located within the Eastern Virginia Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the facility and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide the Shore Lifecare management, who is responsible for the operation and policy management decisions of the facility. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a

plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provide guidance to implement water management and conservation measures.

2.0 WATER DEMAND

Water demand at this facility is for a variety of purposes. This use includes, but is not limited to, water used for cooking, bathing, laundry, therapy and cleaning, and other assorted domestic purposes. There is very limited opportunity to conserve water wherever it is used and can be managed.

The majority of water that is withdrawn at the facility is potable usage water. The facility maintains an on-site staff that utilizes water for sanitary and domestic needs. Sanitary waste and domestic usage waste is generated and consequently handled by an on-site treatment plant. The facility utilizes an extended aeration treatment works under VPDES permit # VA0063606.

The facility does not engage in any routine irrigation practices; however, there is some occasional use of water for irrigation. The water usage is not Gaussian distributed as the water demand is constant from month to month. There has been little variation in water use since recordkeeping begun.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the facility. As there is no municipal supply pipeline from the County of Accomack, drinking water as well as general-use water is directly withdrawn at the facility. Due to the nature of water usage, almost all water is used for potable purposes. There is one well (Well #1, 100-41) located within the complex that currently supplies adequate quality and quantity of groundwater. A second well (Well #2, 100-1086) is located in a lower portion of the aquifer.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the relative geographic proximity of the facility. Although this region receives approximately 42 inches of precipitation per year, the facility is not large enough to be able to support a precipitation collection system and cistern storage system that could supply the required volume and rate of fresh water during normal operations. During periods of peak demand, surface water resources are not reliable as a result of high rates of evapotranspiration and low inputs from precipitation.

Groundwater has been used for several decades without problems with quality or availability. Thus, deep-groundwater is the more reliable source of quality water – being buffered by slow recharge through downward infiltration and possibly upward seepage.

4.0 WATER CONSERVATION MEASURES

The following conservation efforts are already implemented. Due to the type of facility and the nature of service it provides water consumption at this facility is typically regulated by routine tasks and machines that perform those tasks (washing machines, dishwashers, whirlpool therapy baths, etc.). Despite the fact that this facility must adhere to health standards mandated The Virginia Department of Health by all requirements set by 12 VAC 5-421, the DEQ has requested a detailed accounting of usage endpoints where potable water is consumed/used. The following conservation measures have been taken:

- No unnecessary withdrawal of groundwater will be allowed. Water that is used for a non-routine tasks that are not emergencies must be approved by the water works manager.
- Facility management periodically reviews water use and implements changes where possible and practical to better manage water use and increase water conservation.
- In accordance with the Unified Statewide Building Code, all permanent plumbing fixtures are either already the water-conserving type (i.e. low-flow fixtures, 1.6-gpf toilets, flow restrictors, etc) or they will installed/retrofitted as identified in accordance with Unified Statewide Building Code recommendations.
- The facility has occasionally used water for irrigation purposes. However, the facility has not used the irrigation well at any time over the past five years due to the facilities choice to plant with native/hardy species turf and shrub. Irrigation water, when used to ensure the survivability of the shrubs and grasses, (which are restricted to flower beds and some turf areas) are irrigated with a an engineered system. The system is designed to only irrigate what is needed and no more. Further, irrigation water, if required, will be applied in the evening or a night to decrease the effect of evaporation. Through the continued use of native and hardy species, the facility should have the ability to maintain the current mode of water conservation.
- The facility may occasionally use water for exterior, non-potable applications. This water demand is on an as-needed basis (i.e., emergency clean-up, sanitary clean-up, etc)

as such, water when needed for these purposes is regulated by nozzles or distributed with fixed volume containers such as buckets. Some water is used to assist the sewage treatments plant. This water is regulated by a nozzle and is used as needed only.

- Water for general potable consumption is used by the following tasks:
  - Food preparation / Cafeteria maintenance
  - Sanitary / sewage requirements
  - Laundry
  - Therapy Baths
  - Custodial use

The following usage end points are describes as below:

1. Water used for food preparation and the like is used on a as-needed basis. The Cafeteria/kitchen's largest water usage is primarily regulated by the facilities commercial grade dishwasher. As this dishwasher is automated, it used a fixed amount of water that only consumes what is required. Other clean-up tasks such as food-prep area cleaning and floor cleanup must adhere to Virginia Health Standards. Water used for area-clean will be used as needed. Buckets, sinks or other temporary holding devices are favored over running spigots and taps.
2. Water for sanitation and sewage is used as-needed. Many residents require assistance with Water used for showering/cleaning is also consumed as-needed. Most residents do not have the ability to bathe themselves and often require assistance. During assisted or non-assisted hygiene, running faucets should be prevented during activities that occur daily (face washing, teeth brushing, etc.). Showering of able-bodied residents should be monitored in a discrete manner to ensure that showers longer than what is reasonable do not occur.
3. The facility has a laundry operation on-site. This facility regularly washes bed linens, clothing, dining linens, and bathing linens. The washers are modern and efficient. Routine operation requires that wash loads are at maximum capacity to increase the efficiency of consumables and the labor required to process the laundry.

4. Therapy baths are used as needed to aid in the physical therapy of some of the residents. The water used for these basins will be maintained at the minimal levels required for proper operation/sanitation of the basins. Basins that maintain permanent volumes of water shall be maintained according to manufactures specifications.
5. Water that is used for custodial applications is used only as needed. Most water used for custodial tasks are carried in fixed volume containers such as buckets and spray bottles. Custodial applications that require non-fixed volume of water (such as surface spray downs or trash canister washing) will be regulated by a flow restricting device such as a nozzle.

- Although the facility has effective conservation methods in place, the facility will continue to encourage employees to conserve water through the use of regular conversational reminders, or posters or bulletins posted in message areas or bulletin boards. These will be posted on a quarterly basis to remind the staff and the coherent residents that they should be aware of leaking toilets or running faucets. These talking points are addressed in the facilities Conservation and Management Plan Employee Education Program.

- *Water Reuse Evaluation*: Water reuse opportunities, when identified and when feasible, will be implemented. The largest source or reusable water is generated by the facilities water treatment plant. None of the water from this treatment plant could be reused for potable applications. However, some of the treated water could be used for Irrigation if the facility (and DEQ) were to modify the facilities VPDES permit. As this facility houses residents that are considered in guarded/fragile health, it is not feasible to implement or allow treated wastewater as irrigation water as there are many public health concerns. These concerns are addressed in the draft Water Reclamation and Reuse Regulations.

There are limited measures remaining for conservation improvements. The possibilities that remain are primarily restricted to capital expense items such as increased efficiency clothes washing machines and/or dish washing machines. Plumbing improvements can be made as they are needed. If in the event that a toilet, sink tap, or any other flow regulating device needs to be replaced, it will be replaced with a device compliant with the aforementioned Unified Statewide Building Code. The majority of large capital items (such as clothes washers, etc.) are typically repaired when service is required rather than purchasing any new equipment. As such, the facility will continue this action with these devices until a full replacement is warranted. The following improvement actions will take place when they are required:

- Commercial water consuming equipment will be replaced with equipment that is no less efficient than what is currently in place.
- Water conservation efforts will be logged in order to demonstrate and document the conservation efforts that have been made. These logs will be made available to the DEQ upon request.

➢ *5.0 WATER MANAGEMENT MEASURES*

The following management measures will be implemented with regard to the water supply:

➢ Water Loss Reduction:

(a) The facility conducts monthly records review to find excessive usage that may indicate a leak in the system or significant change in operations.

(b) The facility will conduct routine inspection of all above ground water piping systems and storage tanks for any indication of leaks.

(c) The facility will conduct routine observations along underground potable water piping systems for indications of leaks.

(d) Any leak discovered in the potable water storage/supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water.

➢ Mandatory water use restrictions will be implemented during water shortage emergencies declared the local governing body, the Director of DEQ, or the Governor. Non-essential uses of water, such as irrigation will be restricted. In addition, facility personnel will be prohibited from general washing of buildings, paved surfaces, or equipment. The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.

CONSERVATION AND MANAGEMENT PLAN
EMPLOYEE EDUCATION PROGRAM

SHORE LIFECARE AT PARKSLEY
26181 PARKSLEY ROAD
PARKSLEY, ACCOMACK COUNTY VIRGINIA

ACCOMACK, VIRGINIA
OCTOBER, 2007

TRAINING OBJECTIVES:

- Identify the requirement for water conservation.
- Recognize Water Efficiency Improvement Best Management Practices.
- Identify restricted uses
- Practice in water conservation
- Report leaks

Identify the requirement for water conservation.

Shore Lifecare at Parksley is located within the Eastern Shore Groundwater Management Area (GWMA). A region is designated as a GWMA when there is the concern that potential demands on ground water resources may not be sustainable. In compliance with the Ground Water Management Act of 1992 when an individual user of ground water, whether an agricultural, industrial or municipal user, withdraws over 300,000 gallons per month must have a permit to withdrawal water from the Virginia Department of Environmental Quality. Shore Lifecare must maintain and preserve this right to use this resource and is obligated to actively analyze water supply issues and develop a plan for proactive water conservation and management.

The water that is used in production is withdrawn directly from the facilities network of production wells. The water is directed through a series of filters, heaters, tanks, boilers, conditioners or any combination of these processes to a user endpoint. **NOTE:** Water for human consumption may only be withdrawn from wells that have been approved by the Virginia Department of Health.

Recognize Water Efficiency Improvement Best Management Practices

The EPA has identified Water Efficiency Improvement Best Management Practices (BMPs) in ten possible areas. Of these ten areas identified for improvement, four are related to Shore Lifecare's operations. All related BMPs are implemented. These water efficiency BMPs are:

Public Information and Education Programs – Shore Lifecare has a continuing education program to maintain awareness of water conservation. This document is the basis of that program. *Employees are required to attend training sessions and are encouraged to make suggestions that might lead to additional conservation of water resources.*

Distribution System Audits, Leak Detection and Repair – Shore Lifecare conducts monthly records reviews to discover excessive usage that may indicate a leak in the system or significant change in operations. Managers also conduct routine physical inspections of any above ground water piping systems and storage tanks for any indication of leaks. The Facility is obligated to repair any leaks that are discovered immediately. *Employees should report any and all water leaks to the appropriate manager when discovered.*

Toilets, Urinals, and Faucets - Facility management has committed to the use of water saving plumbing, processes and fixtures where appropriate. All new or renovation construction where appropriate will include fixtures and equipment designed to conserve water use.

Miscellaneous High Water-Using Processes - As the majority of the water use is actually automated through the batching computer it is generally accepted that the management already maintains efficient use of water for high-use-processes.

Water Reuse

Due to the nature of this facilities operations, opportunities to reuse water are limited all water used is for potable applications. There are no legally viable options for water reuse at this time.

Additional Water Conservations Measures

This facility currently operates very efficiently. No additional conservation measures are available to the facility at this time. If technologies and public policies are altered in the future, the facility will revisit the feasibility of adopting additional water conservation measures.

Tangier Island

3100-001 / NEW

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: July 14, 2008

WATERWORKS NAME:	Town of Tangier	**WATERWORKS CLASS:**	V
COUNTY/CITY:	Accomack County	**TYPE:**	Community
LOCATION:	The Island of Tangier		
OWNER:	The Town of Tangier Mayor of Tangier P.O. Box 244 Tangier, Virginia 23440 Phone: 757-891-2438		
OPERATOR:	Licensed Class V Operator Required		
PERMIT NUMBER:	3001833		
EFFECTIVE DATE:	July 14, 2008		
TYPE OF TREATMENT:	None		
SOURCE:	4 Wells		
DESIGN CAPACITY:	132,800 gpd		

DESCRIPTION OF THE WATERWORKS

The Town of Tangier Waterworks consists of four (4) active wells, an elevated storage tank and the distribution system.

The four active wells are located along the two mainland areas and discharge directly to the distribution system through four separate entry points. The wells can be controlled by the water elevation in the tank, by timers or by manual operation. The elevated tank controls activate the wells sequentially as needed. The time control calls on the wells in anticipation of demand.

The 168,222 gallon elevated tank floats on the distribution system. The tank is 118 feet in total height with a 28 feet deep bowl. The bottom of the bowl is 90 feet above grade; the overflow elevation is 117.8 feet above grade. The tank is about 32 feet in diameter and supported by four legs. The actual storage capacity of the tank is 167,021 gallons. The tank is equipped with a roof hatch, screened vent, overflow and interior and exterior ladders.

Well No. 4 (also known as South Main Street, Main Ridge-South or Black Dye [West]) was completed in September 1971 (beginning and ending dates unknown). The well bore is 920 feet deep, with an unknown amount of cement grout extending to an unknown depth. The galvanized steel well casing is 4-inch diameter and extends to 176 feet. A galvanized steel casing 2-inches in diameter was installed from 176 feet to 900 feet, extending to 915 feet is a 2-inch brass screen of unknown slot size. It is unknown if there is a gravel pack for the well. The well is equipped with a submersible pump (rated for 49 gpm at 155 TDH) driven by a 3 HP motor. The pump intake is set at 105 feet. The well was last tested in 1989 (duration and dates of test unknown) with a yield of 41 gpm, with the water level dropping from 11 feet (static condition) to 52 feet (dynamic condition). The pump test in 1989 was done with a 50 psi discharge pressure at the surface.

Well No. 7 (also known as North King Street, or Wheatley) was completed in September 1960 (beginning and ending dates unknown). The well bore is 930 feet deep, with an unknown amount of cement grout extending to an unknown depth. The galvanized steel well casing is 4-inch diameter and extends to 100 feet. A galvanized steel casing 2-inches in diameter was installed from 100 feet to 900 feet, extending to 915 feet is a 2-inch brass screen of unknown slot size. It is unknown if there is a gravel pack for the well. The well is equipped with a submersible pump (rated for 45 gpm at 162 TDH) driven by a 3 HP motor. The pump intake is set at 75 feet. The well was last tested in 1989 (duration and dates of test unknown) with a yield of 40 gpm, with the water level dropping from 13 feet (static condition) to 52 feet (dynamic condition). The pump test in 1989 was done with a 50 psi discharge pressure at the surface.

Well No. 10 (also known as North Main Street, or Meat Soup [North]) was completed in 1960 (beginning and ending dates unknown). The well bore is approximately 1,000 feet deep, with an unknown amount of cement grout extending to an unknown depth. The unknown material well casing is 4-inch diameter and extends to 110 feet. An unknown material casing 2-inches in diameter was installed from 110 feet to about 990 feet, extending to 915 feet is a 2-inch unknown material screen of unknown slot size. It is unknown if there is a gravel pack for the well. The well is equipped with a submersible pump (rated for 49 gpm) driven by a 3 HP motor. The pump intake is set at 105 feet. The well was last tested in 1989 (duration and dates of test unknown) with a yield of 44 gpm, with the water level dropping from 14 feet (static condition) to 44 feet (dynamic condition). The pump test in 1989 was done with a 50 psi discharge pressure at the surface.

Well No. 2 (also known as West Ridge North) was drilled in September 1960 to a total depth of 1,033 feet. The well is cased with 4-inch galvanized pipe to a depth of 185 feet at which point it telescopes to two inches from 185 to 1012 feet. Two-inch brass screens are installed between 1012 to 1027 feet. The static water level in 1989 was 13 feet. The well was pumped in 1989 at 41 gpm which produced 38 feet of drawdown. The well electrodes are set at 42 and 105 feet to enable the pump starter to energize and to cut the well off. The well is equipped with a 3 HP submersible pump rated for 49 gpm at 155 TDH. The intake is set at 105 feet.

The water system also has four wells which are currently inactive. They are Wells Nos. 3, 6, 8, and 9. These wells have gone by the names of: West Ridge South (3), New Testament, Black Dye (6), South King Street (8) and Health Center, School, Main Ridge Road, Water Tank, Meat Soup South (9). These wells are not available for production.

Other Permits

The Department of Environmental Quality (DEQ) may develop a Groundwater Withdrawal Permit for this waterworks in the future. Compliance with the conditions and requirements of any DEQ permit shall not limit the authority of the Health Department to assign capacity to the waterworks, based on the following evaluation.

CAPACITY EVALUATION OF THE WATERWORKS

Design Basis: per Waterworks Regulations, one ERC = 400 gpd.

1. Estimated Water Demand: (324 connections)(400 gpd/ERC) = 129,600 gpd

2. Source Capacity:

Well #	Well Yield, gpd = gpm / (0.5 gpm/ERC) * 400 gpd/ERC		Well Pump, gpd = gpm * 1440 min/day		Limiting Capacity, gpd
2	41 gpm	32,800 gpd	49 gpm	70,560 gpd	32,800 gpd
4	41 gpm	32,800 gpd	49 gpm	70,560 gpd	32,800 gpd
7	40 gpm	32,000 gpd	45 gpm	64,800 gpd	32,000 gpd
10	44 gpm	35,200 gpd	49 gpm	70,560 gpd	35,200 gpd
Total	-	-	-	-	132,800 gpd

3. Storage Capacity: 167,021 gal.
167,021 gal. / 200 gal/ERC = 835 ERC
835 ERC * 400 gpd/ERC = 334,000 gpd

Conclusion: This waterworks is limited to a capacity of 132,800 gpd due to limited well yield. This permit does not suspend, minimize, or otherwise alter this owner's obligation to comply with applicable federal, state, or local laws and regulation or permits.

LMA/DWT/ssd

Triangle Enterprises Mobile Home Park

3100-001 / NEW

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT
TRIANGLE MOBILE HOME PARK, MAPPSVILLE – ACCOMACK COUNTY, VA

ATTACHMENT (Section 5)

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Nature of Activity Utilizing Water and Documentation of Beneficial Use

The Triangle Mobile Home Park is located approximately one third of one mile southeast of Mappsville, Virginia and has been in operation since 1978. The property was originally designed for 74 mobile homes and subsequent connections. Throughout the last twenty years, site occupancy has varied from 60 sites to as high as 72 sites; currently the site utilizes 64 sites/connections. Expansion of this facility is not probable; the facility is currently operating near its VDH system design maximum. Any additional connections over the maximum would require the installation of additional storage capacity.

Data Acquisition and Reliability

The data used in this evaluation is based on two key components: known withdrawals and known occupancy during the same period. Withdrawal data collected prior to January 2004 is known to be inaccurate. Data collected for the period between January 2004 and December 2006 has been determined to be reliable (Chart 1). Occupancy data was collected for this same time period. Occupancy data was correlated against withdrawal data to establish a per-person consumption rate. These rates were plotted against the same period to evaluate if any patterns and/or seasonal variability are present (Chart 2).

The preliminary evaluation of the whole three year period was inconclusive with respect to seasonal sensitivity. However, evaluation of just the 2006 data appears to be reliable as relatively level consumption rates and seasonal variation are both observed. Occupancy during 2006 was near the facility maximum. Consumption rates during 2006 were within a reasonable range given the age of the plumbing within each home. The 2006 data is evaluated on the following page.

** Update 3/4/09

Consumption data has been reevaluated for the period of February 2008 through February 2009. This time period was used as these are the months that follow the majority of repairs performed onsite. In January 2009 there was a significant leakage event, the data from this month was omitted from analysis. The consumption rate is now based on a per-connection consumption demand as opposed to per-person consumption demand. The following pages have been edited to reflect this revised method of consumption demand.

Month	Volume, Gallons	Connections	Days	Gallons per Connection per Day
February, '08	476,500	64	29	257
March	449,000	64	31	226
April	477,200	64	30	249
May	511,900	64	31	258
June	562,900	64	30	293
July	610,200	64	31	308
August	517,300	64	31	261
September	511,100	64	30	266
October	444,500	64	31	224
November	423,500	64	30	221
December	411,700	64	31	208
January, '09	716,600	64	31	361*
February	348,600	64	23	237
Averages		64		251

Table 1 February 2008- September 2008 Consumption Rates Per Occupant (see Chart 3). *Data omitted due known numerous leaks and losses.

The Gallons per Person per Day was calculated in excel with the following equation:

$$\frac{\dfrac{VOLUME_{gallons}}{Connections}}{Days} = \frac{gallons}{connection} * day^{-1}$$

On average, the per-connection consumption rate of 251 gallons per connection was determined. Summer months typically display increased usage during the warmer months.

Projected Demand and Withdrawal Request

Currently the facility has 64 active connections. From the table above, the average Connection usage average was 251 gallons per connection per day. The anticipated maximum demand can be calculated by forecasting the maximum site occupancy by the average consumptions rate. This site can only increase to 72 connections due to land limitations. As such, the site is capped with 72 connections. By multiplying the average consumption rate (from table 1) by the maximum connections, a maximum volume anticipated can be established.

The maximum number of connections at this site is 72. Utilizing the data from Table 1 above and the maximum anticipated occupancy of the site, monthly and annual maximums can be calculated.

By utilizing the average rate of consumption calculated in the right column of Table 1 a new table can be made using the calculated maximum occupancy:

Month	Gallons per Connection per Day	Connections	Days	Volume, Gallons
January	251	72	31	560,232
February	251	72	28	506,016
March	251	72	31	560,232
April	251	72	30	542,160
May	251	72	31	560,232
June	251	72	30	542,160
July	251	72	31	560,232
August	251	72	31	560,232
September	251	72	30	542,160
October	251	72	31	560,232
November	251	72	30	542,160
December	251	72	31	560,232
Total			365	6,596,280

Table 2 Consumption Rates at Maximum Occupancy

$$\frac{gallons}{connection} * day^{-1} * DAYS * CONNECTIONS_{total} = VOLUME_{gallons}$$

From Table 2, the anticipated maximum occupancy of 72 sites (per month) would result in a withdrawal demand of 6,596,280 ≈ 6.60 Million Gallons per year is expected. In order to establish a maximum monthly withdrawal, the maximum consumption rate experienced during the highest use month (July) can be extended to accommodate all 72 connections:

$$\frac{610{,}200_{gallons}}{64_{connections}} \div 31^{July}_{days} = 308_{gal/_{connection}} \times 72_{connections} \times 31_{days} = 686{,}475^{month}_{Max\_gallons}$$

This facility requests that that the following withdrawal volumes be permitted:

Annual Maximum Total	**6.60 Million Gallons Per year**
Monthly Maximum Total	**0.69 Million Gallons per month**

Apportionment of Withdrawal to Individual Wells

The apportionment table below depicts the contribution of withdrawal from each well. The percentage of withdrawal from each well is approximately even (50%/50%). Well #3 does withdrawal at a slightly increased rate. To establish the withdrawal contribution of each well, the volumes recorded from February 2008 through February 2009 were evaluated:

Month	Well #3, 100-1104	Well #4, 100-1105	Total
Feb-08 – Feb-09	3,374,600	3,086,400	6,461,000
Percent Withdrawal	**52%**	**48%**	**100%**

The apportionment table below is based on the data generated in Table 2. It does not include the affect of the maximum monthly request or seasonal variability. It is based on the averages generated in table 2 which 'flatten' the seasonal effect.

[1]APPORTIONMENT OF WITHDRAWALS	**Well-#3** (DEQ #100-1104)	**Well-#4** (DEQ #100-1105)	**Total**
January	291,321	268,911	560,232
February	263,128	242,888	506,016
March	291,321	268,911	560,232
April	281,923	260,237	542,160
May	291,321	268,911	560,232
June	281,923	260,237	542,160
July	291,321	268,911	560,232
August	291,321	268,911	560,232
September	281,923	260,237	542,160
October	291,321	268,911	560,232
November	281,923	260,237	542,160
December	291,321	268,911	560,232
Annual Estimated Usage	3,430,066	3,166,214	6,596,280

Chart 1. Monthly Withdrawals 2004-2006

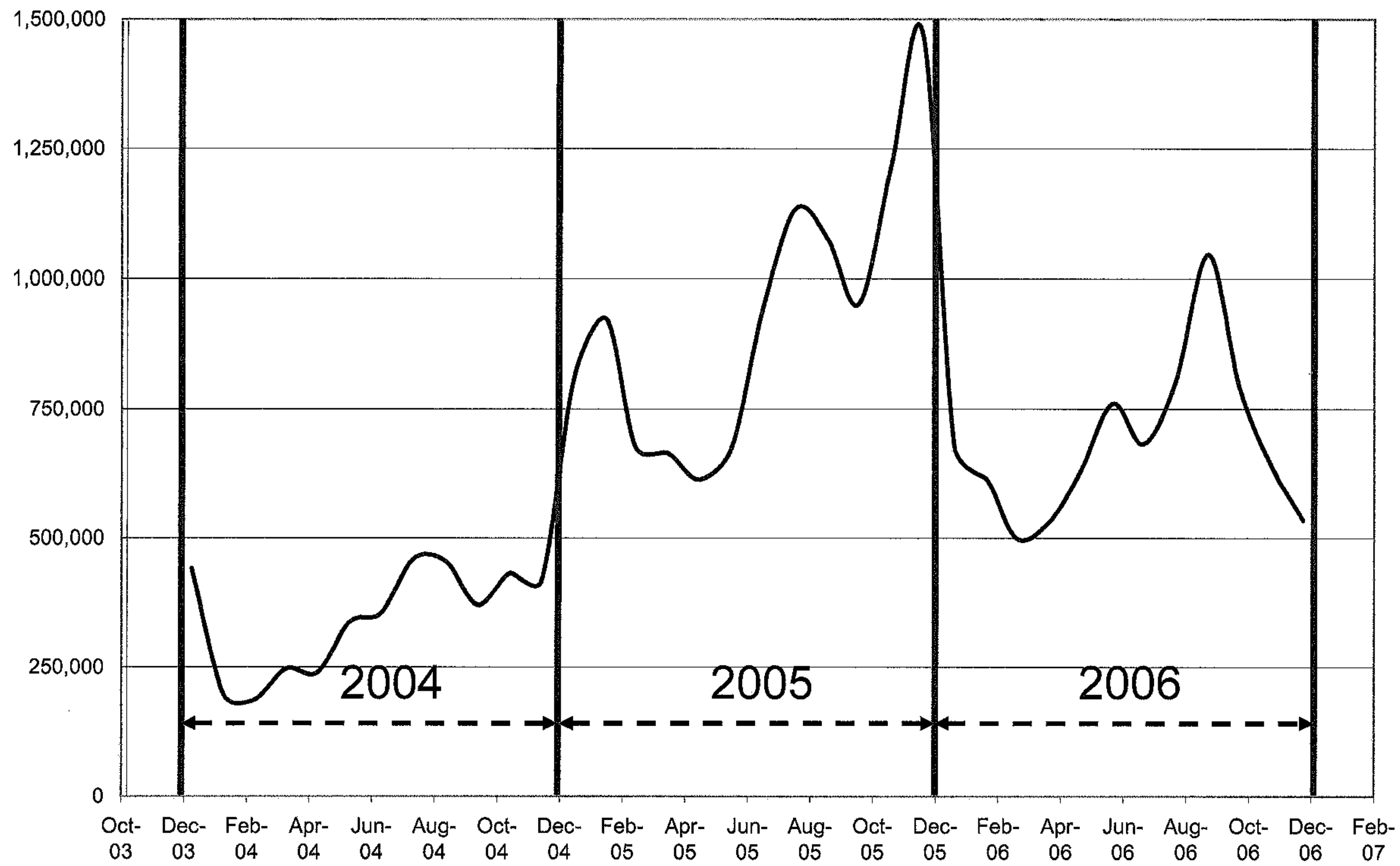


Chart 2. Triangle MHP Consumption Rate Per Occupancy

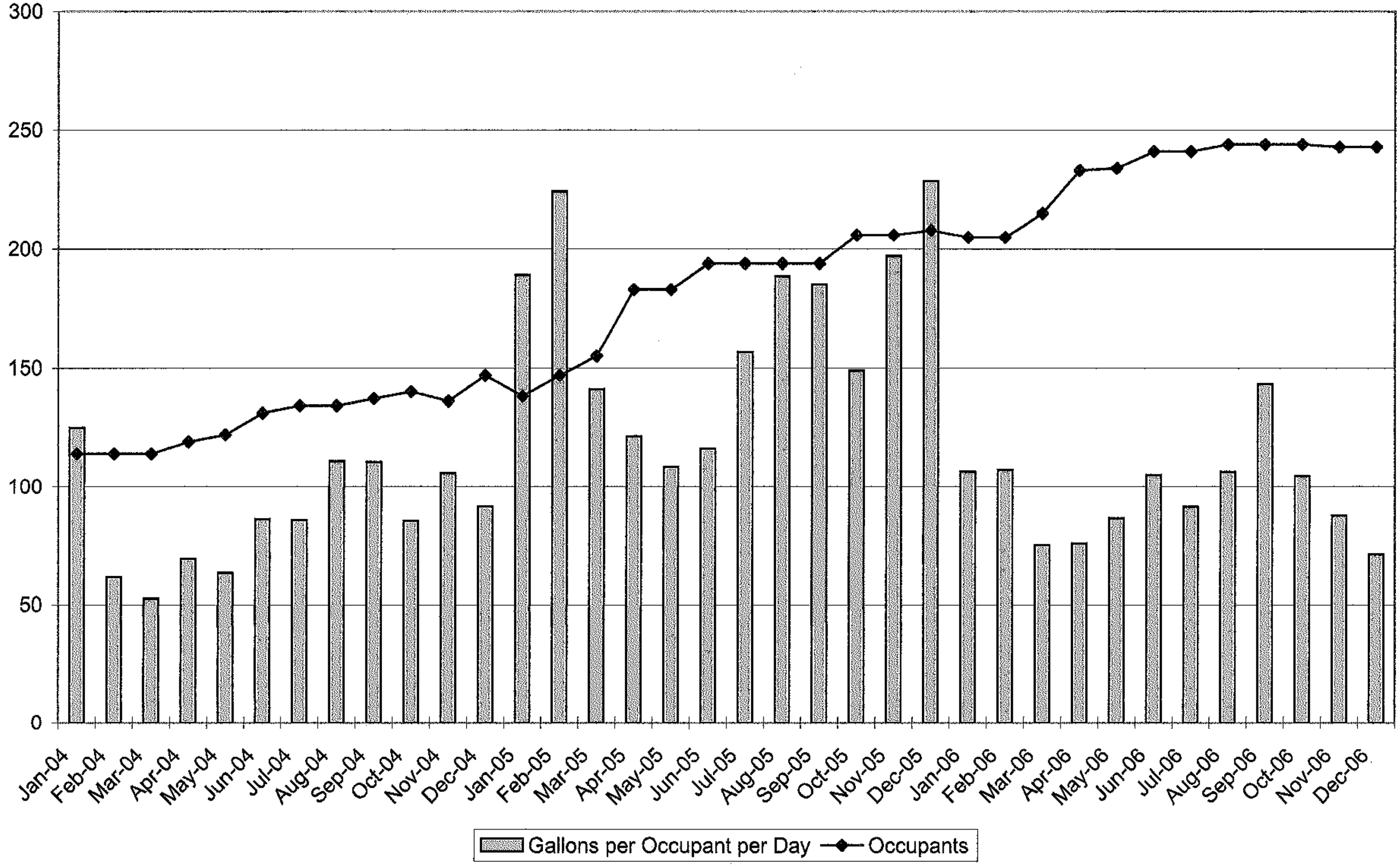
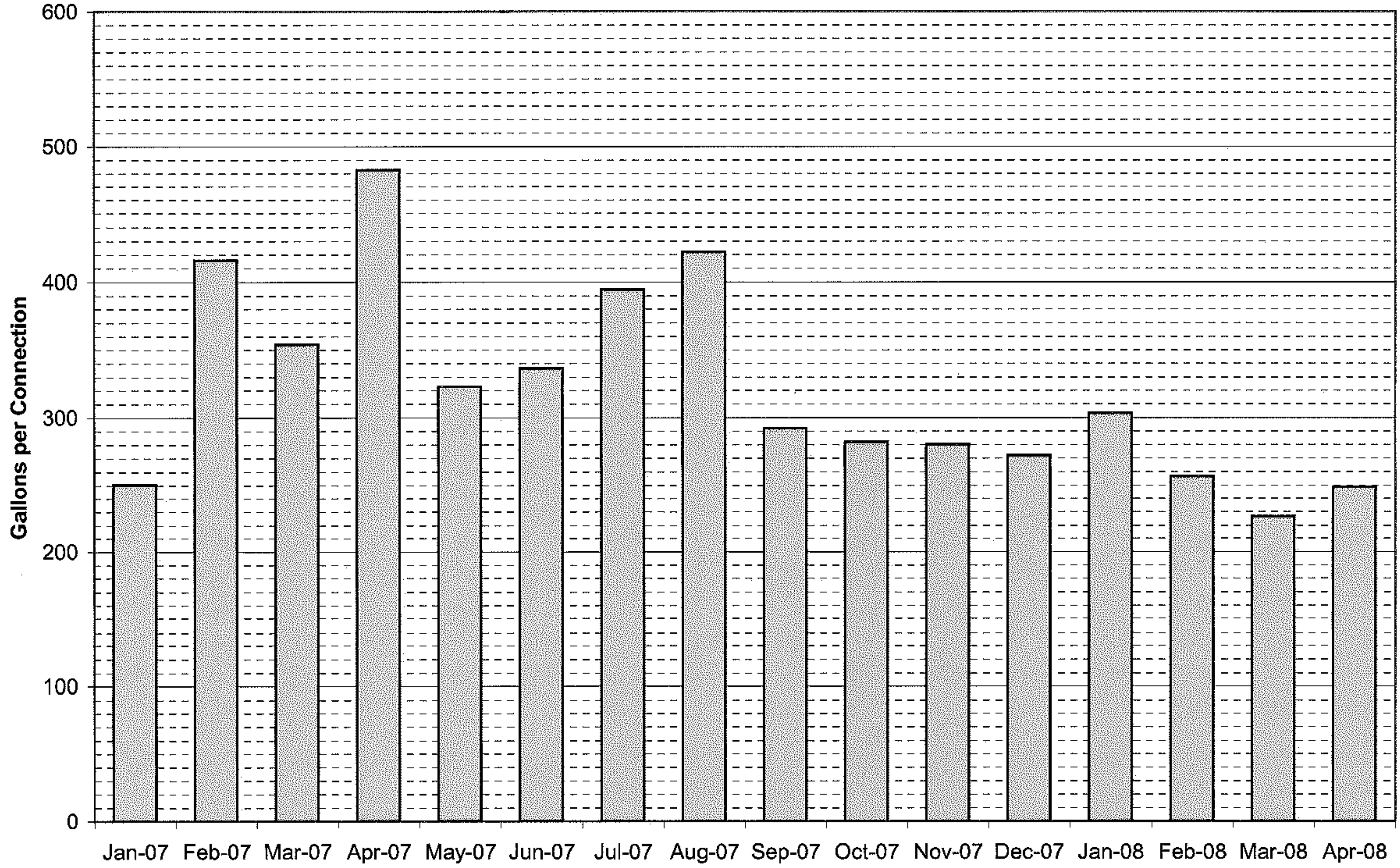


Chart 3. Jan-2007 thru April-2008 Per Connection Consumption Rates



GROUNDWATER CONSERVATION AND MANAGEMENT PLAN

TRIANGLE MOBILE HOME PARK
29304 CHESTER STREET
MAPPSVILLE, ACCOMACK COUNTY VIRGINIA

ACCOMACK, VIRGINIA

JUNE, 2007

Table of Contents

1.0 GENERAL INFORMATION

The Triangle Mobile Home Park (MHP), herein referred to as the "facility", is a mobile home residential community near the town of Mappsville, Accomack, Virginia. The facility provides a full time potable water supply (Community System) to leasees of Triangle Enterprises Inc.

Typical consumption at the facility requires consumption of a virtually fixed amount of groundwater from its two-well system located centrally on the MHP property. Because this property is located within the Eastern Virginia Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the facility and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide the management of Triangle Enterprise Inc., who are responsible for the operation and policy management decisions of the facility. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provide guidance to implement water management and conservation measures.

2.0 WATER DEMAND

Water at this facility is utilized for a variety of purposes. This use includes, but is not limited to, water used for cooking, bathing, laundry, cleaning, and other assorted domestic purposes. Nearly all water that is withdrawn at the facility is for potable use. The facility maintains a full-time water distribution system to support each individual tenant/connection with water for all domestic needs. Sanitary waste and domestic usage waste generated on-site is handled by several permitted septic systems located throughout the property.

The facility does not engage in any routine irrigation practices; however, there may be some occasional use of water for vegetable garden irrigation and/or car washing. Water withdrawal data, that was deemed reliable, was assessed. No patterns had emerged suggesting that the water usage at this facility is evenly distributed; the water demand did not remain constant from month to month during the entire assessed period. However, the change appears to be seasonal in nature with heavier use in the summer and lesser use in the winter.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the facility. As there are no municipal supply pipelines located within the County of Accomack, drinking water, as well as general-use water, is directly withdrawn and distributed at the facility. Due to the nature of water usage, almost all water is used for potable purposes. There are two wells located within the complex that supply adequate quality and quantity of groundwater.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the relative geographic proximity of the facility. Although this region receives approximately 42 inches of precipitation per year, the facility is not large enough to be able to support a precipitation collection system and cistern storage system that could supply the required volume and rate of fresh water during normal operations. During periods of peak demand, surface water resources are not reliable as a result of high rates of evapotranspiration and low inputs from precipitation.

Groundwater has been used for at this location since 1978 without issues regarding quality or quantity. Due to the dynamic nature of the confined aquifer system, groundwater is naturally buffered during recharge to the aquifer. Thus, the regional, confined aquifer's groundwater is the most reliable source of quality water as opposed to any other options (surface water, sea water, etc.).

4.0 WATER CONSERVATION MEASURES

The following conservatory measures will be implemented with regard to the water supply including groundwater from the facilities' wells.

- No unnecessary groundwater withdrawal will be permitted. A bi-lingual notice will be dispatched to each tenant notifying them that the facility is located within the Eastern Shore Ground Water Management Area. This notice will explain the obligation Triangle Mobile Home Park has to obtain and preserve a ground water withdrawal permit with the Virginia Department of Environmental Quality. This notice will also include highlights on how each individual household can assist in water conservation efforts.

- Facility management will regularly review water use and will implement changes when identified:
    - Well readings will be collected once per week to allow for the immediate identification of unusual use and/or leaks.
    - The Management will adopt and maintain an electronic database to record and monitor the well readings collected above.

- Individual metering of each connection may be required if non-normal water use continues after the inception of the initial water conservation campaign which began as of October 1, 2007. These meters would be evaluated monthly in order to identify if each individual connection consumes water greater than the facility average. If such a pattern is identified, the tenant of that connection will be notified that their consumption is non-normal and some form of corrective action may be required.

- In order to comply with the Unified Statewide Building Code, plumbing fixtures that are aged shall be replaced with low-flow fixtures as a condition of renewing each tenants lease. The replacement activity shall be achieved prior to the anniversary of each tenant's one-year lease period if the tenant remains on-site. New tenants shall be required to demonstrate the same. Receipts for goods, services and/or other proof shall be provided to Triangle Enterprises to demonstrate compliance with the condition.

- Some tenants do occasionally use water for irrigation purposes. Watering is typically restricted to private vegetable gardens. In the event of drought, these areas shall not be watered in order to conserve water.

- Encourage tenants to conserve water through the use of regularly posted bulletins and other conversational reminders, posters and/or notices posted in public areas. Each new bulletin will be posted in public spaces and distributed to each unit as they are issued. This will take place no less than on a quarterly basis. These notices began circulation as of October 1, 2007.

- *Water Reuse Evaluation*: All water used at this facility, with the exception of occasionally used irrigation water, can not be reused or recycled.

5.0 WATER MANAGEMENT MEASURES

The following management measures will be implemented with regard to the water supply including groundwater from the facilities' wells.

- Water Loss Reduction:
  - (a) The facility will conduct weekly readings in order to identify excessive flow that may indicate a leak in the system or significant change in consumption.
  - (b) The facility will conduct routine inspection of all above ground water piping systems and storage tanks for any indication of leaks on a weekly basis.
  - (c) The facility will conduct routine visual observations along underground potable water piping systems for indications of leaks at least once per week.
  - (d) Any leak discovered in the potable water storage/supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water.

- Mandatory water use restrictions will be implemented during water shortage emergencies declared the local governing body, the Director of DEQ, or the Governor. Non-essential uses of water, such as irrigation will be restricted. In addition, facility personnel will be prohibited from general washing of buildings, paved surfaces, or equipment. The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.

- Water Conservation: Water conservation efforts as described in section 4.0 of this document shall be followed in order to preserve the resource and right to withdrawal water from the resource.

TRIANGLE MOBILE HOME PARK
TRIANGLE ENTERPRISES, INC

NOTICE OF:

WATER CONSERVATION AND MANAGEMENT REQUIREMENTS

Triangle Mobile Home Park is located in the <u>Eastern Shore Groundwater Management Area</u>. Triangle Enterprise's requires your cooperation to ensure that the facility remains in compliance with State Regulations governing the use of water at this facility. Triangle Enterprises requests that:

1. Water for Car/Trailer washing and swimming pools is not used.
2. Irrigation water for lawns, trees, and gardens is restricted to vegetable gardens only. These gardens may only be watered during the times between sunset and sunrise.
3. If leaking pipes are identified within your home, they are to be repaired/reported immediately to Triangle Enterprises.
4. As of September 21, 2007 tenants of Triangle Mobile Home Park will be required to allow access for routine plumbing inspections to ensure that item 3 (above) is enforced.
5. Plumbing fixtures that do not comply with the Statewide Uniform Building Code must be replaced. This includes replacing old plumbing fixtures with low flow faucets, installation of flow restrictors, and 1.6 gallon per flush toilets.

Tenants who do not abide by the above conditions may have their leases revoked by Triangle Enterprises as non-compliance of any Groundwater Withdrawal Permit regulation and/or Permit condition is enforceable by the State of Virginia.

Triangle Enterprises, Inc. (revised 10/1/2007)

TRIANGLE MOBILE HOME PARK
TRIANGLE ENTERPRISES, INC

NOTICIA DE

LOS REGLAMIENTOS SOBRE LA CONSERVACION Y EL MANEJO DE AGUA

Triangle Mobile Home Park esta situado en el Area de la Conservacion de Agua Subterraneo del Eastern Shore. Triangle Enterprises requiere su cooperacion para asegurar que esta facilidad cumple con todas las leyes del estado sobre el uso de agua en esta facilidad.

1. Se prohibe las piletas o piscinas.

2. Se prohibe regar el cesped, los arboles, las flores, o las plantas ornimentales. Se permite regar las huertas de vegetales comestibles—pero solamente durante las horas entre el puesto del sol y la salida del sol.

3. Si se encuentra una perdida de agua en la plomeria o las canarias de su hogar, debera notificar y hacer reparacion inmediatamente.

4. Empezando el 21 de septiembre del 2007, los alquelinos tienen que permitir las inspecciones rutinarias de la plomeria dentro de sus casas para enforzar el articulo numero 3.

5. La plomeria o la caneria que no cumple con los codigos de plomeria del estado ("Statewide Uniform Building Code") sera reparado o replazado, incluyendo la instalacion de grifos de bajo flujo, aereadores en los grifos, y los inodoros (toilets) de bajo flujo de 1.6 galones por uso.

Bajo del Permiso del Uso del Agua Subterraneo, el estado de Virginia exige que Triangle Enterprises enforce estos reglamientos. Triangle Enterprises puede revocar el contrato de cualquier alquelino quien no cumple con estas condiciones.

Triangle Enterprises, Inc.

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE: June 10, 2005

WATERWORKS NAME:	Triangle Enterprises Mobile Home Park	CERTIFIED CLASS: VI
COUNTY/CITY:	Accomack County	TYPE: Community

LOCATION: Triangle Enterprises MHP is located on State Route 769 (Beartown Road) 0.5 miles off the intersection of U.S. Route 13 and State Route 769 south of town of Mappsville, Accomack County, Virginia.

OWNER: Ms. Elaine H. Pettit
P.O. Box 147
22116 Lankford Highway
Tasley, Virginia 23441
Phone: (757)-787-3083

OPERATOR: Mr. Willie Strand
P.O. Box 147
22116 Lankford Highway
Tasley, Virginia 23441
Phone: (757) 787- 4664

PERMIT NO.: 3001887

DATE ISSUED: June 10, 2005

TYPE OF TREATMENT: Chlorination (not required)

SOURCE: Groundwater: Two Wells

DESIGN CAPACITY: 17,400 gpd

DESCRIPTION OF PROJECT

This system consists of two wells, an 8,000 gallon ground storage tank, a 2,000 gallon hydropneumatic tank, booster pumps, hypochlorite feed systems, and HPDE water mains.

Well 2: This well was drilled starting on June 12, 1989, and was completed on June 13, 1989. The well bore is 260 feet deep, with cement and bentonite grout extending from 4 feet to 50 feet. The 4-inch diameter PVC well casing extends to 240 feet, extending to 260 feet with PVC screen (10 slot size). The well is equipped with a submersible pump rated at 28 gpm at 120 feet TDH driven by a 3.0 H.P. motor. The pump intake is set at 150 feet. The well has a tested yield of 40 gpm, over a 24-hour period, with the water level dropping from 30 feet (static condition) to 65 feet (dynamic condition).

Well 3: This well was drilled starting October 30, 2001, and was completed on October 31, 2002. The well bore is 305 feet deep, with cement grout extending from the surface to 60 feet. The schedule 80 PVC well casing is 6 inches in diameter and extends to 275 feet, extending to 30 feet of PVC (10 slot) screen. The well is equipped with a submersible pump rated at 24 gpm at 137 feet TDH, driven by a 1.0 H.P. motor. The pump intake is set at 150 feet. The well has a tested yield of 31 gpm over a 48-hour period (from September 1 to September 3, 2001) with the water level dropping from 46 feet (static condition) to 85 feet (dynamic condition).

Distribution System: The distribution system consists of approximately 3700 L.F. of 4-inch diameter polyethylene water mains.

Hypochlorite Feed Systems: The hypochlorite feed system for each well consists of one 35 gallon graduated solution tank and an LMI chemical metering pump rated at 0.02 gph (0.5 gpd) to 2.0 gph (24 gpd). The development samples for the two wells indicated that disinfection was not required for the given raw water quality. The development samples collected were negative.

EVALUATION OF CAPACITIES

The capacity of the proposed system is evaluated on the basis of Equivalent Residential Connections (ERCs) and Trailer Connections (TC's). An ERC is defined as 400 gallons per day, where as a TC will utilize 300 gallons per day. The capacities are evaluated as follows:

I. Source Capacity

A. Source Yield

Yield:

Well Number	Well Yield* (gpm)	Pump Capacity
Well 2	40	28
Well 3	31	24

*Well 2 was tested at a 40 gpm rate over a 24 hr period. Well 3 was tested at a 31 gpm rate over a 48 hr period.

40 + 31 = 71 gpm
71 gpm / .5 gpm / ERC = 142 ERC

B. Pump Performance: 28 + 24 = 52 gpm
52 gpm * 1440 min/day = 74,880 gallons per day

C. Source Equivalent = 142 ERC * 400 gpd/ERC = 56,800 gallons per day

II. Storage Capacity

A. Effective Storage = 8,000+2,000/3 ≈ 8,700 gallons

B. Storage Capacity = $\frac{\text{8,700 gallons}}{\text{200 gal/ERC}}$ = 43.5 ERCs

C. Storage Equivalent = 43.5 * 400 gpd/ERC = 17,400 gallons per day

III. Booster Pump Capacity

A. Combined capacity of both pumps = 150 gpm = $11.4\ (N)^{0.544}$

B. Booster Capacity (N)= 114 ERCs

C. Capacity Equivalent = 114 * 400 gpd/ERC = 45,600 gallons per day

IV. Limiting Case

Storage Capacity = 17,400 GPD
Capacity Equivalent = 17,400 GPD / 300 gpd / TC = 58 TCs

Based on the calculation above, this waterworks is limited to a capacity of 17,400 gpd, or 58 trailer connections, based on storage limitations. It is stressed that the flow restriction is the limiting factor, and that the permitted number of trailer connections is only an indicator of when the flow restriction will be reached, as determined by Health Department engineers.

LARGE NON-AGRICULTURAL SELF-SUPPLIED WATER USERS

3100-001 / NEW

Commonwealth Chesapeake Power Station

MALCOLM PIRNIE

3100-001 / NEW

ATTACHMENT FOR APPLICATION ITEM NO. 5
JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Part 5.A—Briefly describe the nature of the activity and the proposed beneficial use of ground water.

The Commonwealth Chesapeake Power Station (CCPS) is a nominal 312-megawatt (MW), simple-cycle, oil-fired, combustion turbine (CT) electric generating facility using technologically advanced, high efficiency General Electric (GE) LM6000 turbines. The facility is currently under construction on an approximately 120-acre site located in the southern portion of the Delmarva Peninsula in Accomack County, Virginia. The plant will be interconnected to the regional electric transmission grid through a 138-kilovolt (kV) transmission line that is adjacent to the site. CCPS is a peaking power plant, which means that the facility will be operated on an intermittent basis primarily during periods of peak electricity demands and/or when available generating capacity in the region is insufficient to meet electricity needs. Normally, in the region, peak electricity demands occur in the summer months; however, intermittent shortages of electricity could occur at any time over a yearly period. Therefore, CCPS could be intermittently operated at any time during the year to meet electric capacity shortages such as occurred in the region during the summer of 1999. The facility provides benefits to the public by assisting in preventing electric *brown-outs* or *black-outs* in the region. In addition, on August 5, 1998 the Virginia State Corporation Commission issued a "Certificate of Public Necessity and Convenience" for the CCPS and associated facilities.

Based on the need to meet peak power demands, CCPS may intermittently be operated up to a maximum of 2,000 hours per year. The air construction and operation permits from the Virginia Department of Environmental Quality (VDEQ) limits the hours of operation to 2,000 hours per year, assuming the plant is operating at full load capacity. On a monthly basis, CCPS may be intermittently operated up to 350 hours at full load capacity. Since peak power demands fluctuate on a daily (i.e., by the hour of the day) and weekly (i.e., by week or days of the week) basis, CCPS will probably not operate on a continuous basis at full load over a monthly period; however, the timing of plant operations must provide flexibility to operate at any time up to 350 hours per month and up to a total of 2,000 hours per year to meet electric power needs.

Therefore, the ground water withdrawal amounts requested in this application (i.e., a maximum of 61.4 million gallons per year and a maximum of 10.8 million gallons per month) from the water table Columbia aquifer are needed and beneficial to support the CCPS operations for up to 2,000 hours per year and 350 hours per month, respectively. A minimal amount of ground water (i.e., approximately 490 gallons per day) will be withdrawn from the Upper Yorktown (upper confined) aquifer to supply potable/sanitary water for the CCPS operations.

Part 5.B—Documentation of beneficial use

Simple-cycle, combustion turbine generator (CTG) technology is the most energy-efficient, cost-effective means available to provide peaking electric generating capacity. Simple-cycle CTGs can be started and shut down very quickly to meet changing levels of power demands on a daily or even hourly basis. Also, at a facility with multiple CTGs such as CCPS, the CTGs can be individually operated to efficiently meet fluctuating demands.

The CCPS facility will consist of seven GE LM6000 CTGs and associated equipment and facilities required for plant operations and maintenance. The plant will be constructed in two phases. Phase I construction began in January 2000 and consists of installing three CTGs with a commercial operation date in July 2000 to meet summer peak power demands. Phase II will consist of installing the remaining four CTGs with commercial operation to meet summer 2001 peak demands.

Water is required for the operation and maintenance of commercial power plant facilities. The simple-cycle, CTG technology, which will be used at the CCPS, requires the least amount of water per MW output compared to other generating technologies such as combined-cycle and steam turbine. Also, the specific uses of water within the facility require differing qualities of water (i.e., from very high quality to lower quality) to provide for efficient operations and prevent damage to the equipment. CCPS has been designed, has selected specific equipment, and will be operated in such a manner as to minimize the amount of water consumed by maximizing the recycling, reuse, and conservation of all plant water supply and wastewater streams. This results in the plant being a *zero wastewater discharge* facility, which also minimizes potential environmental impacts. Further, the facility will utilize the lowest quality of water source available (i.e., the water table Columbia aquifer) to conserve higher quality water resources in the site area (i.e., Upper Yorktown aquifer). Utilization of this lower quality water source results in the requirement for a more costly water supply treatment (i.e., demineralization) unit to meet the very high quality water needs for certain plant operations.

The beneficial use of ground withdrawals from the Columbia aquifer requested in this permit application is needed for the operation and maintenance of the CCPS. As shown in the water flow balance diagram in Chart 1, this water will be used for four purposes:

- Nitrogen oxide (NO_x) air emissions control injection water.
- Cooling tower makeup water in conjunction with refrigerant chillers.
- Miscellaneous building and plant uses water.
- Firefighting protection water (one time volume and then only if necessary).

The following briefly describes the need for these water uses, the equipment selected to minimize water use, and water recycling/reuse/conservation measures to be used for the CCPS operations to minimize ground water withdrawals and potential environmental impacts.

First, thermal processes associated with the combustion of fuel oil in the CTGs produce NO_x in the air emissions from the facility exhaust stacks. The concentration of these NO_x emissions in exhaust air can be controlled by lowering the temperature of the combustion process. Therefore, during CTG operation, water is injected into the turbine combustion chamber to lower flame temperatures, which, in turn, reduces NO_x emissions. The amount of water injected must be carefully controlled so the flame temperature is not lowered too much, which would adversely affect the fuel combustion process. All of the water injected into the combustion chamber is vaporized and is exhausted into the atmosphere. This injection use of water is needed to meet NO_x air emission concentration limits required by the VDEQ air permits for the CCPS facility to minimize potential environmental impacts.

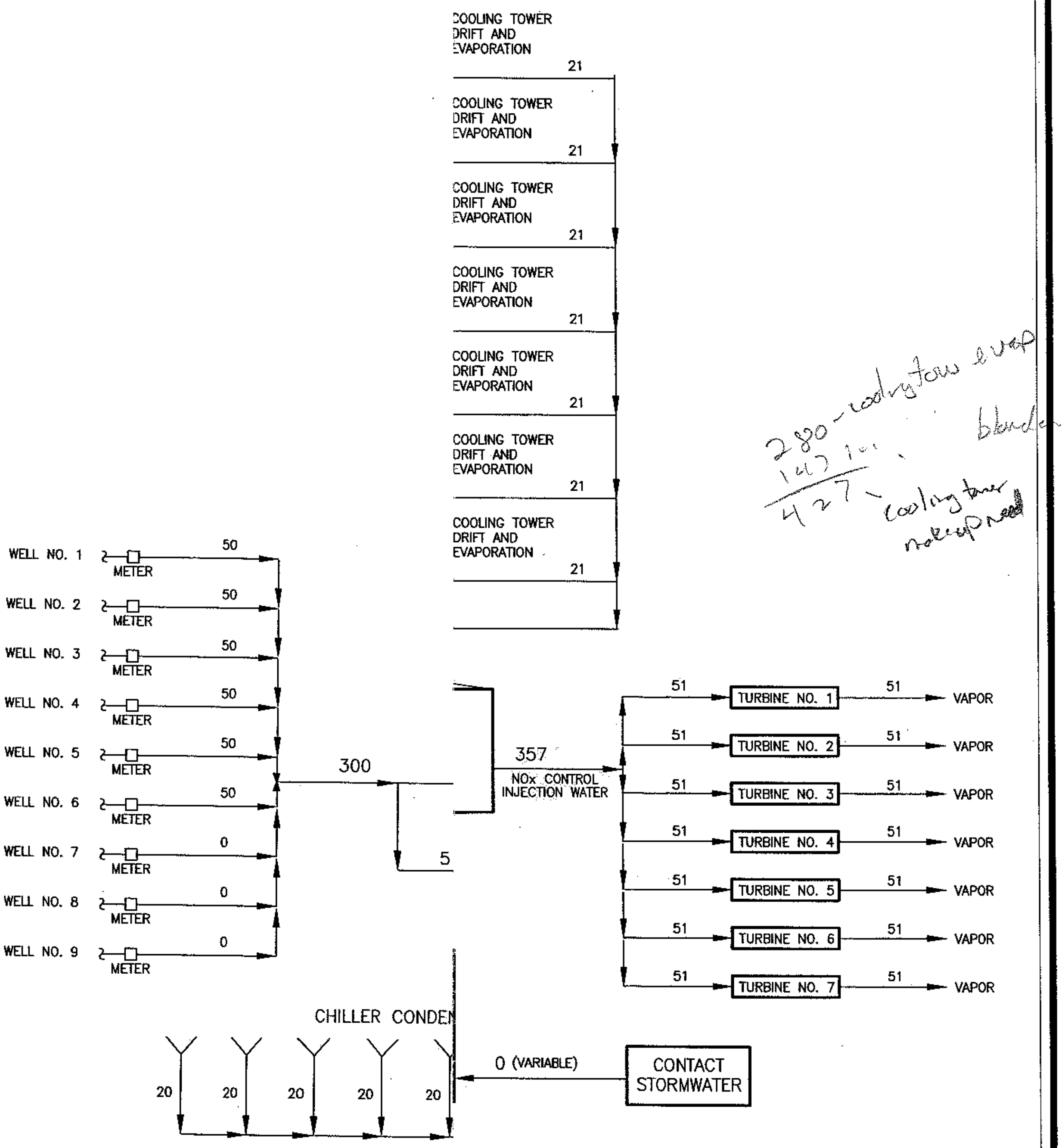
The water used for NO_x emission control must be of very high quality to prevent damage as it passes through the CTG equipment. The quality of the ground water to be withdrawn from the

Columbia aquifer is significantly lower than the requirements for NO_x emission control uses. Therefore, the portion of the ground water used for this purpose will be treated onsite in a potable demineralization water treatment unit(s) and stored in a 750,000-gallon tank. The treatment unit(s) will be periodically transported offsite for regeneration at appropriately permitted facilities, which avoids potential environmental impacts at the site.

As shown in Chart 1, each CTG requires approximately 51 gallons per minute (gpm) for NO_x control injection water or the total of approximately 357 gpm when all seven CTGs are operating.

Similar to other power plants, CCPS will require water for cooling purposes to control the temperature of certain equipment and improve the efficiency of the plant. Again, the simple-cycle CTG technology uses the least amount of water for cooling compared to other available technologies. CCPS will use closed-loop chillers and mechanical draft cooling towers for cooling purposes. Use of the chillers provides 68-degree Fahrenheit (°F) water for cooling equipment. The cooling towers provide the system for the chillers to reject the equipment heat. The planned equipment cooling system minimizes the amount of water needed for cooling purposes compared to other systems such as once-through cooling. In a cooling tower system, circulating water is used as the heat exchange medium to remove heat from the chiller closed-loop fluid. Heat in the circulating water is rejected to the atmosphere in the cooling towers through evaporation. The small portion of water in the circulating water system that is lost through evaporation and drift must be replaced with makeup water.

Since the evaporation process will cause the concentrations of minerals and solids in the circulating water to increase over time, a portion of the water must be removed and replaced by better quality water to maintain the efficiency of the system and prevent equipment damage. The water removed from the system is known as blowdown water, which is replaced by additional makeup water. In many power plant operations, this blowdown water is discharged from the facility, which means the additional makeup water must be obtained from the plant water source. However, as shown in Chart 1, CCPS has been designed to recycle and reuse all of the cooling tower blowdown water, which again minimizes the amount of ground water used by the facility.



NOTE: WATER FLOWS IN GALLONS PER MINUTE (GPM)

CHART 1.

WATER BALANCE - ANNUAL AVERAGE

Source: ECT, 2000; Brown & Root, 2000.

COMMONWEALTH CHESAPEAKE POWER STATION

357 gpm turbines
140 gpm net cooling
15 misc
512 * 2000 * 40 = 61.4 mil gallons

Another water conservation measure for the CCPS is the use of refrigerant chillers for cooling the inlet air to the CTGs. Cooling of the inlet air improves the efficiency (i.e., heat rate) of the CTGs, which lessens both the amount of fuel oil and, in turn, the amount of water used in generating a MW of electricity. The use of chillers minimizes water use compared to other inlet air cooling methods such as evaporative coolers that are less expensive but use significantly more water. Further, the use of chillers actually produces water in the form of condensate from the chilled air. This condensate water is collected and used in the plant water system to minimize ground water withdrawals.

427
-147
-140
140

As shown in Chart 1, approximately 61 gpm per CTG or a total of 427 gpm for all seven CTGs of makeup water is required for the cooling tower system to replace water lost through evaporation, drift, and blowdown water. The blowdown water of approximately 21 gpm per CTG or a total of 147 gpm for all seven CTGs is totally recycled and reused in the plant water systems. Further, approximately 20 gpm per CTG or a total of 140 gpm for all seven CTGs of water is produced as condensate in the inlet air chillers and is used in the plant water systems. Therefore, on a net basis, the plant cooling systems only consume approximately 20 gpm per CTG or 140 gpm for all seven CTGs by maximizing the recovery, recycling, and reuse of water to minimize ground water use.

As shown in Chart 1, the plant operations will require small amounts of water for use in plant buildings and other miscellaneous uses, such as equipment and facility cleaning and washes. These uses will only be intermittent or periodic and are estimated to require approximately 15 gpm of water on an annual average basis. During plant operations, these miscellaneous water uses will be carefully managed and scheduled to minimize water use.

Two other water conservation measures incorporated in the design of the CCPS involve the fire protection water tank and the management of runoff and drainage water from areas associated with industrial activities. As shown in Chart 1, ground water withdrawn from the onsite wells will be routed through the 300,000-gallon fire water tank prior to being supplied to the raw water tank. By this design, water in the fire water tank will be continually circulated during plant operations so that water of acceptable quality is maintained in the tank. This design eliminates the need to periodically (e.g., every 6 months or yearly) dump and waste the water in the fire water tank, which maximizes water conservation and minimizes ground water use. Further, as shown in Chart 1, contact storm water runoff from areas associated with industrial activities and drainage water from plant drains in equipment areas will be routed to an oily water separator for appropriate treatment and then recycled and used in the overall plant water system. The specific amount of water that may be collected, treated, and used in the plant water system is difficult to estimate due to the sporadic availability of such water. While this component of water flow is shown as zero in the plant water balance, the effective management and use of this periodically available water will again assist in minimizing ground water use during plant operations.

A final design feature of the CCPS that will assist in minimizing potential environmental impacts associated with ground water withdrawals at the site is the provision of two large water storage tanks: 1.5-million-gallon raw water tank and 750,000-gallon treated water tank. With a combined water storage capacity of 2.25 million gallons, the use of these tanks decreases the required rate at which ground water is withdrawn to supply the plant operations. As shown in Chart 1, the total net water consumption rate for the full plant operations (i.e., all seven CTGs) is 512 gpm. By design, the maximum ground water withdrawal rate is 300 gpm to minimize potential impacts. The difference between the water consumption and supply rates (i.e., 212 gpm) will be made up by using water volume already stored in the tanks. The storage tanks provide sufficient water supply for approximately 7 days of continuous plant operation at full load until the plant operations would need to be shut down to allow time to refill the tanks.

357
140
15
512

where did that come from?

Based on these rates of water consumption and supply, the production wells would need to be operated up to approximately 3,411 hours or 142 days per year at a total withdrawal rate of 300 gpm to supply the maximum annual water requirements of 61.4 million gallons for up to 2,000 hours of full plant operations (i.e., all seven CTGs). On an annual average basis, the ground water withdrawal rate to support up to 2,000 hours of full operation would be approximately 117 gpm. To supply the maximum monthly water requirements of 10.8 million gallons for up to 350 hours of full plant operations, ground water withdrawals at a total rate of 300 gpm would need to occur for up to approximately 600 hours or 25 days per month. The monthly average withdrawal rate to support up to 350 hours of full operations would be approximately 245 gpm.

Based on the net water consumption rate of 512 gpm for full plant operations, the nominal 312-MW plant will use approximately 1.64 gpm of water to produce 1 MW of electricity. One MW of electricity will supply the power needs of approximately 300 households and small businesses.

Ground water will be supplied for the plant operations by withdrawals from nine new wells to be constructed on the site (see Figure 3). During full plant operations, only six wells will be operated with three wells serving as backup. The maximum pumping rate for each well will be 50 gpm or a total of 300 gpm for six wells. Each well will be equipped with a flow meter to document the amount of withdrawals. The well locations have been selected to effectively distribute ground water drawdown within the plant property boundaries and limit offsite drawdowns to minimize potential offsite impacts.

In summary, CCPS represents a beneficial use to the public for the proposed ground water withdrawals requested in this application since the plant will assist in meeting peak electricity demands in the region. The Virginia State Corporation Commission has issued a "Certificate of Public Necessity and Convenience" for the CCPS and associated facilities. CCPS will use the lowest quality of water available in the site area to preserve higher quality ground water resources. The plant has been designed and specific equipment selected to minimize the amount of ground water required for plant operations. For operations, water will be conserved and recycled and reused to the maximum extent possible, and the rate of withdrawal has been minimized. Further, the results of ground water modeling conducted for the project show the requested withdrawals will not adversely impact onsite or offsite ground water levels, availability, or its existing users.

Part 5.C—Water demand projections

The Virginia portion of the Delmarva Peninsula is estimated to have a peak load of approximately 150 MW, with the overall peninsular load projected to be more than 1,000 MW today. In the future, the peninsula's geographic zone is expected to grow at a 1.6-percent annual growth rate, whereas the Virginia portion will advance even faster at a rate of 2 percent per year. Operating at a nominal 312 MW during the summer of 2001, the peaking plant will be able to supply electricity to meet the needs of approximately 94,000 households and small businesses on the Delmarva Peninsula; thus, during periods of operation, it will be generating to cover approximately 30 percent of the region's load.

In addition, CCPS through its production of electricity will assist in sustaining the peninsula's voltage level during periods of peak demand and temperatures, as was experienced last summer. Physically, the power will be produced and consumed on the Delmarva Peninsula, where it is required today and will be critically important as the region continues to grow.

As discussed previously, CCPS water requirements will be supplied from the lowest quality water source (i.e., Columbia aquifer) available in the site vicinity. Use of this source will minimize any potential impacts to the higher quality Upper Yorktown aquifer, which is a primary source of potable and industrial water utilized in the site area. A small amount of water (i.e., 490 gallons per day) will be withdrawn from the Upper Yorktown aquifer for potable/sanitary use by the CCPS operational personnel. This small withdrawal is not included in this application since the use is substantially less than VDEQ's 300,000-gallons-per-month regulatory permitting threshold.

Again, as discussed previously, raw or untreated water will be used in most of the plant water systems, except for injection water used to control NO_x air emissions from the CTGs. The NO_x control injection water must be of very high quality to prevent damage within the CTGs. A portable water demineralization unit(s) will be used onsite to treat water for this high quality use. The demineralization unit will be periodically switched out for regeneration at an approved facility. Thus, no wastewaters from the treatment unit(s) will be discharged at the site.

Part 5.D—Apportionment of withdrawal to individual wells

Because the nature of the CCPS facility is a *peak-demand* operation dependent on the intermittent needs of a second party, there is no predefined schedule for ground water withdrawal from the facility well system. In general, facility operation will occur when demand for electricity is high, which is seasonally and typically during summer periods. Table 1 presents an operational pumping schedule that outlines the general frequency of production well use. Table 2 presents the estimated apportionment of ground water withdrawals from individual production wells for each month in a calendar year, as well as average and maximum projected withdrawals.

The total potential pumping volume for each month is based on a maximum of 350 hours of facility operation for that month and does not necessarily reflect a specific number of operational days or hours of pump operation. The facility is not guaranteed to operate any or all of those hours.

The net rate of water consumption by the facility during 100-percent operation (seven turbines) is 512 gpm. For a given 16-hour period (typical operational duration), the total daily consumption during full operation would be 0.49 million gallons per day (MGD), while, for a full 24-hour period, the daily consumption would be 0.74 MGD during full operation. Process water will be supplied for the plant operations by withdrawals from nine new production wells to be constructed within the site property. The locations of these wells are shown in Figure 3. During full plant operation, only six of these production wells will be operated with the other three wells reserved for backup. The maximum pumping rate for each well will be 50 gpm for a total of 300 gpm from six pumping wells. Each well will be equipped with an inline flow meter to measure the volume of withdrawal. The well locations have been selected to effectively minimize ground water drawdown within the plant property and limit offsite drawdown to 1 foot or less to minimize potential offsite impacts.

To help minimize fuel and water consumption, turbines will be individually activated depending on the level of electricity production required. Production wells will be activated as required to replenish and maintain water volume within the onsite storage system. Production wells P1 through P6 will be utilized simultaneously during most normal operations. However, wells P7, 8, and 9 may be substituted to permit routine well, pipe, or pump maintenance. Activation of production or backup wells may be rotated during a pumping cycle for purposes of managing water table drawdown. When any of the backup wells are used, the deactivated wells/systems will be repaired and reactivated as soon as possible.

When activated, production wells will be pumped at an average rate of 50 gpm. The wells may be deactivated at any time but would likely run until raw water storage volume has recovered to standby levels or until a monthly maximum yield (10.8 million gallons) has been reached. The facility may not withdraw any or all of that maximum potential yield.

WATER CONSERVATION AND MANAGEMENT PLAN

COMMONWEALTH CHESAPEAKE POWER STATION
COMMONWEALTH CHESAPEAKE CO., L.L.C

NEW CHURCH – ACCOMACK COUNTY, VIRGINIA

FEBRUARY 2000
(Revised April 2000)

WATER CONSERVATION AND MANAGEMENT PLAN

1.0 GENERAL INFORMATION

The Commonwealth Chesapeake Power Station (CCPS) is a nominal 312-megawatt (MW), simple-cycle, oil-fired, combustion turbine (CT) electric generating facility. The facility is currently under construction on an approximately 120-acre site located in the southern portion of the Delmarva Peninsula in Accomack County, Virginia. The plant will be interconnected to the regional electric transmission grid through a 138-kilovolt (kV) transmission line that is adjacent to the site. CCPS is a peaking power plant, which means that the facility will be operated on an intermittent basis primarily during periods of peak electricity demands and/or when available generating capacity in the region is insufficient to meet electricity needs. Normally, in the region, peak electricity demands occur in the summer months; however, intermittent shortages of electricity could occur at any time over a yearly period. Therefore, CCPS will be intermittently operated at any time during the year to meet electric capacity shortages such as occurred in the region during the summer of 1999. The facility provides benefits to the public by assisting in preventing electric *brown-outs* or *black-outs* in the region.

Normal operation of CCPS will require production and consumption of variable amounts of groundwater from facility property. Because this property is located within a Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared. The purpose of this document is to analyze water supply and demand issues facing CCPS and to develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide CCPS management in responsible operation and policy management decisions. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provides guidance to implement water conservation measures.

2.0 WATER DEMAND

Water demand for CCPS may be grouped into three separate components, listed in order of decreasing consumptive volume: 1) process water, 2) potable water and, 3) firefighting water. The process water and firefighting water will be withdrawn from the Columbia water table [unconfined] aquifer while the potable water will be withdrawn from the Upper Yorktown [confined aquifer].

The process water includes demineralized [process] water for air emissions control and untreated ground water for equipment cooling and for small miscellaneous plant needs. To control nitrogen oxides (NO_x) emissions and meet the VDEQ air permit requirements, water is injected into the fuel combustion chamber to lower flame temperature, which results in reducing the formation of NO_x. The number of operating turbines will vary depending on the load required from the facility and dictates the consumption rate of treated water. The average consumption rate of process water for NO_x emissions control ranges from 3,060 gph (1-turbine) to 21,420 gph (7-turbines). Equipment cooling is performed through the use of a closed loop mechanical cooling tower and refrigerant chiller system. This system requires makeup water for losses due to evaporation, blow-down, and drift (unevaporated water carried out of a cooling tower by the airflow). The average consumption of water for the cooling system is similarly dependent upon the number of operating turbines and ranges from 2,400 gph (1-turbine) to 16,800 gph (7-turbines). The total maximum monthly consumption of water from the target aquifer is 10.8 million gallons (MG), while the annual total will not exceed 61.4 MG.

Firefighting water requirements are dictated by local fire codes and are independent of facility operation. The volume of firefighting water required to be stored and available onsite is 300,000 gallons. The firefighting water is stored in its' own tank located in series with the Facilities' process water system. This system operates with a flow-through design so that the process water continually flows through the firefighting water storage tank and piping and from that system through the rest of the CCPS water system. This design ensures constant storage of the required volume for firefighting purposes while maintaining good operation of the water storage and piping system without the need for periodic flushing and refilling. Therefore, the need of firefighting water represents only a ***one-time*** withdrawal.

Potable water needs for CCPS operations personnel are minimal and will be produced from a different source than for the process water. A deep well will provide groundwater from the Upper Yorktown [upper confined] aquifer. Potable water will not be stored in a bulk storage tank but will utilize an on-demand pump and well system with pressure tank. The volume of water required is dependent upon the number of personnel and facilities available to them. Normal operation of the CCPS will include two shifts of 7 persons per shift. With the utilization of water saving devices, the projected use of potable water is 35 gal/person. The total projected daily demand for potable water is 490 gpd. This quantity of water represents a *de-minimus* volume as compared to CCPS process water.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the project site. There is no municipal water system or surface water body in the vicinity that could provide process water, firefighting water, or potable water to the CCPS.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the relative geographic proximity of the CCPS. This region receives approximately 42 inches of precipitation per year, thus only surface water and groundwater occur in sufficient quantity or regularity to be economically viable sources for supply. The bulk of annual precipitation falls during wet winter and spring months when the CCPS may operate only light loads resulting in low water demand. Conversely, the summers are usually dry and hot with several weeks of air temperatures in the 90°F range that stress available resources when the CCPS is expected to operate a majority of its' annual load. During periods of anticipated peak demand, surface water resources are not reliable as a result of high rates of evapotranspiration and low inputs from precipitation. Thus, groundwater is the most reliable source – being buffered by slow recharge through downward infiltration and upward seepage.

The Columbia [water table] aquifer is the target aquifer for CCPS supply of process and firefighting water. The Upper Yorktown [upper confined] aquifer is the target aquifer for CCPS supply of potable water. Analytical modeling of the Columbia aquifer revealed that there are sufficient quantities of water available in the target aquifer to meet Plant demand without creating an adverse impact to water levels.

4.0 WATER CONSERVATION MEASURES

There are two general methods of industrial water conservation. *Demand-side management* is the complementary method to the more traditional approach of *supply-side management*.

4.1 Demand-side Management

Demand-side management addresses water conservation through technological as-well-as operational and systematic modifications to control the *demand* for water.

4.1.1 Water Saving Processes and Plumbing

All mechanical equipment and electrical generation devices that use water at the CCPS are new and state-of-the-art with respect to efficiency of water use and consumption. CCPS systems are designed for operation as zero liquid-water discharge facilities that will effectively minimize the amount of water required to perform equivalent operations at similar facilities. System design includes processes and best available technologies that result in the highest practical water use efficiency and include maximum water reuse and recycling.

- Highly water-efficient, simple-cycle, combustion turbine generators – low water consumption
- Closed-loop, mechanical draft, cooling towers – no water discharge; minimal losses
- Treatment & reuse of cooling tower blowdown – no water discharge
- Refrigerant chiller coolers (minimal water use compared with other more common, less expensive coolers such as evaporative coolers) – no water consumption; produce water as condensate for plant use
- Flow-through firefighting water storage tank – no tank flushing/refilling
- Equipment wash water recovery & recycling – no water discharge

- Contact stormwater from equipment areas recovered, treated, & used – no water discharge

- Water-saver water fixtures & plumbing devices – low water consumption

All domestic plumbing fixtures in the CCPS will meet the 1999 BOCA plumbing code [Chapter 29] and American Water Works Association standards for water-efficient plumbing products and low consumption devices.

The CCPS yard landscaping is designed using xeriscaping [water-wise] concepts and systems. Under extreme implementation of that design concept, there will be no irrigation system and no added landscape elements that require irrigation.

Stormwater drainage management includes routing collected non-contact stormwater to a BMP catchment basin. This BMP is a wet pond that allows infiltration of incoming stormwater, which will help to recharge the aquifer during and after precipitation events.

4.1.2 Water Loss Reduction Program

All CCPS systems are designed to reduce water loss and waste. All CCPS equipment and systems that involve water use, reuse, collection, and consumption through water processing, storage, transference, utilization, collection, recycling, and plumbing will be inspected and maintained on a regular basis (i.e., at least monthly). CCPS managers and operators will be instructed to observe water utilizing equipment and systems and, where possible, identify areas where changes in operating procedure, mechanical equipment, or mechanical repair will facilitate water conservation or reduction of water loss. Equipment repair should be completed as soon as possible (i.e., immediately if possible or within 1 week if new equipment must be obtained and installed) to reduce water losses due to damaged and defective components. Applicable equipment and systems should be upgraded with advances in water efficient technologies when and where appropriate.

4.1.3 Water Use Education Program

CCPS personnel will be instructed and receive training on the importance of efficient water use and conservation methods. This instruction and training program will be conducted during orientation activities and should be reinforced through refresher training on appropriate time intervals. Placards and motivational posters that promote water conservation will be posted in CCPS restrooms and other strategic locations.

CCPS managers and operators will be instructed to observe water utilizing equipment and systems and, where possible, identify areas where changes in operating procedure, mechanical equipment, or mechanical repair/upgrades will facilitate water conservation or reduction of water loss.

CCPS managers and operators will be instructed to observe methods, procedures, and policies to evaluate changes that could result in improvement of water use efficiency and reduce water loss or waste.

4.1.3 Evaluation of Potential Water Reuse Options

The typical operation of similar facilities was reviewed during the design process for this facility. This facility was then designed to incorporate all best-available-technology possible regarding water reuse and recycling options in all phases of facility operation. Approximately 201,600-gpd of water will be reclaimed from chiller condensation. An additional 211,680-gpd will be recovered from cooling tower blowdown. Miscellaneous industrial [non-septic] wastewater will be treated through an onsite oil-water separator and transferred back into the raw water tank for reuse.

4.2 *Supply-side Management*

Supply-side management addresses water conservation through design and operation of the water supply system to control or manage supply. These controls typically provide for issues such as water loss through evaporation or seepage from surface water bodies or leakages from piping systems. Regarding a groundwater source, supply-side management focuses on conservation of the water supply itself.

4.2.1 *Supplemental Water Supply*

During the Plant engineering design and review process, potential additional sources of water beyond recycling were explored. A relatively new concept in facility design was incorporated into the Plant equipment to collect condensation from the refrigerant chiller cooling system. The recovery and subsequent use of this water comprises an additional source and supplemental water supply for the Plant. As such, this volume represents a positive (or credit) rate on the water balance rather than an outflow (consumption/loss).

4.2.2 *Unnecessary Withdrawal*

No unnecessary groundwater withdrawal will be permitted. All CCPS systems are designed to prevent unnecessary groundwater withdrawals. The firefighting water will be stored in a tank within the flow-through system so that no tank draining will be required to maintain the tank, valves, and piping in good condition. Therefore, only initial startup volume will be required for firefighting water purposes. For equipment cooling, the mechanical cooling tower and chiller system utilizes a closed-loop system. Turbine intake air is cooled via a chiller system rather than an evaporative cooler. Additionally, there will be no landscape irrigation system.

4.2.3 *Requirements for Mandatory Water Use Reduction*

To protect area potable water supplies, the CCPS will utilize the lowest quality, reasonable water source available (water table aquifer). The CCPS components and systems have all been designed to be as water efficient as possible, thus any additional restrictions on water consumption will significantly affect facility operation.

The facility will strive to comply with mandatory water use reductions during water shortage emergencies as declared by the Director of the VDEQ, while providing for the public need for electricity. Under this condition, the first action taken will provide for cessation of all non-essential uses including non-lavatory wash water, personnel showers, outdoor uses, etc.

The reduction on groundwater withdrawal will be dictated by obligations to meet the public's need for electricity. Pumping rates and or pumping times will be adjusted to meet the water use reductions in balance with the public demand for electricity. Except for the months of July and August, the maximum groundwater withdrawal will decrease by 10% per month. The maximum decrease in groundwater withdrawal will be 20% - from 0.432 MGD to 0.347 MGD. Should a need arise to continue CCPS operations that require additional water consumption, then alternative temporary sources of water will be utilized; e.g., onsite or offsite surface water, tanker trucks, etc.

Once the service obligations are met during a declared emergency, pumping will terminate and storage tanks will not be refilled until equivalent monthly numerical reduction limits have been met or exceeded. If the emergency restrictions continue into the following month, then pumping may either continue at the restricted rate or resume under normal rates until the maximum withdrawal for that month has been reached. If groundwater withdrawal resumes at normal rates during this period, however, then the pumping must cease once that maximum withdrawal has been reached. Groundwater withdrawal may resume again after equivalent monthly numerical reduction limits have been met or exceeded. After imposed water restrictions have been lifted, groundwater pumping may resume at permitted rates.

Eastern Shore Yacht and County Club

3100-001 / NEW

ATTACHMENT 5
WATER NEED JUSTIFICATION

Introduction

The Eastern Shore Yacht and Country Club (The Club) was founded in April 1960 on 125 acres of land on the Yeo Neck that were acquired. The construction of the clubhouse was completed by 1961. The first nine holes of the golf course were completed by September 1961 and the back nine by June 1965. The Club operates a swimming pool with snack bar, clay tennis courts, a dock/marina, clubhouse facilities including lockers, showers, lounge, and dining room. Groundwater has been the primary source of water used for golf course irrigation although initially only the ponds were pumped.

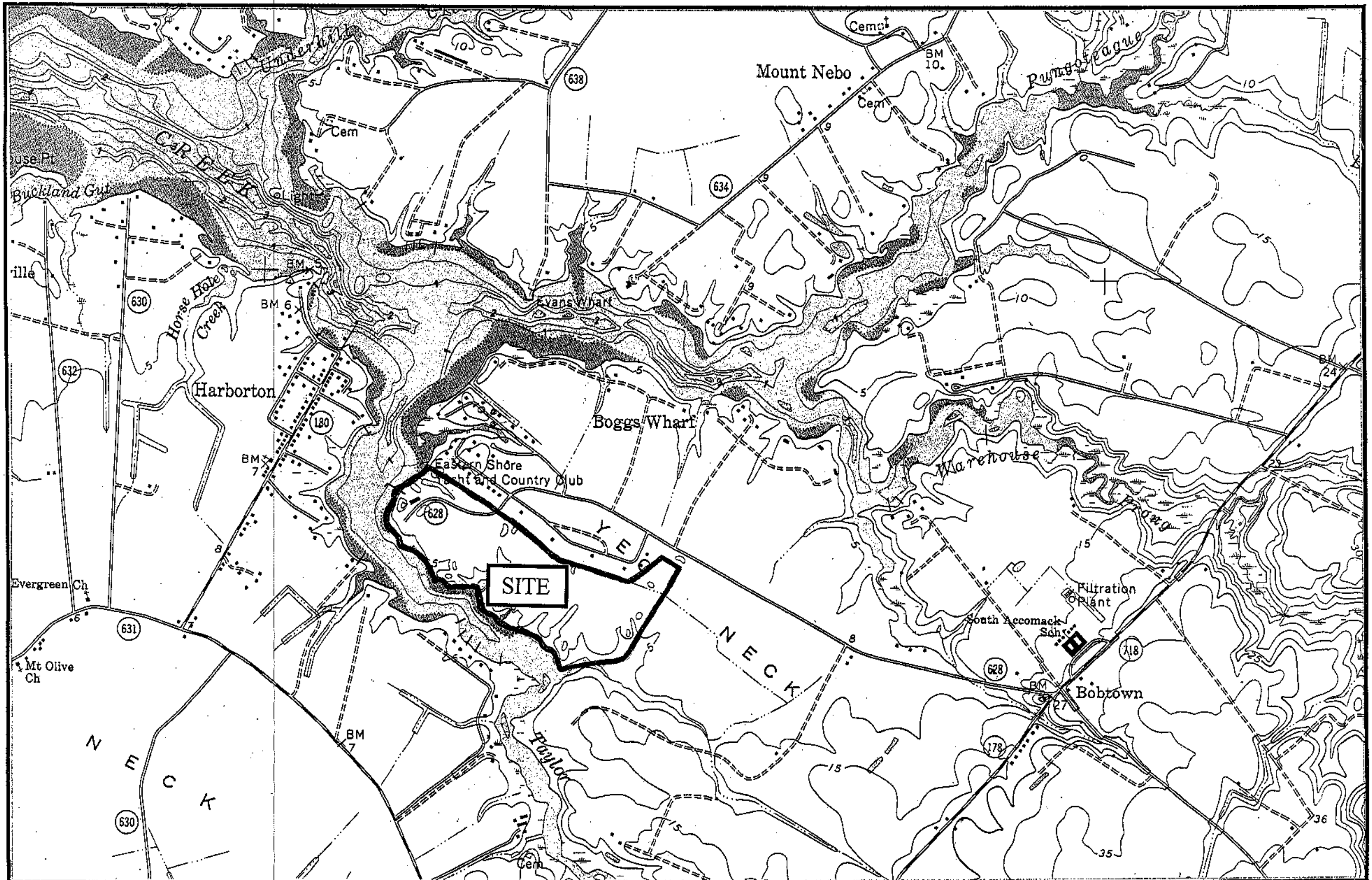
According to Mr. Kevin Dean, Greens Supervisor, he is relatively sure that the galvanized irrigation piping was built with the golf course. This was replaced by PVC in 1988 although watering was still done by hand. In 1999, the system was computerized in order to increase efficiency by allowing greater control over areas to be irrigated at any set time and to allow for closer estimation of the volume of water required at a particular place and time.

Little historical data is available related to pumpage of existing wells. Presently, The Club operates six (6) wells as described in Attachment 8. Although some groundwater is pumped year-round, the variability of the discharge indicates that it should be considered a seasonal withdrawal. Meters were installed on the main wells and the golf course irrigation system during 1999 with completion of the computerized irrigation system. Available data related to gallons pumped per month from 1999 through August 2000 are shown in Table 1.

Water Required-Irrigation

Golf course irrigation water has in the past and is presently pumped from a small pond situated between holes 12 and 17. This pond is one of a chain of six connected ponds that receive some recharge from both surficial stormwater runoff and also from the shallow Watertable Aquifer. It has been reported that during the early history of The Club, irrigation water was pumped solely from the ponds. However, the ponds tended to dry up during dry periods. The Pumphouse #1 Well was constructed to provide some irrigation water during dry periods. This well was pumped to the irrigation pond as late as July and August 1999. At present it is used to prime the irrigation system in the spring and to feed a garden hose that is used on an as need basis.

During 1992, two 6-inch diameter deep wells (12S and 17N) were drilled and constructed by Bundick Well Drilling Company. Both wells discharge to the ponds and are used only for golf course irrigation. The wells have been metered since the Spring of 1999, providing limited historical data during a period of generally normal to above



RKA

SITE LOCATION MAP
EASTERN SHORE YACHT AND COUNTRY CLUB
MELFA, VIRGINIA
(FROM PUNGOTEAGUE, VA QUADRANGLE)

N

FIGURE NO. 1

SCALE
1 IN. = 2,000 FT.

normal precipitation. Thus, they do not reflect golf course irrigation needs during dry conditions.

Review of Palmer Drought Severity Index (PSDI) data calculated for the period 1895 to 1999 for the Tidewater Climate Division indicates that periods of moderate, severe, and extreme drought have occurred and periods of extended drought conditions were identified. The PSDI calculations, however, are based on regional averages, therefore not all "regional" drought periods identified were necessarily periods of drought conditions in the local vicinity of The Club. The precipitation probability table for the Painter 2W reporting weather station was also reviewed for the identified PSDI drought periods. This table lists precipitation by month that if it occurred would be less than or equal to that at the various probabilities. As an example, the 0.50 probability for each month is approximately equal to "normal" precipitation. The 0.20 probability rainfall was then selected as a reasonable estimate of rainfall drought conditions that would require significant additional turf maintenance irrigation. The 0.20 probability rainfall represents <u>approximately</u> a 0.40 probability level for <u>below normal rainfall</u>.

Using the evapotranspiration data for the coastal plain/tidewater area that was developed by TORO and used by Smith Turf and Irrigation for The Club irrigation system design, and taking "normal" precipitation into account, water need deficits occurred in 5 months (May-September) as shown in Table 2. Evaluation of PSDI data indicates that nine extended relatively dry periods have occurred since 1925. Comparison of the 0.20 probability precipitation with actual precipitation data from the Fort Monroe/Norfolk Composite for the period 1925 through 1955 and data from the Painter 2W reporting station from 1956 to present indicates that in approximately 52% of the months during these dry periods, the actual precipitation was lower than the 0.20 probability precipitation or did not exceed it by more than 0.45 inches per month (the approximate 0.30 probability precipitation). Based on this evaluation it appears that the 0.20 probability precipitation provides a reasonable lower bound for the water need requirement during extended dry periods. The 0.20 probability precipitation was used to determine water need for the summer months June, July, and August. The somewhat wetter 0.30 probability was used for April, May, September, and October. The 0.20 to 0.30 probability water deficit by month is also shown for the 80 acre course on Table 2.

Pumpage from Wells 12S and 17 N as shown by available meter readings is often greater than water pumped for irrigation from the ponds. This is due to the facts that:

1. The irrigation pumps are computer controlled while the well pump timers are set individually.

2. The irrigation pumps are controlled at a maximum of 450 gpm but may pump considerably less depending on the area selected for irrigation while

the wells pump approximately 200 gpm for the timed interval selected. Often the timed interval for Well 12S is set shorter because it discharges in close proximity to the pond discharge point to Taylor Creek. Thus, a part of Well 12S pumpage can presently be lost to overflow.

3. The wells are pumped to mix the pond water when chemicals are added to ponds to control algae or other related conditions.

Groundwater volumes requested as part of this permit application are contained in Table 3. The basis for Wells #3 and #4 are The Club management estimates; for Well #1 PH, a combination of metered data and estimates; for Well #2, limited metered data; and for Wells 12S and 17N, calculated drought condition irrigation volumes only (no additional pumpage was considered). A schematic diagram of the well facilities is included. As shown, the annual volume requested is ~~40.275 MG~~ and the maximum month is ~~8.99~~ MG.

25.0

6.5

TABLE 1
EASTERN SHORE YACHT & COUNTRY CLUB
HISTORICAL METERED WATER USAGE IN GALLONS

Month/Year	Irrigation	Irrigation Well 17N	Irrigation Well 12S	#1 Pumphouse	#2 Clubhouse
Jan. 1999				0	
Feb.			0	0	21,580
Mar.			0	0	24,350
Apr.			0	0	61,640
May	0	0	0	329,710	257,840
June	721,625	1,306,360	489,550	111,220	244,070
July	3,123,687	3,445,810	487,270	368,910	147,050
Aug.	2,073,720	1,657,590	799,080	41,060	206,820
Sept.	60,200	0	0	0	111,860
Oct.	443,798	365,120	286,650	10	65,600
Nov.	262,446	0	40	0	49,430
Dec.	0	0	0	0	37,950
Totals, 1999	6,685,476	6,774,890	2,062,590	850,710	1,246,500
Jan. 2000	0	0	0	0	18,310
Feb.	0	0	0	0	21,710
Mar.	0	0	0	0	77,850
Apr.	0	0	0	0	48,640
May	1,046,730	889,560	531,330	29,190	190,020
June	1,126,102	1,333,280	1,034,220	300	170,540
July	563,639	432,950	215,240	0	141,690
Aug.	341,215	220,490	0	0	159,360
Partial totals 2000	3,077,686	2,876,280	1,780,790	29,490	828,120

+ 8,837,480

− 2,152,004

+ 4,657,070

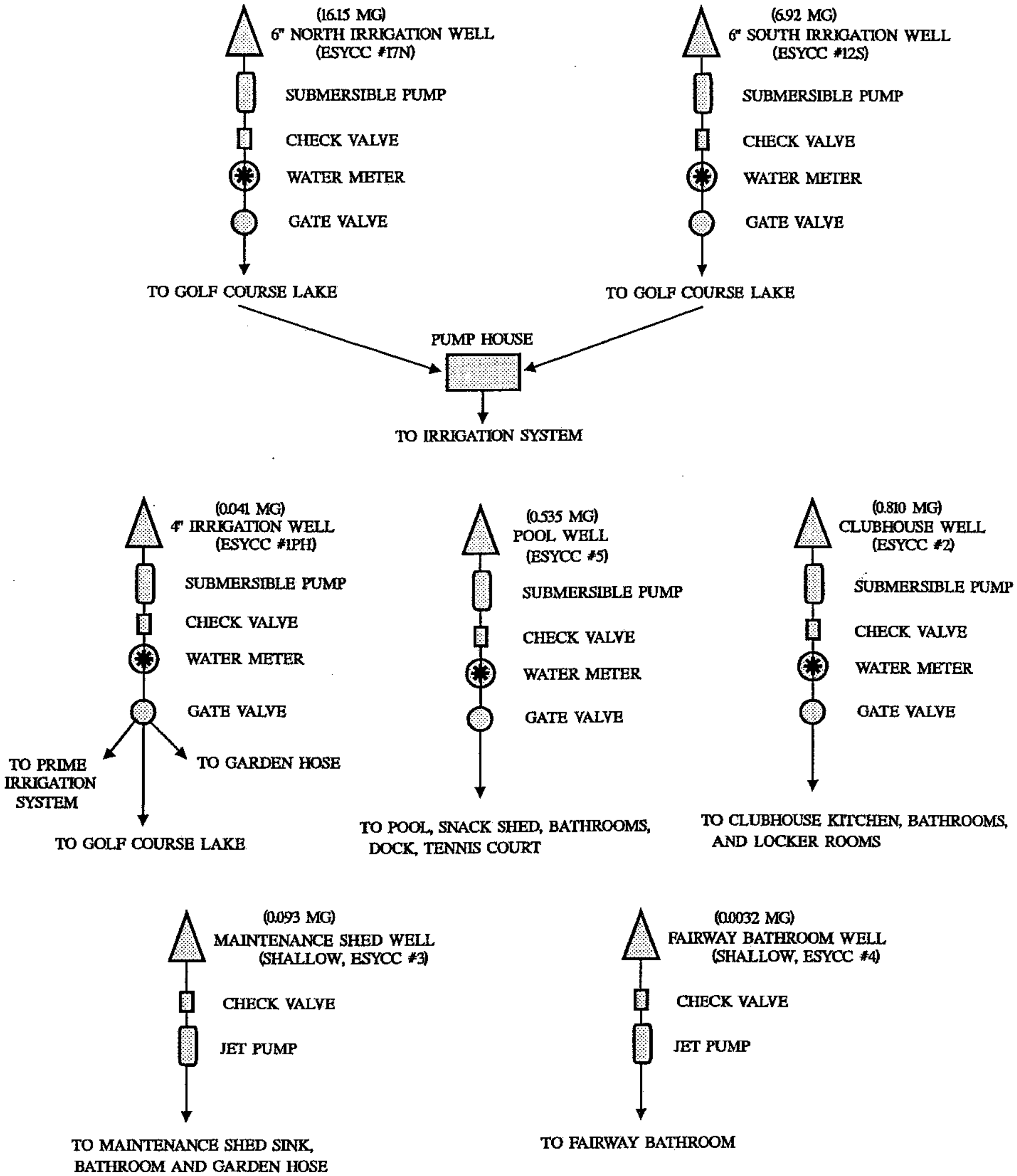
− 1,579,384

TABLE 2
EASTERN SHORE YACHT & COUNTRY CLUB
GOLF COURSE IRRIGATION WATER REQUIRED

Month	Precip. (in) Normal	ET (in)	Net +/- (in)	Water Req. (gal) Normal	Precip. (in) 20th %/30th%	Precip (in) Net +/-	Water Req (gal) Dry Weather
Jan.	3.75	0.18	+3.57	0	2.20	+2.02	0
Feb.	3.40	0.25	+3.15	0	2.12	+1.87	0
Mar.	4.16	0.89	+3.27	0	2.60	+1.71	0
Apr.	2.92	2.06	+0.86	0	2.12/2.43	+0.37	0
May	3.48	3.66	-0.18	391,018	1.99/2.40	-1.26	2,737,123
June	3.34	5.14	-1.80	3,910,176	2.58	-2.56	5,561,139
July	4.29	6.07	-1.78	3,866,730	3.45	-2.62	5,691,478
Aug.	3.80	5.50	-1.70	3,692,944	2.98	-2.52	5,474,246
Sept.	3.16	3.93	-0.77	1,672,686	2.09/2.57	-1.36	2,954,355
Oct.	3.08	2.20	+0.88	0	1.51/1.90	-0.30	651,696
Nov.	3.03	1.02	+2.01	0	1.48	+0.16	0
Dec.	3.51	0.37	+3.14	0	1.79	+1.17	0
						Total	23,070,037

Notes:

1. Painter 2W Normal precipitation (1961-1990).
2. Dry condition irrigation requirements based on Painter 2W 20th percentile rainfall for June-August and somewhat wetter 30th percentile rainfall for April, May, September, and October.
3. Water required is based on deficits in inches of water per acre per month applied to the 80 acres currently being irrigated at ESY&CC at 27,154 gallons per acre-inch.
4. Evapotranspiration values calculated for the Painter 2W station by Virginia State Climatologists Office using the Thornwaite formula.
5. Revised 10/3/01.



RKA	WATER SYSTEM SCHEMATIC EASTERN SHORE YACHT AND COUNTRY CLUB MELFA, VIRGINIA	FIGURE NO. 1

TABLE 3
EASTERN SHORE YACHT & COUNTRY CLUB
VOLUME OF WATER REQUESTED
GALLONS PER MONTH

Month	GC Restroom Well #4	Maint. Shed Well #3	Pumphouse Well #1	Clubhouse Well #2	Pool Well #5	Irr. Wells 17N/12S	Total Month
Jan.	0	7,750	1,000	20,000	0	0	28,750
Feb.	0	7,750	1,000	25,000	0	0	33,750
Mar.	0	7,750	1,000	80,000	0	0	88,750
Apr.	400	7,750	30,000	65,000	0	0	103,150
May	400	7,750	1,000	90,000	170,000	2,737,123	3,006,273
Jun.	400	7,750	1,000	95,000	155,000	5,561,139	5,820,289
Jul.	400	7,750	1,000	95,000	65,000	5,691,478	5,860,628
Aug.	400	7,750	1,000	95,000	115,000	5,474,246	5,693,396
Sept.	400	7,750	1,000	85,000	30,000	2,954,355	3,078,505
Oct.	400	7,750	1,000	70,000	0	651,696	730,846
Nov.	400	7,750	1,000	50,000	0	0	59,150
Dec.	0	7,750	1,000	40,000	0	0	48,750
Total Year	3,200	93,000	41,000	810,000	535,000	23,070,037	24,555,224

Notes:
1. Estimated irrigation well usage (17N=70%) (12S=30%)
2. Revised 10/15/01
3. Includes new proposed Pool Well #5 estimated usage

TABLE 2
EASTERN SHORE YACHT & COUNTRY CLUB
GOLF COURSE IRRIGATION WATER REQUIRED

Month	Precip. (in) ~~Normal~~ Avg	ET (in)	Net +/-	Water Req. (gal)	Precip. (in) 20^{th} %/30th%	Precip (in) Net +/-	Water Req (gal)
Jan.	3.75 3.91	0.49	+3.26	0	2.20	+1.71	0
Feb.	3.40 3.31	0.64	+2.76	0	2.12	+1.48	0
Mar.	4.16 4.13	1.40	+2.76	0	2.60	+1.20	0
Apr.	2.92 2.92	2.88 2.06	+0.04 0.86	0	60 ~~2.12~~/2.43 30 3.31	-0.45 -0.37 +0.39	977,544 803,758
May	3.48 3.47	4.96 3.66	-1.48 -0.19	3,215,034	60 ~~1.99~~/2.40 30 3.65	-2.56 -1.31	5,561,139 3,845,239
June	3.34 3.51	6.60 5.14	-3.26 -1.63	7,081,763	20 2.58	-4.02	8,732,726 8,56
July	4.29 4.10	7.44 6.07	-3.15 -1.97	6,842,808	20 3.45	-3.99	8,667,569 5,69
Aug.	3.80 4.28	6.70 5.50	-2.90 -1.22	6,299,728	20 2.98	-3.72	8,081,030 5,47
Sept.	3.16 3.41	4.77 3.93	-1.61 -0.52	3,497,435	60 ~~2.09~~/2.57 30 4.04	-2.20 -0.73	4,779,104 1,585,796
Oct.	3.08 3.57	2.79 2.20	+0.29 1.37	0	60 ~~1.51~~/1.90 30 3.13	-0.89 +0.43	1,933,365 0
Nov.	3.03 2.96	1.32	+1.71	0	1.48	+0.16	0
Dec.	3.51 3.37	0.62	+2.89	0	1.79	+1.17	0

power or Palmer

State Climatologist

Net x 27,154 x 80

Net x 27,154 x 80

173,786 diff

Notes:

1. Painter 2W Normal precipitation (1961-1990).
2. Dry condition irrigation requirements based on Painter 2W 20^{th} percentile rainfall for June-August and somewhat wetter 30^{th} percentile rainfall for April, May, September, and October.
3. Water required is based on deficits in inches of water per acre per month applied to the 80 acres currently being irrigated at ESY&CC at 27,154 gallons per acre-inch.

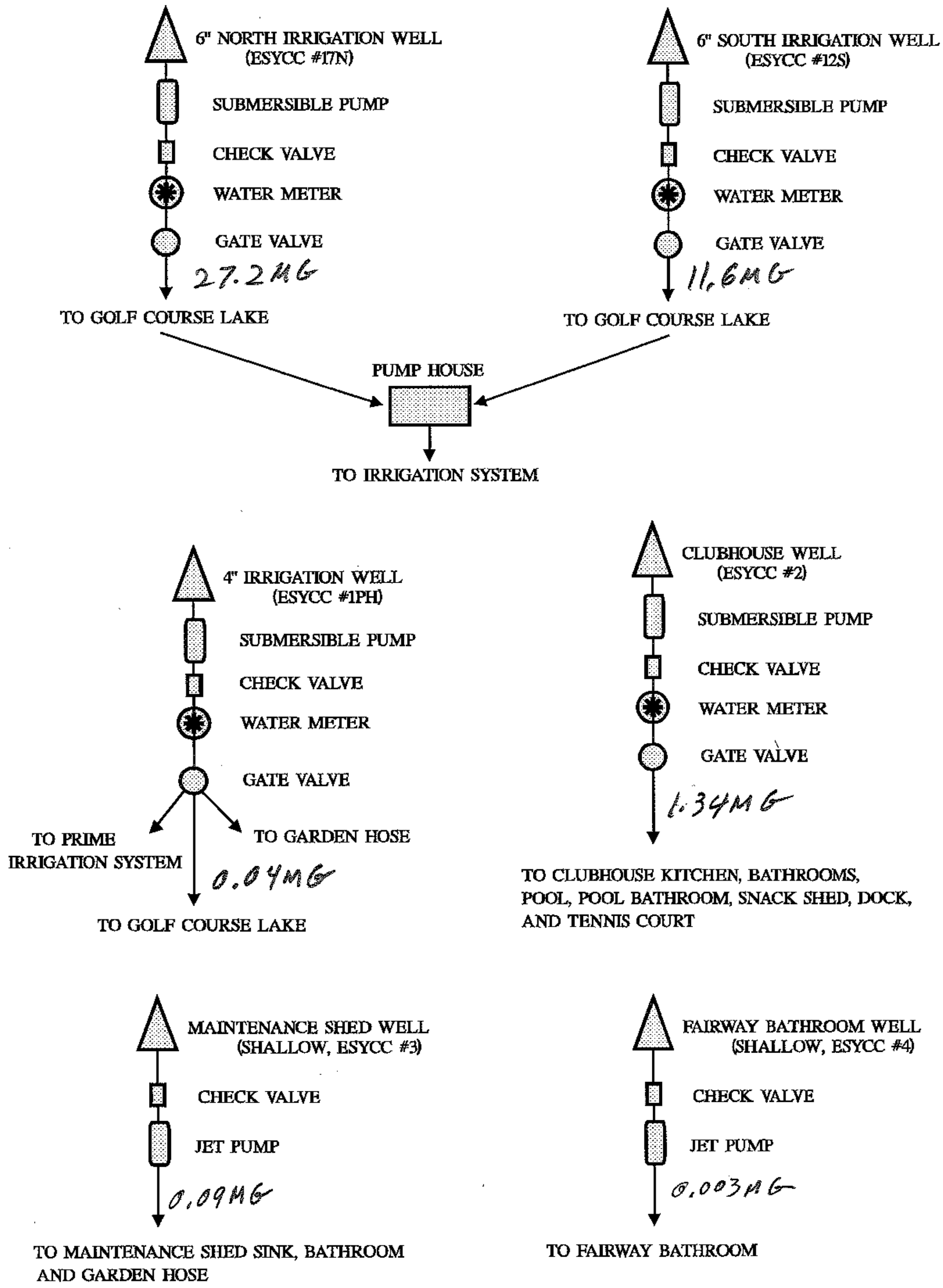
27,154 x 80 x 4 = 8,689,280 gal/month @ 1"/week

26,936,768

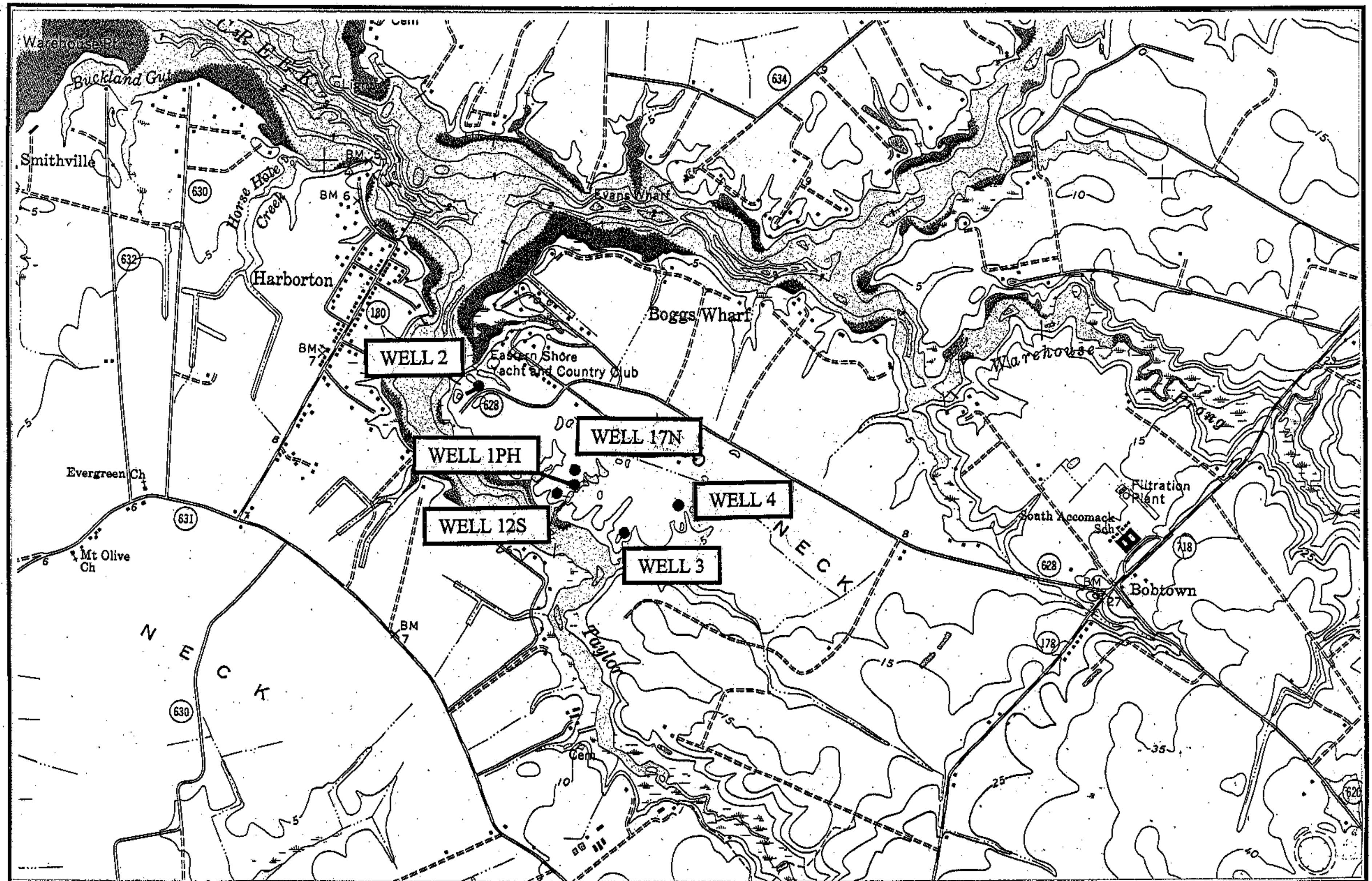
38,732,477

TABLE 3
EASTERN SHORE YACHT & COUNTRY CLUB
VOLUME OF WATER REQUESTED
GALLONS PER MONTH

Month	GC Restroom Well #4	Maint. Shed Well #3	Pumphouse Well #1	Clubhouse Well #2	Irr. Wells 17N/12S	Total Month
Jan.	0	7,750	1,000	20,000	0	28,750
Feb.	0	7,750	1,000	25,000	0	33,750
Mar.	0	7,750	1,000	80,000	0	88,750
Apr.	400	7,750	30,000	65,000	978,000	1,081,150
May	400	7,750	1,000	260,000	5,561,000	5,830,150
Jun.	400	7,750	1,000	250,000	8,733,000	8,992,150
Jul.	400	7,750	1,000	160,000	8,668,000	8,837,150
Aug.	400	7,750	1,000	210,000	8,081,000	8,300,150
Sept.	400	7,750	1,000	115,000	4,779,000	4,903,150
Oct.	400	7,750	1,000	70,000	1,993,000	2,072,150
Nov.	400	7,750	1,000	50,000	0	59,150
Dec.	0	7,750	1,000	40,000	0	48,750
Total Year	3,200	93,000	41,000	1,345,000	38,793,000	40,275,200
	0.003	0.09	0.04	1.34	38.8	
	0.01%	0.22%	0.1%	3.3%	96.3%	
					70% / 30%	
					27.2 / 11.6MG	



RKA	WATER SYSTEM SCHEMATIC EASTERN SHORE YACHT AND COUNTRY CLUB MELFA, VIRGINIA	FIGURE NO. 1



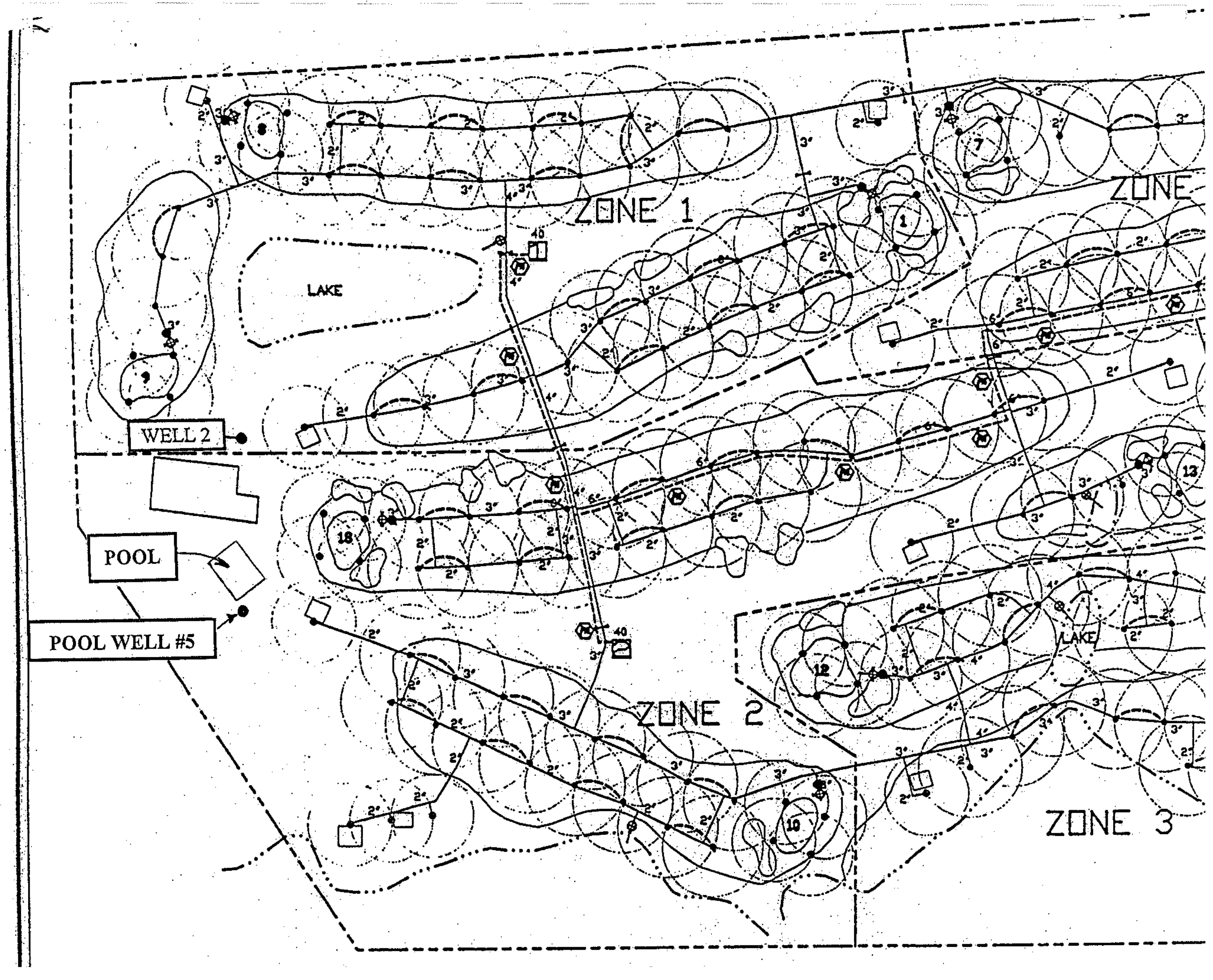
RKA

WELL LOCATION MAP
EASTERN SHORE YACHT AND COUNTRY CLUB
MELFA, VIRGINIA
(FROM PUNGOTEAGUE, VA QUADRANGLE)

N

FIGURE NO. 1

SCALE
1 IN. = 2,000 FT.


ZONE 1
ZONE 2
ZONE 3
LAKE
WELL 2
POOL
POOL WELL #5

ATTACHMENT 13
WATER CONSERVATION AND MANAGEMENT PLAN
(Amended March 2001)

1.0 Water Saving Plumbing and Processes

Any domestic plumbing fixtures which may need to be installed at Eastern Shore Yacht and Country Club (the Club) following issuance of this permit will meet the most recent BOCA plumbing code for ultra low water consumption.

In an effort to ensure that our Club makes the most of its water sources, the Club has already taken steps to conserve water in many areas.

1.1 On the golf course:

a. Since the main use of water at the Club involves the irrigation of the golf course, the first and most important step has been to install a state-of-the-art irrigation system. The new system is capable of watering only those areas deemed necessary by the Golf Course Superintendent. This irrigation occurs only at night. Since the Club only irrigates at night, they avoid over watering and as well as the immediate evaporation loss that occurs with daytime irrigation during hot, dry months. The system is capable of watering only parts of a particular hole and is even capable of watering only portions of greens. This flexibility allows the Superintendent to conserve more water than was ever possible with the old system. All of the monitoring is done by the Superintendent and his staff as part of their daily inspection of the golf course. During this inspection, they also check for leaks in the system which are repaired as soon as possible. Decision Criteria employed during the inspection are:

General-It is generally assumed that golf courses water on a set schedule, but that is not the case. Turf always performs better under controlled dry conditions-especially greens. Wind, evaporation rates, temperature, and evaluation of existing soil moisture all determine when and how much you have to water. Therefore, irrigation has to be adjusted on a daily basis. The Club is in the process of converting the cool season fairways to Bermuda grass, which will help reduce water usage in the future. Bermuda grass is a warm season grass as compared to the cool season perennial rye in several fairways and its requirements for water is a lot lower than the rye grass.

Greens-Soil is generally kept at field capacity (macro pores dry, micropores filled). During hot weather the greens are syringed rather than watered. Light watering , such as syringing, is used for evaporative cooling of the greens surface. Generally only a few gallons per green are used-not enough to filter past the leaves to the soil. Heavy watering is done when the turf does not respond to syringing.

Tees and Fairways-Water is applied when the turf wilts. When the grass goes off color and doesn't stand up straight it is scheduled for watering.

b. The remote bathrooms located on the course are shut down every autumn after which we drain the pipes to avoid freezing. A Porta-Potty is used for approximately six months of the year.

c. A sensor (Childers Lake Level Sensor LLS0100)is going to be utilized to ensure that water levels in the ponds do not reach the level at which the water would flow into the creek due to pumpage from the deep wells.

1.2 Club House

In the clubhouse, a variety of steps are taken to use as little water as possible:

a. All of the toilets in the public restrooms are already low flow fixtures.

b. All of our hoses use a pistol grip on sprayers to lessen and control the water flow. Hoses cannot discharge unless they are in use.

c. All faucets in the restaurant and clubhouse and as well as those on our course and at the dock are checked on a daily basis by maintenance people and by cleaning staff, thus lessening the likelihood that a faucet might be left on and waste water.

d. Additional checks of all the facilities around the clubhouse, pool, tennis court and dock are undertaken by the manager on his daily walk around the facility.

1.3 Pro Shop

The pro shop also makes use of a limited amount of water:

a. Perhaps the largest use comes in the form of the hoses used to wash down the golf carts. These stations are inspected by the Pro on a daily basis and the hoses used always have the proper pistol grip handles to minimize water flow and negate water loss when hoses are not in use.

1.4 Tennis Courts

The tennis courts are watered by an automated irrigation system:

a. This irrigation is brief during the day (10 minutes) and longer overnight.

b. The system is manually turned off during rainy periods by Club personnel.

c. In the winter, the pipes are drained to avoid freezing and subsequent leaks from frozen pipes.

1.5 Dock/Marina Area

a. The faucets located at the end of this water line are inspected on a daily basis by the staff cleaning the trash bins on the dock.

b. The line leading to the dock is drained every autumn to avoid pipe damage.

1.6 Swimming Pool

The swimming pool is an obvious source of possible waste:

a. Lifeguards are trained to backwash the system only after checking with management.

b. Water levels are closely monitored to avoid overfilling.

c. The pool deck area is swept rather than hosed down.

d. The member shower station is situated next to a guard station to ensure water is turned off and that there are no leaks.

e. The pool restrooms are cleaned and inspected for running water twice daily.

f. All pool lines are drained every autumn to avoid leaks due to freezing.

2.0 <u>Water Loss Reduction Program</u>

a. The Club facilities plumbing systems are currently inspected and maintained on a regular basis. The Club staff will also be instructed at weekly management meetings to note areas where changes will help to conserve water or reduce losses. Members will be requested to notify staff or management of any problems with the water system such as plumbing leaks or dripping fixtures.

b. Leaks in the irrigation system will be detected primarily on a visual basis during daily inspection by the Golf Course Superintendent. Subsurface leaks would cause an irrigation system pressure decline and turn the irrigation pump on periodically. When this is noted the maintenance crew will work to identify the area of the leak and affect repair as soon as possible.

3.0 <u>Water Use Education Program</u>

a. Employees will initially receive instruction as to the importance of efficient water use and conservation methods during their orientation. Water conservation reminders are included in every all-employee meeting. Any problems that might lead to waste are brought up at our weekly management meetings. Signs encouraging water conservation are posted in employee areas.

b. Water Use Education will be made a permanent agenda item for weekly management meeting and all-employee meetings.

c. Placement of water conservation placards will be placed in the clubhouse, member locker and restrooms, the restaurant kitchen, the maintenance building, the pumphouse, and the field golf course seasonal restroom in areas easily visible to facility users. Management and maintenance staff will inspect the placard settings and will replace them as needed.

4.0 <u>Evaluation of Potential Water Reuse Options</u>

a. Wastewater from the Club is returned to the ground using a number of individual septic drainfields.

b. Some stormwater runoff is retained in the irrigation pond system and is reused for irrigation.

c. The high and low water sensors planned for the pond system will facilitate usage of impounded stormwater or shallow recharge from the Watertable Aquifer prior to deep well pumps starting.

5.0 Requirements for Mandatory Water Use Reductions

a. The Club will comply with any mandatory water use reductions required during water shortage emergencies declared by the local governing body or the Director of DEQ. This will include provision of requirements for mandatory water use restrictions to employees and prohibiting all non-essential uses.

ATTACHMENT 13
WATER CONSERVATION AND MANAGEMENT PLAN

1. Water Saving Plumbing and Processes

   Any domestic plumbing fixtures which may need to be installed at Eastern Shore Yacht and Country Club (The Club) will meet the 1993 BOCA plumbing code for ultra low water consumption.

2. Water Loss Reduction Program

   The plumbing systems will be inspected and maintained on a regular basis. The Club staff will be instructed to note areas where changes will help to conserve water, or reduce losses. Members wil be requested to notify staff of any problems with the water system such as plumbing leaks or dripping fixtures.

3. Water Use Education Program

   Employees will receive instruction as to the importance of efficient water use and conservation methods during their orientation. Placards promoting water conservation methods will be posted in appropriate areas.

4. Evaluation of Potential Water Reuse Options

   Wastewater from The Club is returned to the ground using a number of individual septic drainfields.

5. Requirements for Mandatory Water Use Reductions

   The Club will comply with any mandatory water use reductions during water shortage emergencies declared by the local governing body or the Director of DEQ. This will include provision of requirements for mandatory water use restrictions to employees, prohibiting all non-essential uses.

Integrated Fisheries International

3100-001 / NEW

ATTACHMENT 5
WATER REQUIREMENT JUSTIFICATION

Existing Ground Water Withdrawal Permit #GW0033900 was issued to Eastern Shore Seafood Products (ESSP) effective January 1, 1998 and will expire December 31, 2007. The permit, allowing a withdrawal of up to 95,000,000 gallons per year and a maximum month withdrawal of 10,500,000 gallons was taken over by Integrated Fisheries International, Ltd., (IFI) after Seawatch International bought the Mappsville facility in January 2006. IFI began actual operations at the facility during may 2006. Shucking clams, the part of the ESSP operation that used the most water was reportedly discontinued in October 2005. The current IFI operation receives shucked clams and then slices, breads, fries, and freezes the product.

Table 5-1 shows water pumpage by well and month for year 2006, the only year of data available at the reduced scale of the current operation. The 2006 annual total of 11,283,720 gallons is considerably smaller than the approximately 56 million gallons pumped in 2004 and 44 million gallons pumped in 2005. Additionally, because so many wells were out of service during 2006, it is not possible to apportion the current operation annual pumpage to individual wells. Bundick Well and Pump will be reestablishing service at the idled wells.

Christopher Strom, IFI Plant Manager has indicated that presently, the plant is considerably under used. Currently, plans are in place to add a second shift for clam production possibly as early as mid-2007 and to add an additional production line for fish co-packing perhaps within the next 10-12 months. An estimate of annual need of 50,000,000 gallons and a Monthly Maximum of 6,250,000 gallons was provided at the January 23, 2007 preapplication meeting.

Current water need requirement calculations provided by the plant manager are:

1a. Based on an approximate 50,000 gallon per day year 2006 usage x 250 production days = 12,500,000 gallons.

1b. Adding a second (clam) shift would double production usage to 25,000,000 gallons per year.

2. An additional production line for fish co-packing (estimated at up to 3 shifts) would approximately double the requirement of the current and planned clam production lines using 25,000,000 gallons per year.

3. The total requested volume equals the clam production requirement added to the fish co-packing requirement. 25,000,000 gallons + 25,000,000 gallons = 50,000,000 gallons per year for both plant production and the public water supply.

4. The maximum month requirement is the total annual requirement divided by 8 months.

   50,000,000 gallons ÷ 8 = 6,250,000 gallons per month.

SECTION 5
WATER USE CALCULATIONS

Clams

Shift one - 50,000 gallons per day x 250 workdays = 12,500,000 gallons/year
Shift two - 50,000 gallons per day x 250 workdays = 12,500,000 gallons/year

Fish

Shift one - 50,000 gallons per day x 250 workdays = 12,500,000 gallons/year
Shift two - 50,000 gallons per day x 250 workdays = 12,500,000 gallons/year

Total = 50,000,000 gallons/year

Maximum Month - 50,000,000 gallons/year ÷ 8 months = 6,250,000 gal/month

ATTACHMENT 5
INTEGRATED FISHERIES INTERNATIONAL, LTD.
WATER REQUIREMENT JUSTIFICATION - RECALCULATION

Section 5 - #3

The operational history of IFI at this plant is limited to post-May 2006. In January 2006, prior to the sale of the plant, Eastern Shore Seafood Products ceased clam shucking and the chopped clam and clam juice canning operations, the major production water uses. ESSP essentially was then operating a clam slicing, breading, and frying operation similar to that of IFI. The current plant manager took the annual 2006 pumpage (11,283,720 gallons) and divided it by an estimated 250 single shift working days yielding 45,135 gallons per work day per shift rounded to 50,000 gallons/day.

11,283,720 gallons ÷ 250 single shift working days = 45,135 gal/day/shift

Rounded to 50,000 gal/day/shift

Plans are progressing to:
Add 1 clam breading shift/day + 1 clam shift = 2 clam shifts total/day
Add 2 fish co-packing shifts/day = 2 fish shifts identical to clam shifts

4 shifts/day x 250 est workdays = 1,000 shifts

1,000 shifts x 50,000 gal/shift = 50,000,000 gallons/years

Section 5 - #4 Apportionment of Water

The following is a minor modification of the annual percentages submitted on June 27, 2007.

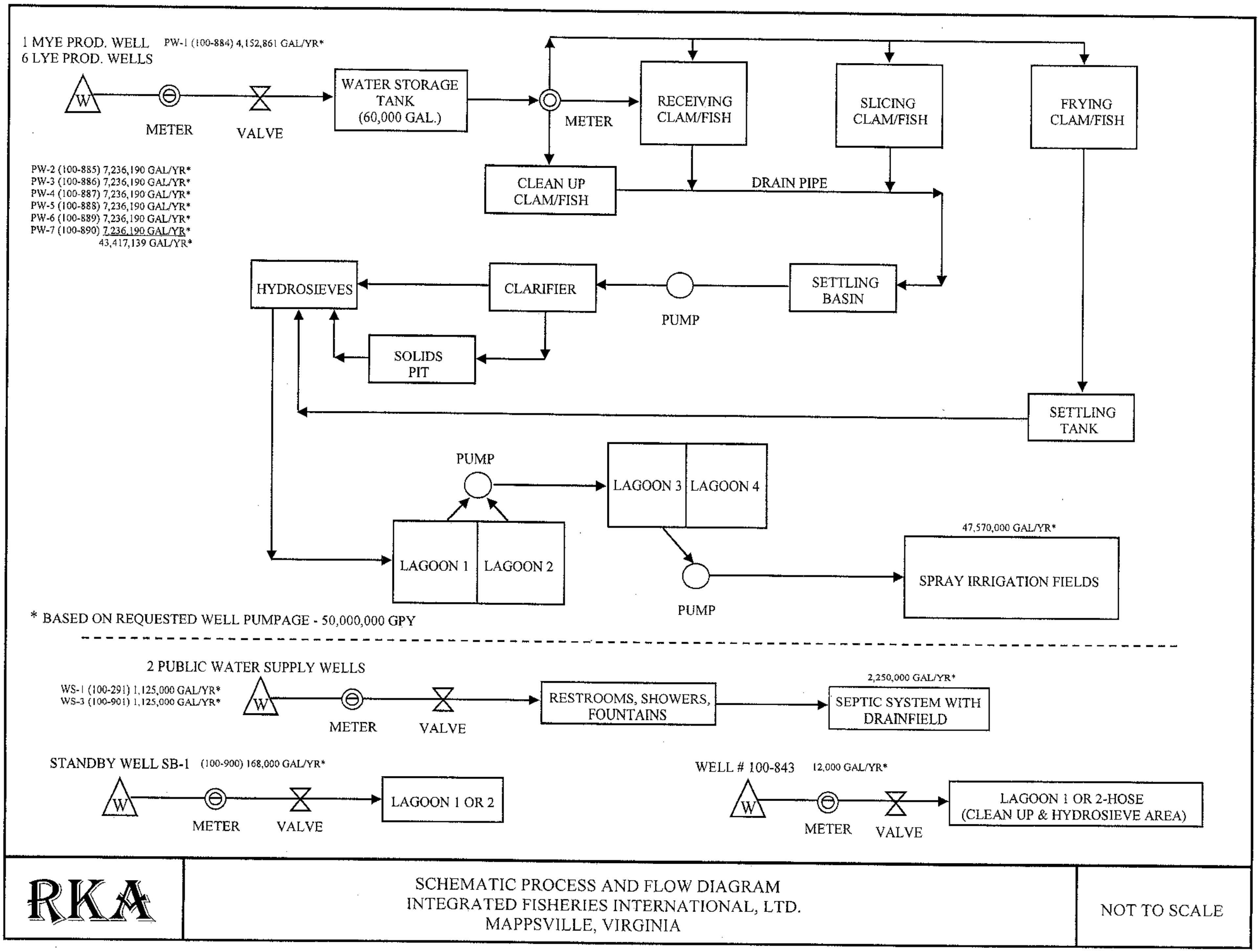
PW-1 - 8.73% - 4,152,861 gallons
PW 2-7 - 91.27% - 43,417,139 gallons (7,236,190 gal/well)
WS-1 & 2 - 4.5% - 2,250,000 gallons (est. 1,125,000 gal/well)
Well 100-843 - 0.024% - 12,000 gallons
Well SB-1 - 0.336% - 168,000 gallons

TABLE 5-1
INTEGRATED FISHERIES INTERNATIONAL, LTD.
GROUNDWATER PUMPAGE - 2006

Month	Production Wells (Gal)									Pub. Water Sup. (Gal)		
	PW-1	PW-2	PW-3	PW-4	PW-5	PW-6	PW-7	100-843	SB-1	WS-1	WS-3	Totals
January	52,000	81,040	84,720	0	86,640	88,680	78,740	0	6,800	–	73,100	551,720
February	64,000	105,700	109,160	0	112,210	115,990	103,120	0	8,000	–	64,400	682,580
March	138,000	219,930	231,360	0	237,060	241,070	217,450	0	0	–	32,400	1,317,270
April	79,000	129,870	136,200	0	140,390	142,800	104,101	-	900	–	22,900	756,070
May	91,000	148,620	128,360	0	161,010	163,130	165,080	0	0	–	30,900	888,100
June	11,300	184,840	0	0	196,700	199,470	177,540	0	0	—	46,300	816,150
July	263,000	226,160	0	0	240,690	245,590	200,480	0	0	–	48,400	1,224,320
August	0	498,200	0	0	534,080	588,940	0	0	0	–	42,800	1,664,020
September	0	347,870	0	0	187,180	408,070	0	0	0	–	44,700	987,820
October	0	452,880	70	0	0	533,290	0	0	0	–	83,900	1,070,140
November	0	247,610	0	0	185,440	288,550	0	0	0	–	7,500	729,100
December	0	182,210	0	0	191,770	211,850	0	0	0	–	10,600	596,430

Annual Total - 2006 - 11,283,720 gallons
2005 - 44,014,320 gallons
2004 - 55,952,770 gallons

2006 Withdrawal Totals - Production - 10,775,820 gallons
Public Supply - 507,900 gallons


1 MYE PROD. WELL
PW-1 (100-884) 4,152,861 GAL/YR*
6 LYE PROD. WELLS
W
METER
VALVE
WATER STORAGE TANK (60,000 GAL.)
METER
RECEIVING CLAM/FISH
SLICING CLAM/FISH
FRYING CLAM/FISH
CLEAN UP CLAM/FISH
DRAIN PIPE
PW-2 (100-885) 7,236,190 GAL/YR*
PW-3 (100-886) 7,236,190 GAL/YR*
PW-4 (100-887) 7,236,190 GAL/YR*
PW-5 (100-888) 7,236,190 GAL/YR*
PW-6 (100-889) 7,236,190 GAL/YR*
PW-7 (100-890) 7,236,190 GAL/YR*
43,417,139 GAL/YR*
HYDROSIEVES
CLARIFIER
PUMP
SETTLING BASIN
SOLIDS PIT
SETTLING TANK
PUMP
LAGOON 3
LAGOON 4
LAGOON 1
LAGOON 2
PUMP
47,570,000 GAL/YR*
SPRAY IRRIGATION FIELDS
* BASED ON REQUESTED WELL PUMPAGE - 50,000,000 GPY
2 PUBLIC WATER SUPPLY WELLS
WS-1 (100-291) 1,125,000 GAL/YR*
WS-3 (100-901) 1,125,000 GAL/YR*
W
METER
VALVE
RESTROOMS, SHOWERS, FOUNTAINS
2,250,000 GAL/YR*
SEPTIC SYSTEM WITH DRAINFIELD
STANDBY WELL SB-1 (100-900) 168,000 GAL/YR*
W
METER
VALVE
LAGOON 1 OR 2
WELL # 100-843 12,000 GAL/YR*
W
METER
VALVE
LAGOON 1 OR 2-HOSE (CLEAN UP & HYDROSIEVE AREA)
RKA
SCHEMATIC PROCESS AND FLOW DIAGRAM
INTEGRATED FISHERIES INTERNATIONAL, LTD.
MAPPSVILLE, VIRGINIA
NOT TO SCALE

ATTACHMENT 13
WATER CONSERVATION AND MANAGEMENT PLAN
INTEGRATED FISHERIES INTERNATIONAL, LTD

INTRODUCTION

Intregrated fisheries International, Ltd., (IFI) has reduced the types of clam processing that were most intense from a water use standpoint. The plant no longer shucks clams or chops and cans clam products. The facility also includes a fish co-packing operation. The requested amount of water is approximately half the previously permitted withdrawal and almost all used water is recycled to the ground via drainfield or a spray irrigation system for treated plant production water.

1. Water Saving Plumbing and Processes

Equipment used in the processing facility is evaluated and upgraded when possible in an effort to effectively reduce the amount of water required to perform normal activities that are similar to operations in the past. Should renovations at the facility occur, any domestic plumbing fixtures replaced will meet the most recent BOCA plumbing code for ultra low water consumption.

Various projects have been undertaken prior to issuance of the 1998 permit reduce water use. Notably, two cooling towers were installed, one rated at 230 tons, the other at 47 tons. Information submitted with the previous application indicates that the combined water saving was 6580 gallons per hour or 110 gallons per minute. IFI recently reworked plant washdown stations replacing old pressure nozzles with new high pressure nozzles with the expectation that they will be more effective at cleaning equipment and therefore more efficient. IFI is committed to identifying areas where water savings can be achieved.

2. Water Loss Reduction Program

The facility processing and plumbing systems are inspected (quarterly) and maintained (within 30 days) on a regular basis. The plant manager or plant treatment system operator and the water system maintenance supervisor are instructed to note areas where changes in the operating procedure and/or equipment setup will help to conserve water, or reduce losses.

3. Water Use Education Program

Employees receive instruction as to the importance of efficient water use and conservation methods during their orientation. Placards promoting water conservation are posted in the processing facility restrooms and other appropriate areas.

4. Evaluation of Potential Water Reuse Options

Process wastewater is collected and pumped to the wastewater facilities where it eventually reaches adjacent spray irrigation fields. Wastewater from sinks and restrooms at the facility drains to an onsite septic system with leach field.

5. Requirements for mandatory Water Use Reductions

IFI will comply with any mandatory water use reductions during water shortage emergencies declared by the local governing body or the Director of DEQ. This will include provision of requirements for mandatory water use restrictions to employees, prohibiting all nonessential uses such as lawn and ornamental irrigation or car washing at the plant production facility. IFI agrees to pay any fines levied due to IFI noncompliance with legal, local or State mandatory water use restrictions during water shortage declarations of emergencies.

Trails End Campground

3100-001 / NEW

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE:

WATERWORKS NAME: Trail's End Utility Co., Inc. **WATERWORKS CLASS:** VI

COUNTY/CITY: Accomack County **TYPE:** Community

LOCATION: South of Route 709 east of Horntown (Right onto Horntown Rd, Right onto Fleming, Left onto Justice, Right onto Trails End)

OWNER: Chincoteague Bay Trails End Association, Inc.
5360 Trails End Road
P.O. Box 240
Horntown, VA 23395
(757) 824-3428

OPERATOR: Licensed Class VI Operator Required

PERMIT NUMBER: 3001140

DATE ISSUED:

TYPE OF TREATMENT: None

SOURCE: 3 Wells

DESIGN CAPACITY: 122,800 gpd

DESCRIPTION OF THE WATERWORKS

This system consists of three wells, two 2,000 gallon hydropneumatic tanks, one 60,000 gallon bulk storage tank, two 15 H.P. booster pumps (each rated at 230 gpm) and the distribution system. All three wells are interconnected with combined metering prior to discharge to the 60,000 gallon bulk storage tank.

Well number one was drilled to a total depth of 310 feet on July 13 through 16, 1973 and provided with 150 feet of 6-inch diameter casing followed by 20 feet of 6-inch diameter screen. The well was grouted to a depth of 50 feet with a cement-water grout. The static water level in the well was 15.5 feet. The well yield was 30 gpm for a drawdown of 118 feet during a 22 hour drawdown test. This well is equipped with a Goulds submersible pump rated at 70 gpm and powered by a 5 H.P. electric motor.

Well number two was drilled to a total depth of 73 feet on July 15 through 18, 1974 and provided with 56 feet of 8-inch diameter casing followed by 15 feet of 8-inch diameter screen. The well was grouted to an unknown depth with a cement grout. The static water level in the well was 25 feet. The well yield was 120 gpm for a drawdown of 50 feet during a 24 hour drawdown test. This well is equipped with a Goulds submersible pump rated at 100 gpm and powered by a 5 H.P. electric motor.

Well number three was drilled to a total depth of 70 feet on June 18 through 24, 1981 and was provided with 50 feet of 8-inch diameter casing followed by 20 feet of 8-inch diameter screen. The well was grouted to a depth of 50 feet. The static water level in the well was 18 feet. The well yield was 200 gpm for a drawdown of 21 feet during a 24 hour drawdown test. This well is equipped with a Goulds submersible pump rated at 150 gpm @ 100 feet TDH and powered by a 5 H.P. electric motor.

Back up power is provided by one 80 KW generator at the main site and a 25 KW generator at each of the remote well sites.

CAPACITY EVALUATION OF THE WATERWORKS

Design Basis: per Waterworks Regulations, one ERC = 400 gpd and the average water demand for a camp site is 50 gpd/campsite.

1. Estimated Water Demand: (150 residential connections)(400 gpd/ERC) = 60,000 gpd
   (2530 camp sites)(50 gpd/campsite) = 126,500 gpd

2. Source Capacity:

Well #	Well Yield, gpd = gpm / (0.5 gpm/ERC) * 400 gpd/ERC		Well Pump, gpd = gpm * 1440 min/day		Limiting Capacity, gpd
1	30 gpm	24,000 gpd	70 gpm	100,800 gpd	24,000 gpd
2	120 gpm	96,000 gpd	100 gpm	144,000 gpd	96,000 gpd
3	200 gpm	160,000 gpd	100 gpm	144,000 gpd	144,000 gpd
Total	-	-	-	-	264,000 gpd

3. Booster Pump Capacity: Combined Capacity = 460 gpm
   Assigning $Q_{pk\ hr}$= 460 gpm = $11.4N^{0.544}$
   Solving for N = ERC = 895 ERC
   895 ERC*400 gpd/ERC = 358,000 gpd

4. Storage Capacity: (2,000 gal + 2,000 gal)/3 + 60,000 gal = 61,333 gal
   61,333 gal / 200 gal/ERC = 307 ERC
   307 ERC * 400 gpd/ERC = 122,800 gpd

Conclusion: This waterworks is limited to a capacity of 122,800 gpd due to the storage capacity described above. This permit does not suspend, minimize, or otherwise alter this owner's obligation to comply with applicable federal, state or local laws, regulations or permits.

DWT/ssd

VIRGINIA DEPARTMENT OF HEALTH
ENGINEERING DESCRIPTION SHEET

DATE:

WATERWORKS NAME: Trail's End Utility Co., Inc. **WATERWORKS CLASS:** VI

COUNTY/CITY: Accomack County **TYPE:** Community

LOCATION: South of Route 709 east of Horntown (From US 13 North, Right onto Horntown Rd. (Rt. 709), Right onto Fleming Rd. (Rt. 679), Left onto Justice (Rt. 709), Right onto Trails End)

OWNER: Chincoteague Bay Trails End Association, Inc.
5360 Trails End Road
P.O. Box 240
Horntown, VA 23395
(757) 824-3428

OPERATOR: Licensed Class VI Operator Required

PERMIT NUMBER: 3001140

DATE ISSUED:

TYPE OF TREATMENT: None

SOURCE: 3 Wells

DESIGN CAPACITY: 122,800 gpd

DESCRIPTION OF THE WATERWORKS

This system consists of three wells, two 2,000 gallon hydropneumatic tanks, one 60,000 gallon bulk storage tank, two 15 H.P. booster pumps (each rated at 230 gpm) and the distribution system. All three wells are interconnected with individual metering prior to discharge to the 60,000 gallon bulk storage tank.

Well No.1 (AKA DEQ Tag No. 100-00453) was drilled starting on July 13, 1973**,** and was completed on July 16, 1973. The well bore is 310 feet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 6– inches in diameter and extends to 150 feet, extending to 170 feet of unknown screen material and unknown screen slot or mesh size. Gravel pack was not indicated on the GW-2. The well is equipped with a submersible pump (rated at 70 gpm at 100 feet TDH) driven by a 5 HP electric motor. The pump intake setting is not known. The well has a tested yield of 30 gpm over a 22-hour period (July 14-July 15), with the water level dropping from 15.5 feet (static) to 133.8 feet (dynamic).

Well No. 2 (AKA DEQ Tag No. 100-00803) was drilled starting on July 15, 1974**,** and was completed on July 18, 1974. The well bore is 73 feet deep, with cement grout extending from the surface to (blank on the GW-2). The steel well casing is 8– inches in diameter and extends to 55 feet, extending to 70 feet of unknown screen material and unknown screen slot or mesh size. Gravel pack was not indicated on the GW-2. The well is equipped with a submersible pump (rated at 100 gpm at 100 feet TDH) driven by a 5 HP electric motor. The pump intake setting is not known. The well has a tested yield of 120 gpm over a 24-hour period (unknown dates), with the water level dropping from 25 feet (static) to unknown feet (dynamic). The original yield test produced 25 gpm with a static level of 15.5 feet and a reported dynamic level of 75 feet.

Well No.3 (AKA DEQ Tag No. 100-00899) was drilled starting on June 18, 1981**,** and was completed on June 24, 1981. The well bore is 70 feet deep, with cement grout extending from the surface to 50 feet. The steel well casing is 8– inches in diameter and extends to 50 feet, extending to 70 feet of 8 – inch screen (unknown material and unknown screen slot or mesh size). Gravel pack was not indicated on the GW-2. The well is equipped with a submersible pump (rated at 150 gpm at 100 feet TDH) driven by a 5 HP electric motor. The pump intake is set at 60 feet. The well has a tested yield of 200 gpm over a 24-hour period (June 18-June 20), with the water level dropping from 18 feet (static) to 39 feet (dynamic).

Back up power is provided by one 80 KW generator at the main site and a 25 KW generator at each of the two remote well sites.

CAPACITY EVALUATION OF THE WATERWORKS

Design Basis: per Waterworks Regulations, one ERC = 400 gpd and the average water demand for a camp site is 50 gpd/campsite.

1. Estimated Water Demand: (150 residential connections)(400 gpd/ERC) = 60,000 gpd
   (2530 camp sites)(50 gpd/campsite) = 126,500 gpd
   186,500 gpd

   Actual Water Demand: 2008 Average = 59,480 gpd
   July 2008 Average (peak month) = 94,355 gpd

2. Source Capacity:

Well #	Well Yield, gpd = gpm / (0.5 gpm/ERC) * 400 gpd/ERC		Well Pump, gpd = gpm * 1440 min/day		Limiting Capacity, gpd
1	30 gpm	24,000 gpd	70 gpm	100,800 gpd	24,000 gpd
2	120 gpm	96,000 gpd	100 gpm	144,000 gpd	96,000 gpd
3	200 gpm	160,000 gpd	150 gpm	216,000 gpd	160,000 gpd
Total	-	-	-	-	280,000 gpd

3. Booster Pump Capacity: Combined Capacity = 460 gpm
   Assigning $Q_{pk\ hr}$= 460 gpm = $11.4N^{0.544}$
   Solving for N = ERC = 895 ERC
   895 ERC*400 gpd/ERC = 358,000 gpd

4. Storage Capacity: (2,000 gal + 2,000 gal)/3 + 60,000 gal = 61,333 gal
   61,333 gal / 200 gal/ERC = 307 ERC
   307 ERC * 400 gpd/ERC = 122,800 gpd

Conclusion: This waterworks is limited to a capacity of 122,800 gpd due to the storage capacity described above. This permit does not suspend, minimize, or otherwise alter this owner's obligation to comply with applicable federal, state or local laws, regulations or permits.

DWT/ssd

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KMX Chemical

Groundwater & Environmental Services, Inc.

Exchange Alley Building • 23 South 13th Street, Suite 201 • Richmond, Virginia 23219 • (804) 343-0700 • FAX (804) 343-0770

December 30, 2004

Mr. Henry Ghittino
Virginia Department of Environmental Quality
Tidewater Regional Office
5636 Southern Boulevard
Virginia Beach, Virginia 23462

Re: KmX Chemical Corporation
New Church, Virginia

Dear Mr. Ghittino:

On behalf of KmX Chemical Corporation (KmX), we have enclosed two copies of the following documents related to the groundwater withdrawal permitting process for the KmX facility in New Church, Virginia:

- Application for a Groundwater Withdrawal Permit;
- Mitigation Plan;
- Water Conservation & Management Plan; and
- December 30, 2004 notification to Accomack County.

In addition, the required application fee of $6,000 has been enclosed. If you have any questions or require any additional information regarding the facility or the proposed groundwater withdrawal, please feel free to contact Dr. Majid Kazi of KmX at (905) 825-3109 or myself at (804) 343-0700 for assistance. We appreciate your assistance in this matter and look forward to working with DEQ through the permitting process.

Respectfully Submitted,
Groundwater & Environmental Services, Inc.

Samuel C. Nicolai, P.E.
Project Manager

Enclosures

cc: A. Majid Kazi, KmX

Groundwater
& Environmental Services, Inc.

Exchange Alley Building • 23 South 13th Street, Suite 201 • Richmond, Virginia 23219 • (804) 343-0700 • FAX (804) 343-0770

December 30, 2004

Mr. R. Keith Bull
County Administrator
Accomack County
23296 Courthouse Avenue
PO Box 388
Accomack, Virginia 23301

Re: Groundwater Withdrawal Permit
KmX Chemical Corporation, New Church, Virginia

Dear Mr. Bull:

On behalf of KmX Chemical Corporation (KmX), we have enclosed a copy of the Application for a Ground Water Withdrawal Permit for the KmX facility at 30474 Energy Drive, New Church, Virginia. The New Church facility has previously operated under groundwater withdrawal permit # ES-12-R, and is currently in the process of applying for a new 10-year permit. As outlined on the enclosed Local and Areawide Planning Requirements memo, we are requesting Accomack County's determination that the facility is in compliance with local ordinances.

If you have any questions or require any additional information regarding the facility or the proposed groundwater withdrawal, please feel free to contact Dr. Majid Kazi of KmX at (905) 825-3109 or myself at (804) 343-0700 for assistance. We appreciate your assistance in this matter and look forward to continued operation of the New Church facility within Accomack County.

Respectfully Submitted,
Groundwater & Environmental Services, Inc.

Samuel C. Nicolai, P.E.
Project Manager

Attachment: Application for a Ground Water Withdrawal Permit
Local and Areawide Planning Requirements Memo

cc: A. Majid Kazi, KmX

SUBJECT: LOCAL AND AREAWIDE PLANNING REQUIREMENTS

TO: Applicants for Permits to Withdraw Ground Water ([Facility Name])

9 VAC 25-610-90.C.2.b of the Ground Water Withdrawal Regulation states:

"The application shall include notification from the local governing body of the county, city or town in which the withdrawal is to occur that the location and operation of the withdrawing facility is in compliance with all ordinances adopted pursuant to Chapter 11 (§ 15.1-427 et seq.) of Title 15.1 of the Code of Virginia. If the governing body of any county, city or town fails to respond within 45 days following receipt of a written request by certified mail, return receipt requested, by an applicant for certification that the location and operation of the proposed facility is consistent with all ordinances adopted pursuant to Chapter 11 (§ 15.1-427 et seq.) of Title 15.1, the location and operation of the proposed facility shall be deemed to comply with the provisions of such ordinances for the purposes of this chapter;

In accordance with this section, new applications for permits to withdraw ground water will not be considered complete until the information below is submitted to the Virginia Department of Environmental Quality (DEQ) Regional Office.

To: County Administrator, Accomack County

(County, City, or Town Administrator/Manager)

I am in the process of completing a DEQ application form for a permit to withdraw ground water. In accordance with Chapter 11 (§15.1-427 et seq.) of Title 15.1 of the Code, I request that you sign one of the three statements below certifying that the project described in my attached application is, or is not, in compliance with your local ordinances. Please note that the above referenced regulation statesthat if this form was sent to you by certified mail with return receipt requested, and you do not return it within 45 days I will forward to DEQ a copy of my return receipt with my application and they will process it as if the facility being permitted were consistent with your local ordinances. Please return this form to:

(Applicant's address) Return to: KmX Chemical Corporation

998 C Old Country Road; Suite #177

Plainview, NY 11803

Attn: Plant Manager

I hereby certify,

_____ (1) that the proposed location, and operation of the facility is in compliance with all ordinances adopted pursuant to Chapter 11 (§15.1-427 et seq.) of Title 15.1 of the Code

or

_____ (2) that no local ordinances are in effect pursuant to Chapter 11 (§15.1-427 et seq.) of Title 15.1 of the Code

or

_____ (3) that the proposed location, and operation of the facility is not in compliance with all ordinances adopted pursuant to Chapter 11 (§15.1-427 et seq.) of Title 15.1 of the Code.

Signature	Title
Print Name	Date

rev. 5/25/99

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

APPLICATION FOR A GROUND WATER WITHDRAWAL PERMIT (FOR USE IN GROUND WATER MANAGEMENT AREAS)

PREAPPLICATION CONFERENCE DATE: November 3, 2004

1. **APPLICANT INFORMATION:** FIN/SSN: 32-012-3702

Applicant: KmX Chemical Corporation Phone: 516-385-9900

Applicant Address: 998 C Old Country Road, Suite #177 Plainview, NY 11803
(Street, City, State, Zip Code)

2. **FACILITY INFORMATION:**

Facility/System Name: KmX Chemical Corporation

Facility Address: 30474 Energy Drive, New Church, VA 23415
(If Applicable, Street, City, State, Zip Code)

Contact Name: Todd Godwin Title: Plant Manager Phone: 757-824-3600

Fax: 757-854-2895

Location of Withdrawal Well or Well System: Accomack / New Church
(County/City)

3. **TYPE OF APPLICATION:**

This application is for:

( ) Existing withdrawal, not previously permitted
( ) New withdrawal
( ) Expand or enlarge existing permit No. ____________
( ) Modification of permit No. ____________
( ) Minor amendment of permit No.____________
(x) Renewal of existing permit No. ES-12-R with modification
( ) Renewal of existing permit No. ____________ without modification

Existing withdrawal permit amount 76,440,400 gallons per year (Day,Month,Year)

Date of expiration of existing Ground Water Withdrawal Permit December 31, 2004

Requested withdrawal amount 60,000,000 gallons per year, 6,500,000 gallons per month

4. **TYPE OF USE:** (Check all that apply)

USE	%USE		%USE
( ) Public Water Supply	___	( ) Aquaculture	___
(x) Industrial	100	( ) Golf Course Irrigation	___
( ) Commercial	___	( ) Landscape Irrigation	___
( ) Fire Protection	___	( ) Nursery	___
( ) Drought Relief	___	( ) Crop Irrigation	___
( ) Livestock Watering	___	( ) Other ____________	___

If type of use is public water supply;

Estimate the percentage of the withdrawal for human consumptive use ____ %;

Attach a complete copy of the Virginia Department of Health Water Works Operation Permit and Engineering Description Sheets or equivalent.

OFFICE USE ONLY Application # GW0048500

Date Application Received 1/3/05 Date Fee Received 1/3/05 Amount 6,000.—

Notice Date ________ LGOF Date 12/30/04 Returned ________ Date Complete ________

5. **JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED:**

Briefly describe the nature of the activity and the proposed beneficial use of ground water.

See attached sheets

Documentation of beneficial use: Attach documentation demonstrating that the annual and monthly amount of ground water withdrawal requested is the smallest amount of withdrawal necessary to support the proposed beneficial use and that the amount is representative to support similar uses when adequate conservation measures are employed.

Include a description of the product produced or the service provided, the unit of measure (acres, lbs.,bushels, etc.) of the product or service, the unit of time that the product or service is produced (day, month, year), the amount of water (gallons) required to produce a unit of product or service, and the quantity of the product or service. Include calculations showing the total amount of water required to produce a product or provide a service.

Attach a line drawing showing the water flow through the facility/system. Indicate wells, meter locations, sources of surface intake, and treatment, or other operations generating wastewater. Construct a water balance on the line drawing by showing average flows between intakes, treatment units and discharge points.

Water demand projections: Include documentation to support the intended beneficial use over a ten year permit cycle such as population and water demand projections and expansion plans. Describe special treatment (i.e. RO, EDR) when proposed.

Apportionment of withdrawal to individual wells: Attach an operational pumping schedule for applications with multiple wells. Indicate whether the withdrawal from each well is daily, seasonal or intermittent. Describe the frequency of use and pumping volume for each well for each month in a calendar year.

6. **WASTEWATER TREATMENT AND DISPOSAL:**

Will wastewater be generated as a result of the withdrawal of ground water?
Yes (Yes/No) If yes, check the appropriate box below.

( ) Septic Tank and Drainfield

( ) Public Sewer ____________________
(Name of system)

( ) State Waters ____________________
(Name of water body)

Discharge Permit # ____________

(X) Have applied for a discharge permit from the Department of Environmental Quality.

7. **WELL LOCATION(S):**

Locate all wells (existing, proposed, abandoned, out of service), facility property boundaries and/or water supply service area associated with the application on a (1) United States Geological Survey 7 1/2 minute topographic map, or copies of such maps, and (2) detailed location map of each existing and proposed well. The detailed location map must be of sufficient detail such that all wells may be easily located for site inspection.

8. EXISTING WELL INFORMATION

Complete the well information worksheet for all existing wells associated with this application. **ATTACH** copies of original water well completion reports for each well listed below. DEQ well identification plates must be attached to each existing well. Well identification plates can be obtained at the appropriate DEQ Regional Office.

Well Name	Owner well #	DEQ Well #	Depth (ft.)	Pump Capac. (gpm)	Pump Set (ft)	Well* Type	Well** Status	Screen Interval(s) (ft.)	Office Use Only: Latitude	Office Use Only: Longitude	Office Use Only: El
North Well	1	100-258	259			P	Act				
South Well	2	100-365	253			P	Act				

Attach additional sheets if necessary

* Well Types: (P) Production, (M) Monitoring, (E) Emergency Standby, (R) Drought Relief, (S) Aquifer Storage & Recovery (D) Permanent Dewatering, (O) Other - Specify

** Well Status: (Act) Active, (Abn) Abandoned, (Alt) Altered From the Original Construction, (OSS) Out of Service

9. PROPOSED WELL INFORMATION

Complete the proposed well information worksheet for all proposed wells associated with this application. Contact the appropriate DEQ Regional office to obtain DEQ well identification numbers prior to the start of drilling operations. Reference the DEQ well identification number on all drilling documentation. A DEQ well identification plate must be attached to each completed well. Contact the DEQ RO at least two weeks prior to the start of drilling operations for each proposed well.

Well Name	Owner well #	Depth (ft.)	Pump Capac. (gpm)	Pump Set (ft)	Well* Type	Well** Status	Screen Interval(s) (ft.)	Office Use Only			
								DEQ Well #	Latitude	Longitude	El

Attach additional sheets if necessary

*Well Types: (P) Production, (M) Monitoring, (T) Test, (E) Emergency Standby, (R) Drought Relief, (S) Aquifer Storage & Recovery, (D) Permanent Dewatering, (O) Other - Specify

** Well Status: (NEW) New, (REP) Replacement Well, (ALT) Altered

10. LOCAL AND AREAWIDE PLANNING REQUIREMENTS:

Attach the notification from the local governing body of the county, city or town in which the withdrawal is to occur that the location and operation of the withdrawing facility is in compliance with all ordinances adopted pursuant to Chapter 22 (§ 15.2-2200 et seq.) of Title 15.2 of the code of Virginia.

If the Local Government Ordinance Form (LGOF) is not enclosed, enclose documentation demonstrating that the county, city or town failed to respond within 45 days to such a request made by the applicant by certified mail, return receipt requested (9 VAC 25-610-90 C.2.b).

11. EVALUATION OF THE LOWEST QUALITY WATER NEEDED FOR THE INTENDED BENEFICIAL USE:

Attach an evaluation of the lowest quality water needed for the intended beneficial use. The evaluation must include a list of critical water quality parameters with minimal limits which are associated with the type of use. Demonstrate that the ground water withdrawal will originate from the aquifer that contains the lowest quality water that will support the proposed beneficial use.

12. EVALUATION OF SOURCES OF WATER SUPPLY, OTHER THAN GROUND WATER:

Attach an evaluation of sources of water supply, other than ground water, including sources of reclaimed water. Include information as to the proximity to public water supplies, surface water sources and sources of reclaimed water.

13. WATER CONSERVATION AND MANAGEMENT PLAN:

Provide, as a stand-alone attachment, a water conservation and management plan to <u>include</u>, <u>at a minimum</u>, the following:

- Requirements for the use of water saving plumbing and processes including, where appropriate, the use of water saving fixtures in new and renovated plumbing as provided in the Uniform Statewide Building Code;
- A water loss reduction program;
- A water use education program;
- An evaluation of potential water reuse options;
- Requirements for mandatory water use reductions during water shortage emergencies declared by the local governing body or the Director of DEQ, including, where appropriate, ordinances prohibiting the waste of water generally and requirements for mandatory water use restrictions, with penalties during water shortage emergencies.

14. AREA OF IMPACT OF THE PROPOSED WITHDRAWAL:

Pursuant to 9 VAC 25-610-110 D.2. of the Ground Water Withdrawal Regulations, DEQ staff will perform a technical evaluation to determine the areas of any aquifers that will experience at least one foot of water level decline due to the proposed withdrawal. Hydrogeologic information such as, but not limited to, aquifer properties (transmissivity and storage coefficient) obtained from aquifer testing may be required.

15. MITIGATION PLAN:

Pursuant to 9 VAC 25-610-110 D.3.g. of the Ground Water Withdrawal Regulations, if the DEQ's technical evaluation determines the predicted area of impact extends beyond the property owned by the applicant and/or other ground water users exist within the area of impact, a mitigation plan is required. Since the area of impact most often extends beyond the applicants property, it is recommended that a mitigation plan be submitted at the time of application to reduce application processing time. In the event that the results of the technical evaluation show that the area of impact remains on the applicants property or there are no ground water users within the area of impact, DEQ staff will inform the applicant that a mitigation plan is not required. A model mitigation plan is included in the ground water permit application package.

16. EVALUATION OF THE 80% DRAWDOWN CRITERION:

Pursuant to 9 VAC 25-610-110 D.3.h. of the Ground Water Withdrawal Regulations, DEQ staff will conduct an evaluation to demonstrate that the proposed withdrawal in combination with all existing lawful withdrawals will not lower water levels, in any confined aquifer that the withdrawal impacts, below a point that represents 80% of the distance between the historical prepumping water levels in the aquifer and the top of the aquifer at the points that are halfway between the proposed withdrawal site and the predicted one foot drawdown contour based on the predicted stabilized effects of the proposed withdrawal. Ground water withdrawal permit applications which do not meet the 80% drawdown criteria will be denied.

17. ADDITIONAL INFORMATION REQUIRED BY THE BOARD

In addition to information requested at the preapplication conference, DEQ staff may require hydrogeologic and geophysical information necessary to characterize the aquifer system during application processing and review to obtain a complete application. Information including, but not limited to, the following may be required:

( ) Aquifer testing plan
( ) Pump test (step drawdown test);
( ) Aquifer test (constant rate discharge test);
( ) Monitoring well installation;
( ) Collection and analysis of drill cuttings;
( ) Collection and analysis of continuous core;
( ) Geophysical logs (spontaneous potential, single point resistance, 16/64 short and long normal resistivity, and natural gamma)
( ) Camera survey
( ) Water quality sampling;
( ) Other ____________________

I certify under penalty of law that this document and all information submitted were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is to the best of my knowledge, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations. I further certify that I am an authorized signatory as specified in the Ground Water Withdrawal Permit Regulation 9 VAC 25-610-10 et seq.

Signature: Majid Kazi Date 12/24/04.

Printed Name: MAJID KAZI.

Title: V. P. OPERATIONS

Phone: (905) 825-3109 Ext# 323.

5. JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED:

a. Proposed beneficial use of the water:

Water consumption can divided into the following four major groups:

- (i) Cooling water makeup;
- (ii) Boiler feed water makeup;
- (iii) General purpose (for workers to use for bathing, washrooms, etc.);
- (iv) Periodic equipment cleaning and washing.

b. Documentation of beneficial use:

The calculation sheets included in **Attachment A** provide detailed estimates of the proposed water consumption by the facility over the 10-year permit cycle. Water consumption is anticipated to increase over three separate stages of plant operations:

Stage I: (January 2005 to July 2005) Initial startup to operation at full capacity;

Stage II: (July 2005 to December 2006) Installation of membrane-based dehydration unit at the facility. This plant modification will not only require additional water consumption for its operation, but will also increase the overall water consumption due to higher plant throughput.

Stage III: (January 2007 to December 2015) Planned expansions of the facility, including installation of an esterification reaction system, additional evaporators, etc.

c. Line drawing showing the flow of water through the facility:

A line drawing and water balance of the facility's water consumption over the three stages of development is included in **Attachment B**.

d. Water demand projections:

Water demand projections are based on the three anticipated stages of facility development over the 10-year permit cycle, as described above.

e. Appointment of withdrawal to individual wells:

The full amount of the daily, monthly, or annual groundwater withdrawal may be collected from either of the facility's two production wells. Any limitations on the amount of withdrawal from an individual well will be determined based on the results of the anticipated aquifer testing and resulting groundwater modeling.

11. EVALUATION OF THE LOWEST QUALITY WATER NEEDED FOR THE INTENDED BENEFICIAL USE

Table 1: Required Water Quality

Parameter	Value
pH	8.0-8.5
Total Hardness (as $CaCO_3$)	180 ppm
Ca hardness (as $CaCO_3$)	90 ppm
Silica	10 ppm
Potassium	15 ppm
Sodium (as $CaCO_3$)	175 ppm
Methyl Orange Alkalinity	200 ppm
Phenolphthalein Alkalinity	1.5 ppm
Conductivity	1,300 m-mhos/cm

12. EVALUATION OF SOURCE OF WATER SUPPLY, OTHER THAN GROUND WATER

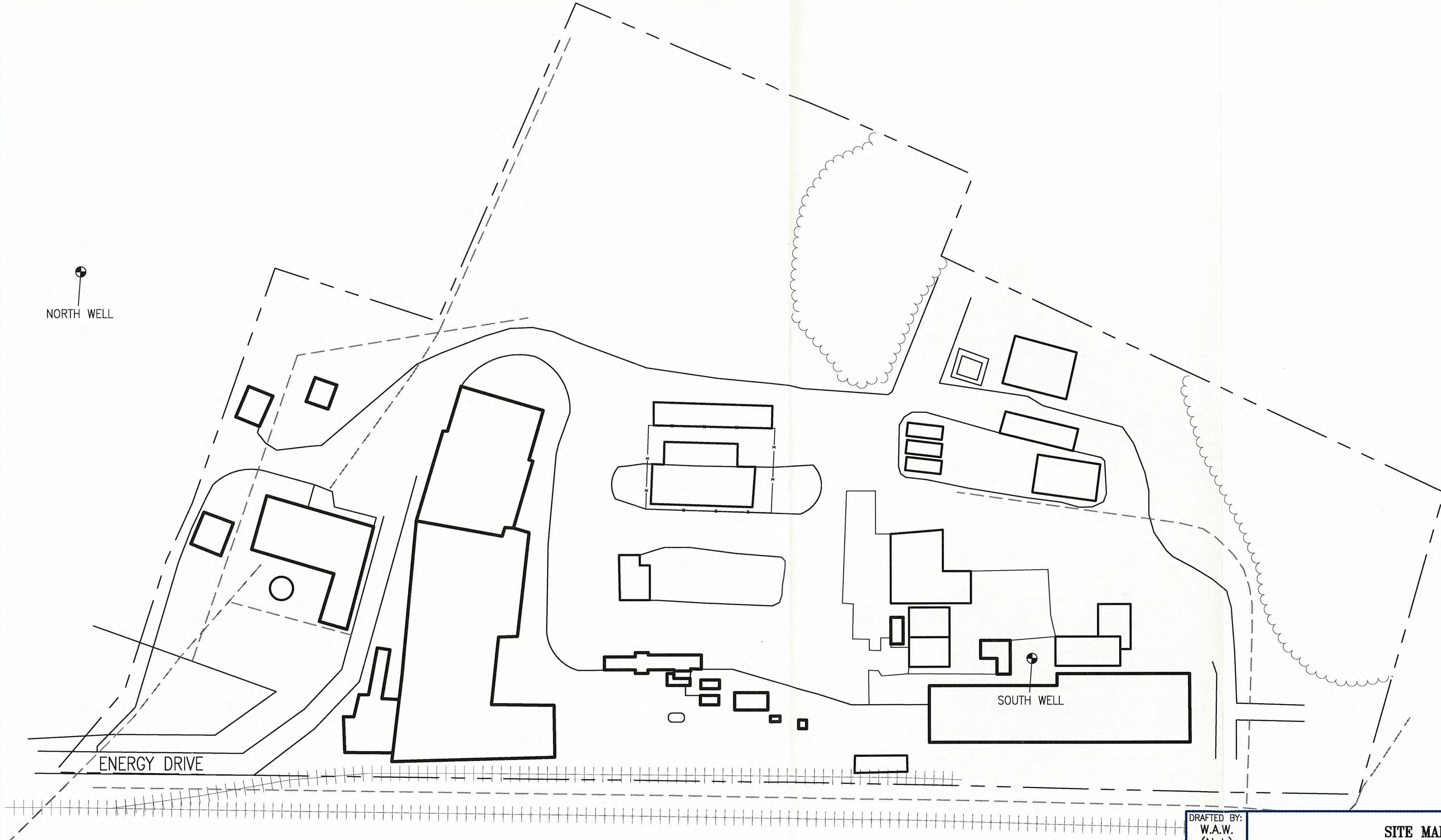
Currently there are no other sources of water available that meet the water quality criteria listed in **Table 1** above. Potential recycling of facility stormwater and/or process wastewater is currently under investigation for long-term consideration at the facility.

SOURCE: USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE 1992
HALLWOOD, VIRGINIA
CONTOUR INTERVAL = 5'

QUADRANGLE LOCATION

LAT. 037° 58' 37.59" N
LONG. 075° 32' 16.91" W
(APPROXIMATE SITE COORDINATES)

DRAFTED BY: W.A.W. (N.J.)	SITE LOCATION MAP
CHECKED BY:	KmX CHEMICAL CORPORATION 30474 ENERGY DRIVE NEW CHURCH, VIRGINIA
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219
	SCALE IN FEET 0 2000 | DATE 12-2-04 | FIGURE 1



LEGEND

- PROPERTY LINE
- VEGETATION
- RAILROAD TRACKS
- FENCE LINE
- UTILITY
- WELL LOCATIONS

NOTE:

SCALE AND NORTH ARROW ARE APPROXIMATE.

DRAFTED BY: W.A.W. (N.J.)	SITE MAP
CHECKED BY:	KmX CHEMICAL CORPORATION 30474 ENERGY DRIVE NEW CHURCH, VIRGINIA
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219
	SCALE IN FEET (APPROXIMATE) 0 100 / DATE 12-15-04 / FIGURE 2

M:\Graphics\1200-Richmond\MISC\KmX Chemical Corp\KmX chemical SM.dwg, 12/20/2004 1:38:13 PM, WWesterlund

Attachment A

KMX Plant Water Consumption

Groundwater from the facility production wells is the primary source of raw water for facility operations. Analysis of the water is as follows:

Table 1: Existing Water Analysis

Parameter	**Value**
pH	8.0-8.5
Total Hardness (as $CaCO_3$)	180 ppm
Ca hardness (as $CaCO_3$)	93 ppm
Mg hardness (as $CaCO_3$)	85 ppm
Silica	20 ppm
Potassium	14 ppm
Sodium (as $CaCO_3$)	170 ppm
Methyl Orange Alkalinity	200 ppm
Phenolphthalein Alkalinity	1.5 ppm
Conductivity	1,300 m-mhos/cm

Water consumption can divided into the following four major groups:

(i) Cooling water makeup;
(ii) Boiler feed water makeup;
(iii) General purpose (for workers to use for bathing, washrooms, etc.);
(iv) Periodic equipment cleaning and washing.

Cooling Tower Make-up Water Consumption

The cooling tower is a closed circulating cooling system with no direct contact with the process side. Chemical treatment is provided to this system to protect the piping and equipment from corrosion, scaling, and algae growth. The following figures are considered as design criteria for water consumption calculation:

Table 2: Cooling Water Design Criteria

Parameter	**Value**
Cooling water circulation rate	1,750 gpm
Cooling tower inlet / outlet temperature differential	20° F
Evaporation rate (each 10° F dt)	0.7% of circulation
Blow down rate (each 10° F dt)	0.2% of circulation
Drift loss	0.05% of circulation
Number of concentration	3.0

Table 3: Blow down Water Analysis

Parameter	**Value**
pH	7.5-8.5
Total Hardness (as $CaCO_3$)	500 – 600 ppm
Silica	40 - 60 ppm
Total Iron	< 1 ppm
Phosphate	20 – 30 ppm
Molibdate	6 – 10 ppm
M-Alkalinity	200 – 400 ppm
Total dissolved solid	2500 – 3500 ppm

Based on the design criteria:

Make-up water for evaporation = (1750)*(0.7/100)*(2)
= 24.5 gpm

Make-up water for blow down = (1750)*(0.2/100)*(2)
= 7.0 gpm

Make-up water for drift loss = (1750)*(0.05/100)
= 0.875 gpm

Total make-up water (cooling) = 32.4 gpm

Boiler Feed Water Make-up

Steam is generated by a water tube D-type boiler, and fuel oil #5 is used as the main fuel source. The steam production rate is 30,000 lb/hr, 200# saturated, and make-up water is supplied by a twin softener system. Each softener is regenerated once per day with sodium chloride; water consumption for each regeneration cycle is 350 gallons.

Table 4: Boiler Make-up Water Analysis

Parameter	**Value**
pH	8.0-8.5
Total Hardness (as $CaCO_3$)	2 ppm (maximum)
Silica	20 ppm
Sodium	520 ppm
M-Alkalinity	200 ppm
Conductivity	950 m-mhos/cm

The system is designed for 95% of steam condensate return, and number of concentration 10. Based on the above described water analysis and design criteria:

30,000 lb/hr / 10 = 3,000 lb/hr
= 360 gph
= 6.0 gpm

Condensate loss calculation:

30,000 lb/hr x (5/100) = 1,500 lb/hr
= 180 gph
= 3.0 gpm

Total make-up water (boiler) = 9.0 gpm

General Purpose Water Consumption

General purpose water includes water for washrooms and showers, as well as water for miscellaneous equipment cleaning.

Number of facility personnel	17
Water consumption per each person	150 gpd

150 x 17 = 2,550 gpd
= 2.0 gpm

Total general water = 2.0 gpm

Total Water Consumption Calculations

1) Total make-up water (cooling)	**32.4 gpm**
2) Total make-up water (boiler)	**9.0 gpm**
3) Total general water	**2.0 gpm**
Sub Total: (rounded)	**44.0 gpm**
Contingency (13%)	**6.0 gpm**
Grand Total:	**50.0 gpm / 24 x 10^6 GPY**

The above water consumption calculations are for Stage I of facility operations, anticipated from January 2005 to July 2005. Based on estimates of increased water consumption from modifications to facility operations:

Stage II: 45 x 10^6 GPY

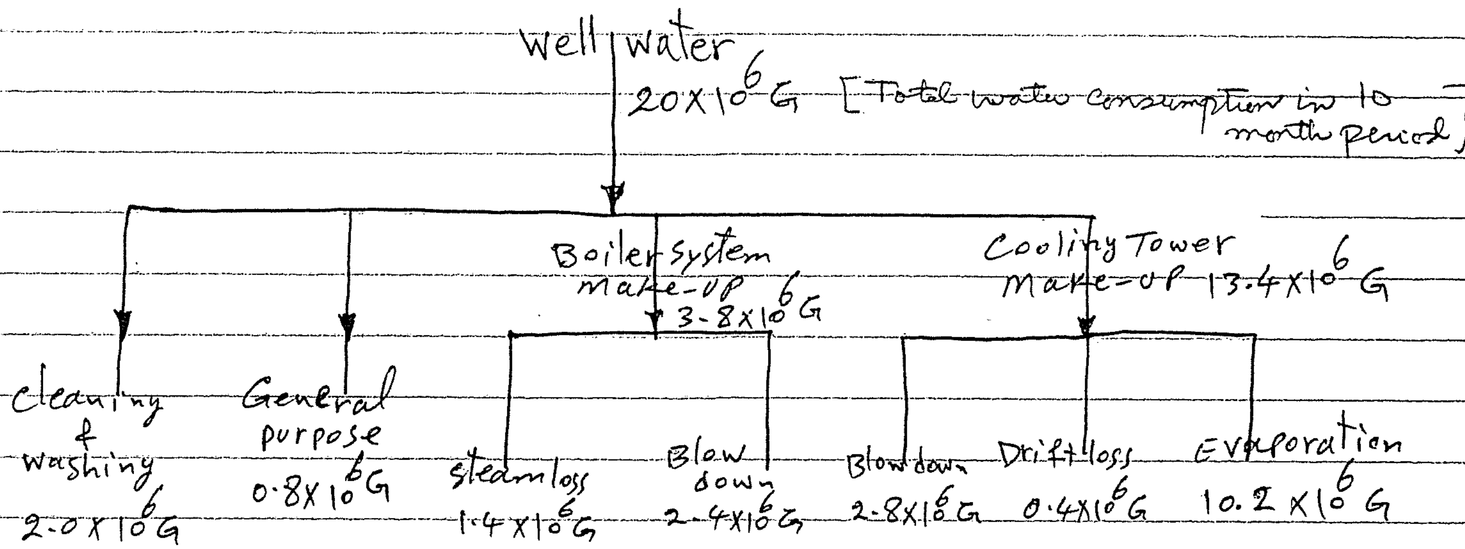
Stage III: 60 x 10^6 GPY

Attachment B

FIGURE 1

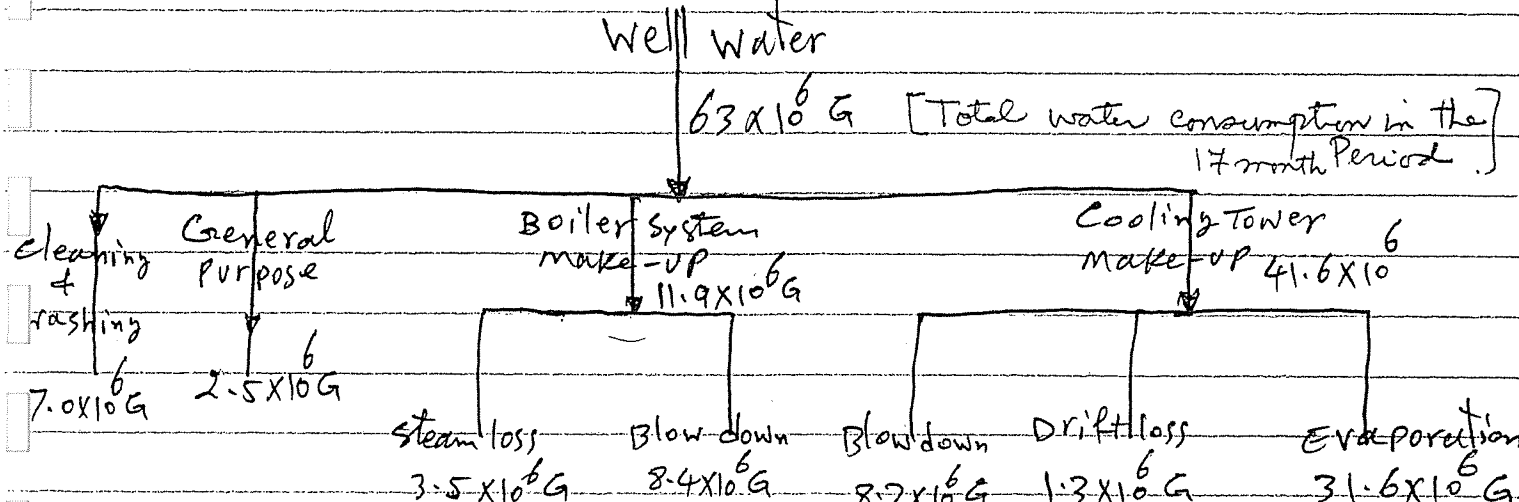
Stay I water Consumption [24×10^6 gal/year]

Startup to Jul. 2005



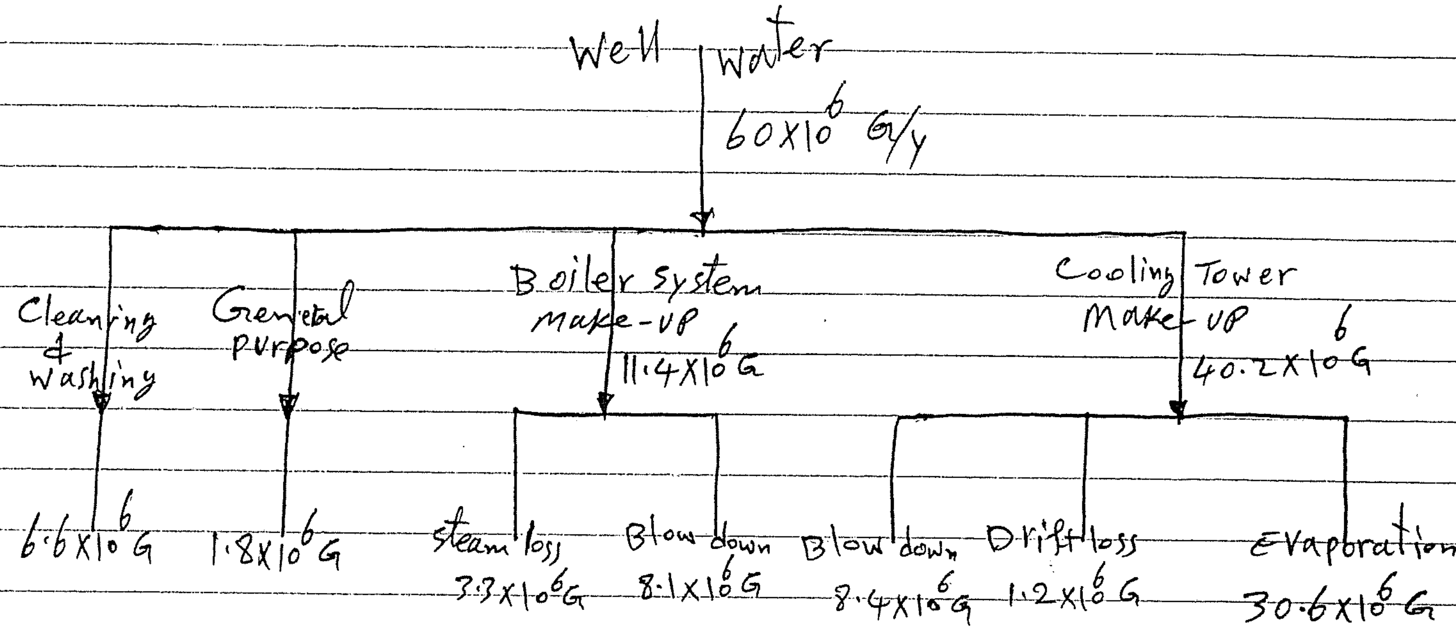
Stay II water Consumption

Aug. 2005 to Dec. 2006 [40×10^6 gal/year]

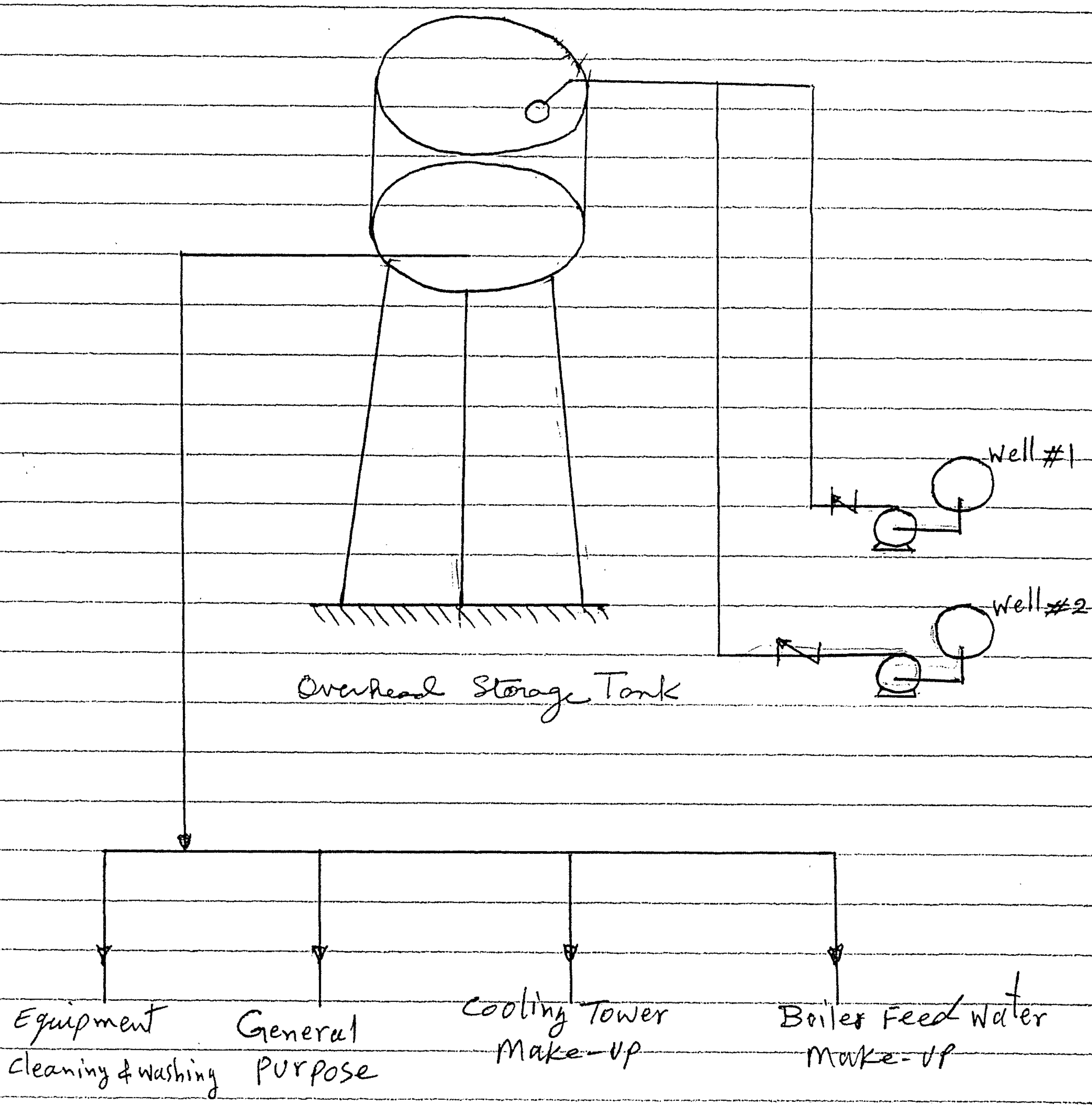


stage III water Consumption (Yearly)

Jan. 2007 to Dec. 2015



Well water Storage & Distribution Schematic Diagram



Attachment C

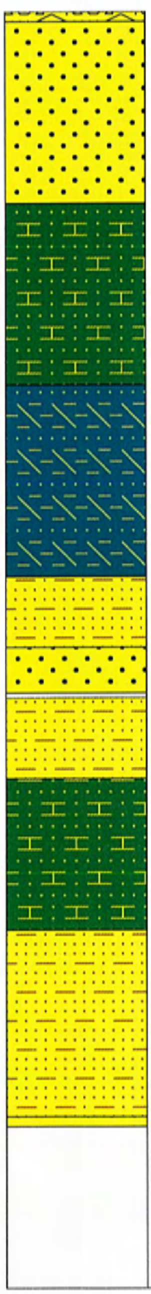
Soil Boring Log

Borehole Number: North Well

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**KmX GW Withdrawal Permitting**	DRILLING CO.:	**Layne Atlantic Company**
SITE LOCATION:		DRILLER:	**AJ Rutter**
JOB NAME:		RIG TYPE:	
LOGGED BY:		METHOD OF DRILLING:	
PROJECT MANAGER:		SAMPLING METHODS:	
DATES DRILLED:	**3/31/47 - 4/5/47**	SAND PACK/BENTONITE	
BOREHOLE NO.:	**North Well**	TOTAL DEPTH:	**259**
WEATHER:		Observed Water Level	NA = Not Applicable
			Page 1 of 1

DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	BLOW COUNT	PID (ppm)	WELL CONSTRUCTION	NOTES

DEPTH: 0, -5, -10, -15, -20, -25, -30, -35, -40, -45, -50, -55, -60, -65, -70, -75, -80, -85, -90, -95, -100, -105, -110, -115, -120, -125, -130, -135, -140, -145, -150, -155, -160, -165, -170, -175, -180, -185, -190, -195, -200, -205, -210, -215, -220, -225, -230, -235, -240, -245, -250



SOIL DESCRIPTION:

- Gravel - coarse Sand ground surface
- Loose coarse Sand, bad water
- Coarse Sand with Clay
- Hard Clay and Sand
- Coarse Sand, trace Clay
- Coarse Sand, trace Shells
- Clay
- Coarse Sand with Clay layers
- Clay with trace Sand
- Medium Sand with Clay
- Fine Sand with Shell

101
75

100-258

LAYNE ATLANTIC COMPANY
NORFOLK, VA.

A.J.Rutter

LOG OF WELL For Kelley H.E. and Company
Located at New Church in Virginia
Date Drilling Started 3-31 1947 Date Started 3-24 1947
Finished Drilling 4- 5 1947 Finished 7-31 1947

FORMATIONS AND DEPTH OF WELL No. 1 — DIMENSIONS OF CASING AND SCREEN

	TOTAL DEPTH OF ALL STRATA FT.	IN.	DEPTH OF EACH STRATUM FT.	IN.	FORMATION FOUND AT EACH STRATUM	TOTAL LENGTH OF ALL SCREENS and CASINGS FT.	IN.	LENGTH OF EACH SEC. OF SCREEN OR CASING FT.	IN.	SPECIFY SCREEN OR CASING	SIZE OF SCREEN OR CASING IN.	GAUGE OF SCREEN
Armco	2		2		Top	60		60		casing	18	5/16
	38		36		Loose coarse sand-bad water SAND	10" casing commences at surface.						
Steel	74		36		Coarse sand with clay-med. hard	110		110		casing	10	40#
Steel	104	10	30	10	Hard clay and sand	140		30		casing	8	30#
#7Opening Everdur	110	10	6		Coarse sand-trace of clay	145		5		screen	8	6
Steel	112	10	2		Course sand-hard rough drilling	184		39		casing	8	30#
#7Opening Everdur	122		9	2	Coarse sand-tr.shell-soft drilling	189		5		screen	8	6
Steel	126		4		Coarse sand-tr. clay	199		10		casing	8	30#
#7 Opening Everdur	128	2	2	2	Sand and shell-very hard	204		5		screen	8	6
Steel	135	6	7	4	Coarse sand-Tr.shell-med.soft	223		19		casing	8	30#
#7 Opening Everdur	136			6	Clay	228		5		screen	8	6
Steel	148		12		Coarse sand-trace of shell	235		7		casing	8	30#
#7 Opening Everdur	150	9	2	9	Same with clay layers	240		5		screen	8	6
Steel	162		11	3	Blue clay- trace of sand	247		7		casing	8	30#
#7 Opening Everdur	182		20		Blue clay-r.sand and shell	252		5		screen	8	6
Steel	214		32		Shell & sand-med. soft drilling	259		7		casing	8	30#
	216		2		Shell and clay							
	219		3		Fine sand and shell							
	221	6	2	6	Shell and sand-med. hard							

100-258

1266

32 partial quality

COMMONWEALTH OF VIRGINIA
WATER CONTROL BOARD
WELL LOCATION FORM

100-258

OWNER H.E. Kelley Co.

USER

LOCATION New Church .2 mi down rd. 709 W. of New Church off 13

COORDINATES N ~~112,500~~ 111,900 E 2,853,~~000~~ 600

ELEVATION 2?0

MAP 142A Hallwood

TOPOGRAPHY

FORMATION

LITHOLOGY

DRILLER Layne-Atlantic Co.

COMPLETED

USE veg. cooling

DEPTH 259

DIAMETER 10-9

	FROM	TO
SCREEN		

STATIC LEVEL

YIELD 254 gpm (365,760 GPD)

PUMPING RATE

DRAWDOWN

TEST LENGTH

SAMPLED

LOCATION BY

DATE

SOURCE OF INFORMATION

REMARKS Drilled

2840 000
+ 13 600
2853 600

(100 900)

2-20-90

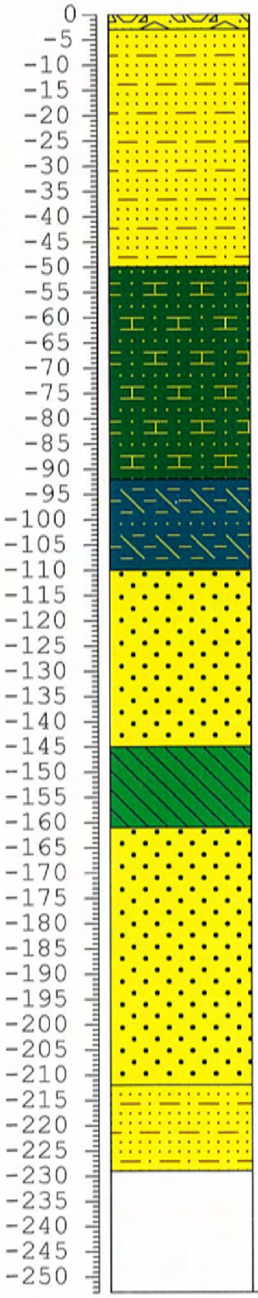
VERIFIED
BY: AH
DATE: 9-24-90

Soil Boring Log

Borehole Number: South Well

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**KmX GW Withdrawal Permitting**	DRILLING CO.:	**Layne Atlantic Company**
SITE LOCATION:		DRILLER:	**AJ Rutter**
JOB NAME:		RIG TYPE:	
LOGGED BY:		METHOD OF DRILLING:	
PROJECT MANAGER:		SAMPLING METHODS:	
DATES DRILLED:	**3/17/47 - 5/16/47**	SAND PACK/BENTONITE	
BOREHOLE NO.:	**South Well**	TOTAL DEPTH:	**253**
WEATHER:		Observed Water Level	NA = Not Applicable
			Page 1 of 1

DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	BLOW COUNT	PID (ppm)	WELL CONSTRUCTION	NOTES



Gravel-coarse Sand ground surface

Loose, Sand, Traces of Clay

CLay and Silt

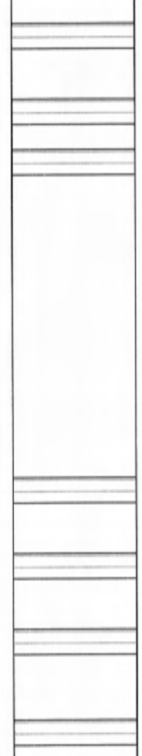
Medium to coarse Sand and Clay

Medium Sand grading from loose to hard

Blue Clay with Shells

Fine Sand with Shells

Medium Sand, Shells, and Clay, grades to Sand as depth increases



Date Drilling Started .... 5-17 ..... 1947 Date Started .... County, State Virginia

Finished Drilling .... 5-16 ..... 1947 Finished 5-24 1947

7-31 1947

FORMATIONS AND DEPTH OF WELL NO. 2.

Well No. 2 is about 1000 feet from well No. 1

TOTAL DEPTH OF ALL STRATA FT.	IN.	DEPTH OF EACH STRATUM FT.	IN.	FORMATION FOUND AT EACH STRATUM	
3		3		Roots and log	
6	6	3	6	Sandy clay	
41		34	6	Loose sand	Sand + Silt
50	4	9	4	Sand-Trace of clay	
92		41	8	Clay- trace of sand	clay + silt
99	5	7	5	Sandy clay	
107		7	7	Coarse sand-med. loose -good	Sand + clay
110	2	3	2	Sand and clay	
116		5	10	Harder sand-trace of good shell	
120	5	4	3	Softer sand-med. coarse-good	
123		2	9	Med. hard sand	
126		3		Med. hard sand with hard streaks	
129		3		Sand-loose-good	
129	4		4	Very hard sand	Sand
140	2	10	10	Med. hard sand-tight	
145	5	5	3	Coarse sand and shell-med. loose-good.	
161		35	7	Blue clay and shell	Blue clay
200		19		Fine sand and shell-loose-fair.	Fine Sand
201		1		Clay	clay
212		11		Same as 161 to 200-fair	Fine Sand
219		7		Sand, shell and clay-slow drilling	Sand + clay
229	5	10	5	Shell and fine sand-mod. loose-This looks better than above and took ...	Fine Sand

DIMENSIONS OF CASING AND SCREEN

TOTAL LENGTH OF ALL SCREENS and CASINGS FT.	IN.	LENGTH OF EACH SEC. OF SCREEN OR CASING FT.	IN.	SPECIFY SCREEN OR CASING	SIZE OF SCREEN OR CASING IN.	GAUGE OF SCREEN	
60		60		casing	16	5/16	Armco
8" casing commences at surface							
100		100		casing	8	30#	Steel
105		5		screen	8	6	#70pening Everdur
115		10		casing	8	30#	Steel
120		5		screen	8	6	#70pening Everdur
125		5		casing	8	30#	Steel
130		5		screen	8	6	#70pening Everdur
140		10		casing	8	30#	Steel
145		5		screen	8	6	#70pening Everdur
189		44		casing	8	30#	Steel
194		5		screen	8		70pening Everdur
204		10		casing	8		
209		5		screen	8		Steel #70pening Steel
221		12		casing	8		
226		5		screen	8		Steel 7Opening Everdur
238		12		casing	8		
243		5		screen	8		Steel 70pening Everdur
253		10		casing	8		Steel

COMMONWEALTH OF VIRGINIA
WATER CONTROL BOARD
WELL LOCATION FORM

100 365

MAY 3 1977

MAY 0 2 1977 STATE WATER CONTROL BOARD

OWNER H E Kelley + Co

USER #2

LOCATION P.O. Box 125, New Church Va

824-4611

COORDINATES N 611900 E 2853600

ELEVATION 20 MAP 142A Hollywood

TOPOGRAPHY

FORMATION LITHOLOGY

DRILLER Layne Atlantic COMPLETED 5/47

USE vegetable canning

	FROM	TO
SCREEN	100	105
	115	120
	125	130
	140	145
	189	191
	204	209
	221	226
	235	243

DEPTH 253

DIAMETER 18 X 8

STATIC LEVEL 9' (5/66)

YIELD

PUMPING RATE

DRAWDOWN

TEST LENGTH

SAMPLED

LOCATION BY DATE

SOURCE OF INFORMATION registration statement

REMARKS 2-20-90

VERIFIED
BY: AW
DATE: 9-26-90

DRAFT

Mitigation Plan
KmX Chemical Corporation
New Church, Virginia

Prepared for:

KmX Chemical Corporation
998 C Old Country Road
Suite #177
Plainview, New York 11803

Prepared by:

Groundwater & Environmental Services, Inc.
Exchange Alley Building
23 South 13th Street, Suite 201
Richmond, Virginia 23219

December 2004

TABLE OF CONTENTS

LIST OF FIGURES

MITIGATION PLAN

DEQ GROUND WATER WITHDRAWAL PERMIT NO. ___________

OWNER NAME: **KmX Chemical Corporation**

FACILITY NAME: **KmX Chemical Corporation**

LOCATION: **30474 Energy Drive, New Church, VA 23415**

INTRODUCTION:

On December 31, 2004, KmX Chemical Corporation (KmX) submitted a Ground Water Withdrawal Permit Application to the Virginia Department of Environmental Quality (DEQ) to withdraw 60,000,000 gallons of ground water per year with a maximum monthly withdrawal limit of 6,500,000 gallons. Ground water withdrawals associated with this permit will be utilized to provide water for the operation of a solvent recovery facility. Specifically, water consumption by the facility can be divided into the following four major groups:

(i) Cooling water makeup;
(ii) Boiler feed water makeup;
(iii) General purpose (for workers to use for bathing, washrooms, etc.);
(iv) Periodic equipment cleaning and washing.

The purpose of this Mitigation Plan is to provide existing ground water users a method to resolve claims that may arise due to the impact of the withdrawal from the facility's two production wells, known as the North Well (100-258) and South Well (100-365).

The predicted drawdown of water levels due to the withdrawal(s) from the Middle Yorktown aquifer was determined based on aquifer testing and subsequent groundwater modeling.

The modeled impacts, as shown on the attached maps, extend beyond the boundary of the facility. Due to these findings, KmX recognizes that there will be a rebuttable presumption that water level declines that cause adverse impacts to existing ground water users within the area of impact are due to this withdrawal. Claims may be made by ground water users outside this area, however, there is a rebuttable presumption that KmX has not caused the adverse impact. KmX proposes this plan to mitigate impacts to existing users and, excludes impacts to wells constructed after the effective date of this permit.

CLAIMANT REQUIREMENT:

To initiate a claim, the claimant must provide written notification of the claim to the following address:

Attn: Plant Manager

KmX Chemical Corporation

30474 Energy Drive

New Church, Virginia 23415

The claim must include the following information: (a) a deed or other available evidence that the claimant is the owner of the well and the well was constructed and operated prior to the effective date of the permit; (b) all available information related to well construction, water levels, historic yield, water quality, and the exact location of the well sufficient to allow to locate the well on the claimant's property; and (c) the reasons the claimant believes that the withdrawal has caused an adverse impact on the claimants well(s).

CLAIM RESOLUTION:

KmX will review any claim within fifteen (15) business days. If KmX determines that no rebuttal will be made and accepts the claim as valid, KmX will so notify the claimant and will implement mitigation within thirty (30) business days. If the claim is not accepted as valid, KmX will notify the claimant that (a) the claim is denied or (b) that additional documentation from the claimant is required in order to evaluate the claim. Within fifteen (15) business days of receiving additional documentation from the claimant, KmX will notify the claimant (a) that KmX agrees to mitigate adverse impacts or (b) the claim is denied. If the claim is denied, the claimant will be notified that the claimant may request the claim be evaluated by a three (3) member committee. This committee will consist of one (1) representative selected by KmX, one (1) representative selected by the claimant, and one (1) representative mutually agreed upon by the claimant and KmX.

Any claimant requesting that a claim be evaluated by the committee should provide the name and address of their representative to KmX. Within fifteen (15) business days of receipt of such notification, KmX will notify the claimant and claimant's representative of the identity of KmX's representative and instruct the representatives to select a third representative within twenty (20) business days. Representatives should be a professional engineer or hydrogeologist with experience in the field of ground water hydrology. KmX agrees to provide reimbursement for its representative and half of the mutual representative for reasonable time spent, at a rate prevailing in the area for experts in the above listed fields, and for direct costs incurred in administering the plan. The claimant will provide the reimbursement for the member of the committee selected by the claimant and half of the reimbursement for the mutual representative.

Within twenty (20) business days of selection of the third representative, the committee will establish a reasonable deadline for submission of all documentation it needs to evaluate the claim. Both the claimant and KmX will abide by this deadline.

Within fifteen (15) business days of receipt of documentation, the committee will evaluate the claim and reach a decision by majority vote. The committee will notify the claimant regarding its decision to (a) deny or (b) approve the claim. If the claim is approved, KmX will mitigate the adverse impacts within thirty (30) business days of making the decision or as soon as practical. If the claim is denied by the committee, KmX may seek reimbursement from the claimant for costs for the 3rd representative on the committee.

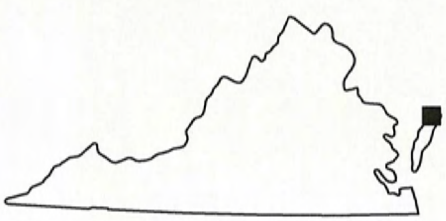
If a claimant within the indicated area of impact indicates that they are out of water, KmX will accept the responsibility of providing water for human consumptive needs within seventy-two (72) hours and to cover the claim review period. KmX reserves the right to recover the cost of such emergency supply if the claim is denied by KmX or found to be fraudulent or frivolous. If KmX denies a claim and the claimant elects to proceed with the three (3) member committee, KmX will continue the emergency water supply at the claimant's request during the committee's deliberations but reserves the right to recover the total costs of emergency water supply in the case that the committee upholds the denial of the claim. Similarly, KmX reserves the right to recover costs associated with the claim process if a claim is found to be fraudulent or frivolous.

If it is determined by the committee or shown to the committee's satisfaction that a well operating under a mitigation plan similar to this Plan other than those owned and operated by KmX has contributed to the claimed adverse impact, KmX's share of the costs associated with mitigation will be allocated in proportion to its share of the impact. Such a determination shall be made by the committee after notification of the third-party well owner, giving the third party well owner opportunity to participate in the proceedings of the committee.

PLAN ADMINISTRATION:

Nothing in this Plan shall be construed to prevent the Department of Environmental Quality Staff from providing information needed for resolution of claims by the committee.

SOURCE: USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE 1992
HALLWOOD, VIRGINIA
CONTOUR INTERVAL = 5'

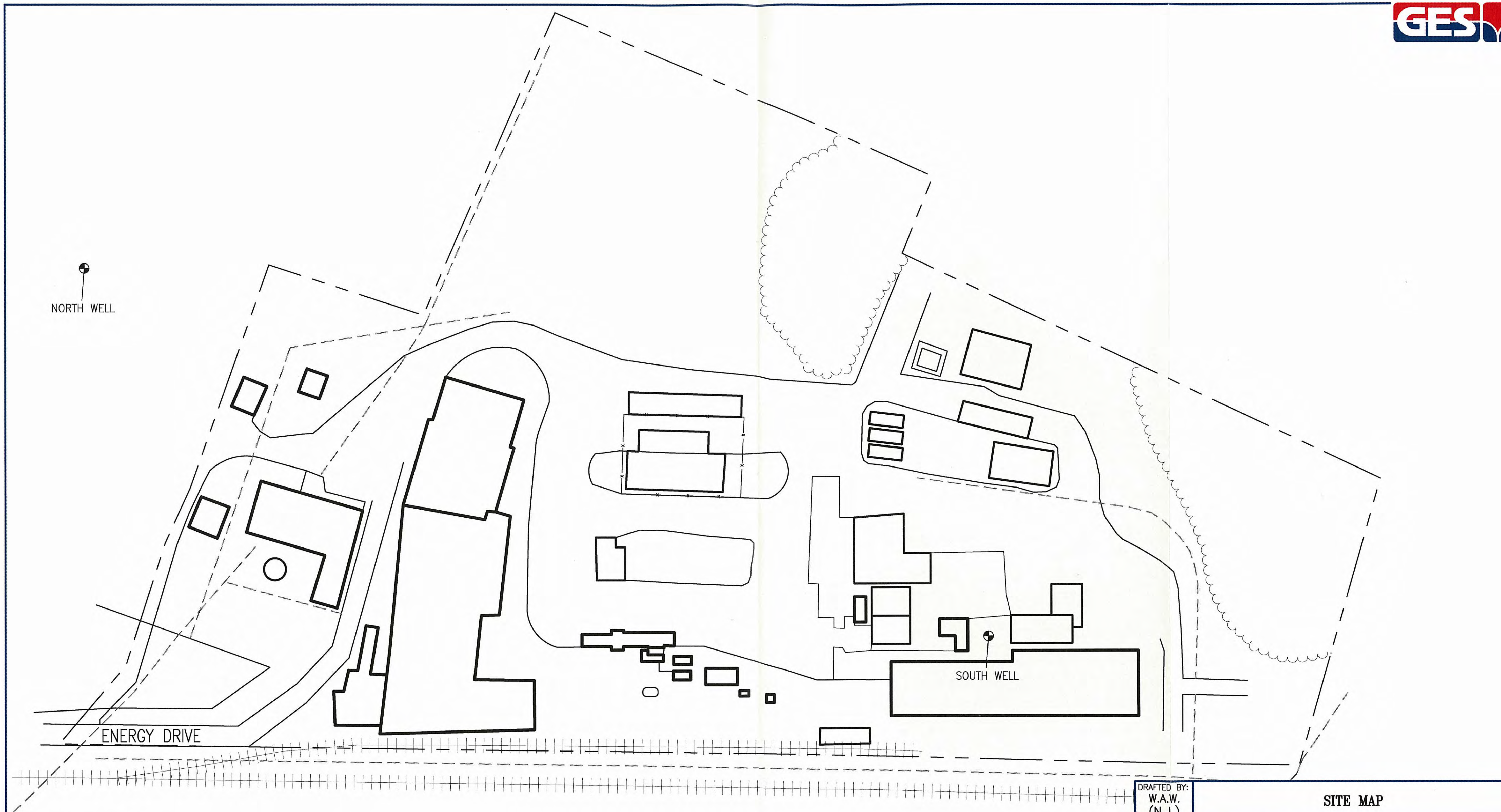


QUADRANGLE LOCATION

LAT. 037° 58' 37.59" N
LONG. 075° 32' 16.91" W
(APPROXIMATE SITE COORDINATES)

DRAFTED BY: W.A.W. (N.J.)	SITE LOCATION MAP
CHECKED BY:	KmX CHEMICAL CORPORATION 30474 ENERGY DRIVE NEW CHURCH, VIRGINIA
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219

SCALE IN FEET	DATE	FIGURE
0 — 2000	12-2-04	1



LEGEND

- PROPERTY LINE
- VEGETATION
- RAILROAD TRACKS
- FENCE LINE
- UTILITY
- WELL LOCATIONS

NOTE:

SCALE AND NORTH ARROW ARE APPROXIMATE.

DRAFTED BY: W.A.W. (N.J.)	SITE MAP		
CHECKED BY:	KmX CHEMICAL CORPORATION 30474 ENERGY DRIVE NEW CHURCH, VIRGINIA		
REVIEWED BY:			
NORTH	Groundwater & Environmental Services, Inc. 23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219		
	SCALE IN FEET (APPROXIMATE) 0 100	DATE 12-15-04	FIGURE 2

M:\Graphics\1200-Richmond\MISC\KmX Chemical Corp\KmX chemical SM.dwg, 12/20/2004 1:38:13 PM, WWesterlund

Perdue

3100-001 / NEW

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

AUG 2008 RECEIVED DEQ TIDEWATER REGIONAL OFFICE

APPLICATION FOR A GROUND WATER WITHDRAWAL PERMIT (FOR USE IN GROUND WATER MANAGEMENT AREAS)

PREAPPLICATION CONFERENCE DATE: 11/9/04

1. APPLICANT INFORMATION: FIN/SSN: ____________

Applicant: Perdue Farms, Inc. Phone: 757-787-5210

Applicant Address: 22520 Lankford Highway, Accomac, VA 23301
(Street, City, State, Zip Code)

2. FACILITY INFORMATION:

Facility/System Name: Perdue Farms, Inc.

Facility Address: Same as above
(If Applicable, Street, City, State, Zip Code)

Contact Name: Bruce Roberts Title: Env. Mgr. Phone: 757-787-5210

Fax: 757-788-5410

Location of Withdrawal Well or Well System: Accomac/Accomac
(County/City)

3. TYPE OF APPLICATION:

This application is for:

( ) Existing withdrawal, not previously
( ) New withdrawal
( ) Expand or enlarge existing permit No.________
( ) Modification of permit No.________
( ) Minor amendment of permit No.________
(X) Renewal of existing permit No. ES-044 with modification
( ) Renewal of existing permit No.____________ without modification

Existing withdrawal permit amount 2,637,850 gallons per day (Day, Month, Year)

Date of expiration of existing Ground Water Withdrawal Permit____________________

Requested withdrawal amount 700,000,000 gallons per year, 78,000,000 gallons per month

4. TYPE OF USE: (Check all that apply)

USE	%USE	USE	%USE
(x) Public Water Supply	2.5	( ) Aquaculture	____
(x) Industrial	97.5	( ) Golf Course Irrigation	____
( ) Commerical	____	( ) Landscape Irrigation	____
( ) Fire Protection	____	( ) Nursery	____
( ) Drought Relief	____	( ) Crop Irrigation	____
( ) Livestock Watering	____	( ) Other__________	____

If type of use is public water supply;

Estimate the percentage of the withdrawal for human consumptive use 2.5 %;

Attach a complete copy of the Virginia Department of Health Water Works Operation Permit and Engineering Description Sheets or equivalent. See Attachment 4

OFFICE USE ONLY **Application #**____________
Date Application Received__________ Date Fee Received__________ Amount__________
Notice Date__________ LGOF Date__________ Returned__________ Date Complete__________

12/08

ATTACHMENT 5
WATER REQUIREMENT JUSTIFICATION

The Perdue Farms Inc., Accomac facility is located approximately one (1) mile north of Accomac, Virginia, and has been in operation since 1971. The facility employs approximately 2,000 people, and is a poultry processing operation at which live poultry is trucked in, processed and packed for shipment. Over the time period the facility has been operational, the chicken products produced have shifted from primarily whole chickens and parts, to cut up pieces that require additional processing and consequently more water to produce. The processing plant currently processes approximately 305,000 chickens per day/1.525 million chickens per five (5) day week, operating twelve (12) months per year and 24 hours per day, with most of the processing typically taking place during the week. Cleanup operations occur at night and on the weekends, and maintenance work generally takes placed on the weekends.

In conjunction with the processing of poultry, Perdue Farms operates a rendering plant at the site to handle the waste by-products from the Accomac facility as well as three (3) other Perdue Farms Inc., processing plants on the Delmarva Peninsula. The products of the rendering operation are animal meals and animal fat products. The meals and fat products are processed and stored for shipment as saleable products.

A garage is located onsite to provide maintenance of the truck fleet and other vehicles used to support the processing and rendering plant operations.

The site also includes a wastewater treatment plant that treats approximately 2.85 million gallons of wastewater seven (7) days a week that is generated from the processing and rendering operations and stormwater. The treated wastewater is either discharged to nearby Parker Creek or reused, with an average of 1,370,000 gallons reclaimed daily for use at the facility yard washdown, rendering area, offal operation, first wash down of Live Receiving areas, and in the wastewater treatment area as dilution water in the lime mixer and wash water on the sludge belt presses.

Water for the Perdue Farms, Inc., facility is provided by six (6) production wells which supply approximately 2.4 million gallons per day for the 5-day processing operation. Five (5) of the production wells (Nos. 1,2,3,4R,5) tap the Middle and Lower Yorktown-Eastover Aquifer and provide the bulk of the groundwater, and one (1) production well (No. 4A) taps the Upper and Middle Yorktown-Eastover Aquifer and primarily serves the truck garage. Raw water pumpage from the production wells at the facility is metered and the total monthly groundwater withdrawal for the years 2003 through 2007 is presented in Table 1, along with the number of birds processed. Monthly records for each well for the years 2003 through 2007 are provided in Table 2.

A schematic diagram showing the Perdue Farms, Inc., water distribution system is shown on Figure 1. The Perdue Accomac complex has two main water feeds, one for the North end of the plant using wells 1, 2, and 3, and one for the South end using wells 4A, 4R, and 5. These two feeds serve the two different sides of the plant, then come together on the water line that includes the water storage tank. The water storage tank line has a CLA-Val valve on it that opens during periods of high water demand and allows water to flow from the tank into the plant water supply system, supplementing the well feed on the two sides of the facility. During periods of low demand the CLA-Val valve closes down, allowing water to flow from the supply system to refill the storage tank. The water storage tank has a capacity of 750,000 gallons, with 187,500 gallons designated for fire protection.

Monthly potable water usage broken down into various categories for the years 2003 through 2007 for the Perdue Accomac facility is presented in Table 3. A description of how the quantities were determined for each category follows.

Total = Metered flow from water wells.

Processing = Metered flow from North and South line water meters, with estimated flows for Condensers, Boiler Feed/Ice, and Sanitary subtracted out. Estimated flows for non-metered areas are then added in (garage, wastewater treatment, etc.).

Sanitation = Metered flow from North and South line water meters, reading taken at the start and end of the sanitation shift.

Condensers = Estimated flow. From operator experience and equipment design information the condensers will use approximately 336,000 to 460,000 gallons per day of operation. For example, in January 2007 the plant operated for approximately 23 days with an estimated average water usage in the condenser equipment of 441,332 gallons per day. 23 days x 441,332 gpd = 10,150,636 gallons per month

Boiler Feed/Ice = Estimated flow. Operator experience and equipment design information shows this water usage to be between 135,000 to 150,000 gallons per day of operation, with ice production accounting for between 7,500 to 12,000 gallons per day of this total. For example, in January 2007 the boilers operated for approximately 27 days (boilers are run for extra days during the month for weekend cleanup operations) with an estimated average water usage of 145,529 gallons per day. 27 days x 145,529 gpd = 3,929,283 gallons per month

Sanitary = Estimated flow. The Water and Wastewater Calculations Manual by Shun Dar Lin, (McGraw-Hill, 2001), shows that the average daily use of water for sanitary purposes per employee in a factory setting is 35 gallons per shift. Estimates are based on a full staff of approximately 2,000 employees plus outside contractors and maintenance personnel, yielding a sanitary flow of 1,800,785 gallons per month for January 2007.

Rendering = Metered flow.

A water balance diagram for the facility based on metered and estimated water volumes for an average day is presented in Figure 2. The flows that are metered are marked on the diagram. The estimated flows were developed from Equipment Design Criteria and knowledge gained from years of operation. The 200,000 gallons listed for Ice, Steam, Cooling Tower, and Finished Product was an estimate developed from knowledge of the amount of ice and water that leaves the plant in the finished product. The steam loss and cooling tower evaporation is known from years of operation and design criteria. The sources of water designated as "Outside Product" on the figure are as follows:

Processing (20,000 gpd) - Bodily fluids from birds processed

- Chemical additives for water treatment in chillers, etc.

Rendering (80,000 gpd) - Processing of blood in centrifuges

- Water with product from other processing plants

Wastewater (2,000 gpd) - Sugar Water

- Sodium Aluminate

Water use data from 2003 through 2007 was deemed the most representative of current operations at the Perdue Accomac facility. Over this time period, the facility withdrew an average of 656 million gallons per year, with a maximum withdrawal of 683 million gallons occurring in the year 2006. The Perdue Accomac complex is currently in the process of increasing production by approximately 13%, from 1.5 million birds per week to 1.7 million birds per week. This will increase the maximum number of birds processed per year to 88,400,000. With a water usage of approximately 7.9 gallons per bird based on 2007 data, this will make the total water required approximately 698 million gallons per year.

88,400,000 birds/year x 7.9 gallons/bird = 698,360,000 gallons per year

Therefore, allowing for an overall increase in the number of birds processed, as well as modest growth in the form of additional processing of chickens to supply new emerging markets, Perdue Farms, Inc. requests a permit to withdraw 700,000,000 gallons per year. A monthly maximum of 78,000,000 gallons is requested based on the facility operating at the maximum permitted daily flow rate of 2.6 million gallons per day for an entire month (30 days).

2.6 million gallons/day x 30 days = 78 million gallons per month

Emerging Markets and Future Growth at Perdue Farms Accomac Complex

As was listed in our response to your March 19, letter (under the Deficiencies 5.4 section) and as clarification.

The example of the emerging markets that was given in section 5 of the original application listed the chicken feet process (only as an example), while this particular process has come to the facility. The very nature of emerging markets is that they are new and emerging, thus just because the chicken feet process is currently in operation does not mean that other emerging or new markets will not appear.

But as was stated in the original response "Any other new processes that should come to the Accomac Plant during this permit cycle are expected to be handled within the current and requested limit". Any expansion of the plants processing areas due to other emerging markets should be handled by the current permitted amount.

TABLE 1
MONTHLY GROUNDWATER WITHDRAWAL/ NO. BIRDS PROCESSED
PERDUE FARMS, INC.
ACCOMAC, VIRGINIA

	2003		2004		2005		2006		2007	
Month	GW Withdrawal (gallons)	No. of Birds	GW Withdrawal (gallons)	No. of Birds	GW Withdrawal (gallons)	No. of Birds	GW Withdrawal (gallons)	No. of Birds	GW Withdrawal (gallons)	No. of Birds
Jan.	60,326,100	7,539,959	57,499,500	7,505,144	53,505,300	7,353,826	58,837,400	7,333,750	51,451,000	6,711,443
Feb.	53,502,700	6,175,994	51,655,200	5,941,135	50,837,500	5,975,979	54,670,800	6,050,446	44,786,000	5,727,468
Mar.	50,284,300	6,047,790	50,603,400	5,774,718	50,151,300	5,744,762	60,430,900	5,880,489	46,986,000	6,002,054
Apr.	55,708,300	7,670,204	54,775,600	7,139,430	55,527,000	7,589,988	55,061,700	7,402,538	46,264,800	5,830,912
May	56,860,200	6,008,260	49,413,000	6,218,013	57,596,900	6,103,084	59,533,336	6,023,660	52,307,600	6,702,949
Jun.	57,929,800	6,700,678	58,393,917	6,147,525	59,960,100	6,534,447	59,172,100	6,362,331	51,590,600	6,402,416
Jul.	56,833,300	7,437,200	56,364,900	7,615,209	59,733,100	7,369,926	57,317,100	7,090,124	52,047,000	6,240,427
Aug.	56,455,000	6,475,013	56,907,200	6,164,585	61,816,100	6,306,508	62,823,000	6,463,908	54,721,000	6,924,473
Sept.	51,562,600	5,676,767	55,318,700	6,266,673	58,787,400	5,629,772	55,389,000	5,650,184	47,416,700	5,951,511
Oct.	57,572,600	7,542,530	58,442,200	7,479,164	55,857,800	7,312,323	56,006,000	7,258,373	52,209,000	6,487,880
Nov.	49,367,000	5,408,510	52,708,200	5,345,959	57,248,500	5,819,454	53,876,000	5,524,465	48,310,600	6,190,546
Dec.	55,568,000	5,317,370	55,016,000	6,676,095	59,377,900	5,866,979	49,870,200	5,663,093	49,054,000	6,078,752
Yearly Tot.	**661,969,900**	**78,000,275**	**657,097,817**	**78,273,650**	**680,398,900**	**77,607,048**	**682,987,536**	**76,703,361**	**597,144,300**	**75,250,831**

TABLE 2
MONTHLY WELL RECORDS FOR THE YEARS 2003 THROUGH 2007
PERDUE FARMS, INC.
ACCOMAC, VIRGINIA

RAW WATER PUMPAGE CALENDAR YEAR 2003

MONTH	WELL NUMBER	TOTAL GALLONS	DAILY AVERAGE	DAYS PUMPED
JANUARY	# 1	7,437,000	265,607	28
	# 2	17,995,000	599,833	30
	# 3	15,210,000	507,000	30
	# 4-A	3,025,100	104,314	29
	# 4-R	6,542,000	261,680	25
	# 5	10,117,000	348,862	29
TOTAL		60,326,100		
FEBRUARY	# 1	6,574,000	243,481	27
	# 2	15,936,000	590,222	27
	# 3	13,614,000	523,615	26
	# 4-A	2,543,700	97,835	26
	# 4-R	6,049,000	274,955	22
	# 5	8,786,000	337,923	26
TOTAL		53,502,700		
MARCH	# 1	6,226,000	207,533	30
	# 2	16,330,000	526,774	31
	# 3	13,638,000	487,071	28
	# 4-A	2,567,300	88,528	29
	# 4-R	6,371,000	245,038	26
	# 5	11,378,000	379,267	30
TOTAL		50,284,300		

APRIL	# 1	6,424,000	229,429	28
	# 2	15,482,000	573,407	27
	# 3	14,111,000	542,731	26
	# 4-A	2,559,300	94,789	27
	# 4-R	6,118,000	266,000	23
	# 5	11,014,000	379,793	29
TOTAL		55,708,300		
MAY	# 1	6,207,000	229,889	27
	# 2	15,406,000	550,214	28
	# 3	13,065,000	502,500	26
	# 4-A	2,562,200	94,896	27
	# 4-R	7,730,000	249,130	23
	# 5	11,890,000	383,548	31
TOTAL		56,860,200		
JUNE	# 1	6,718,000	223,933	30
	# 2	16,435,000	547,833	30
	# 3	14,145,000	505,179	28
	# 4-A	2,866,800	95,560	30
	# 4-R	6,567,000	252,577	26
	# 5	11,198,000	373,267	30
TOTAL		57,929,800		

JULY	# 1	6,118,000	218,500	28
	# 2	16,116,000	575,571	28
	# 3	13,737,000	528,346	26
	# 4-A	2,653,300	91,493	29
	# 4-R	6,083,000	233,962	26
	# 5	12,126,000	391,161	31
TOTAL		56,833,300		
AUGUST	# 1	6,266,000	216,069	29
	# 2	16,073,000	554,241	29
	# 3	13,588,000	503,259	27
	# 4-A	2,714,000	93,607	29
	# 4-R	6,319,000	252,760	25
	# 5	11,495,000	370,806	31
TOTAL		56,455,000		
SEPTEMBER	# 1	6,435,000	221,897	29
	# 2	15,337,000	528,862	29
	# 3	12,291,000	423,828	29
	# 4-A	1,982,600	82,608	24
	# 4-R	4,300,000	172,000	25
	# 5	11,217,000	373,900	30
TOTAL		51,562,600		

OCTOBER	# 1	6,492,000	216,400	30
	# 2	16,606,000	535,677	31
	# 3	13,865,000	495,179	28
	# 4-A	2,525,600	90,200	28
	# 4-R	5,997,000	239,880	25
	# 5	12,087,000	389,903	31
TOTAL		57,572,600		
NOVEMBER	# 1	5,650,000	194,828	29
	# 2	14,082,000	485,586	29
	# 3	11,452,000	440,462	26
	# 4-A	2,271,000	84,119	27
	# 4-R	4,895,000	233,095	21
	# 5	11,017,000	367,233	30
TOTAL		49,367,000		
DECEMBER	# 1	6,323,000	203,968	31
	# 2	15,815,000	527,167	30
	# 3	13,303,000	443,433	30
	# 4-A	2,410,000	80,363	30
	# 4-R	6,272,000	232,296	27
	# 5	11,445,000	369,194	31
TOTAL		55,568,000		

TOTAL FOR YEAR 661,969,300

RAW WATER PUMPAGE CALENDAR YEAR 2004

MONTH	WELL NUMBER	TOTAL GALLONS	DAILY AVERAGE	DAYS PUMPED
JANUARY	# 1	6,788,000	234,069	29
	# 2	16,427,000	566,448	29
	# 3	13,548,000	467,172	29
	# 4-A	2,636,500	90,014	29
	# 4-R	6,376,000	236,148	27
	# 5	11,724,000	378,194	31
TOTAL		57,499,500		
FEBRUARY	# 1	5,764,000	213,481	27
	# 2	14,743,000	546,037	27
	# 3	12,127,000	449,148	27
	# 4-A	2,263,200	83,822	27
	# 4-R	5,344,000	222,667	24
	# 5	11,414,000	393,586	29
TOTAL		51,655,200		
MARCH	# 1	6,325,000	234,259	27
	# 2	16,087,000	574,536	28
	# 3	13,614,000	486,214	28
	# 4-A	2,565,400	88,462	29
	# 4-R	6,205,000	238,654	26
	# 5	12,132,000	404,400	30
TOTAL		50,603,400		

APRIL	# 1	5,835,000	233,400	25
	# 2	15,022,000	600,880	25
	# 3	13,346,000	513,308	26
	# 4-A	2,228,600	89,144	25
	# 4-R	7,226,000	301,083	24
	# 5	11,118,000	370,600	30
TOTAL		54,775,600		
MAY	# 1	6,065,000	233,269	26
	# 2	15,059,000	579,192	26
	# 3	12,695,000	488,269	26
	# 4-A	1,835,000	79,783	23
	# 4-R	5,354,000	267,700	20
	# 5	8,405,000	365,435	23
TOTAL		49,413,000		
JUNE	# 1	6,681,000	230,379	29
	# 2	16,916,000	583,310	29
	# 3	14,286,000	492,621	29
	# 4-A	2,522,900	90,104	28
	# 4-R	5,460,000	202,222	27
	# 5	12,528,017	417,601	30
TOTAL		58,393,917		

JULY	# 1	6,040,000	208,276	29
	# 2	15,773,000	525,767	30
	# 3	13,144,000	486,815	27
	# 4-A	1,792,900	71,716	25
	# 4-R	7,041,000	281,640	25
	# 5	12,574,000	405,626	31
TOTAL		56,364,900		
AUGUST	# 1	6,555,000	211,452	31
	# 2	16,875,000	544,355	31
	# 3	13,653,000	440,419	31
	# 4-A	273,200	30,356	9
	# 4-R	7,671,000	273,964	28
	# 5	11,880,000	383,226	31
TOTAL		56,907,200		
SEPTEMBER	# 1	5,655,000	217,500	26
	# 2	15,257,000	586,808	26
	# 3	12,635,000	485,962	26
	# 4-A	2,115,700	78,359	27
	# 4-R	7,267,000	269,148	27
	# 5	12,389,000	412,967	30
TOTAL		55,318,700		

OCTOBER	# 1	5,911,000	203,828	29
	# 2	16,318,000	562,690	29
	# 3	13,555,000	451,833	30
	# 4-A	2,107,200	75,257	28
	# 4-R	7,995,000	275,690	29
	# 5	12,556,000	405,032	31
TOTAL		58,442,200		
NOVEMBER	# 1	5,897,000	218,407	27
	# 2	15,048,000	557,333	27
	# 3	11,642,000	447,769	26
	# 4-A	2,225,200	85,585	26
	# 4-R	6,448,000	230,286	28
	# 5	11,448,000	381,600	30
TOTAL		52,708,200		
DECEMBER	# 1	6,055,000	224,259	27
	# 2	15,329,000	547,464	28
	# 3	11,912,000	458,154	26
	# 4-A	2,283,000	87,823	26
	# 4-R	6,924,000	238,759	29
	# 5	12,513,000	417,100	30
TOTAL		55,016,000		
TOTAL FOR YEAR		657,097,817		

RAW WATER PUMPAGE CALENDAR YEAR 2005

MONTH	WELL NUMBER	TOTAL GALLONS	DAILY AVERAGE	DAYS PUMPED
JANUARY	# 1	5,644,000	217,077	26
	# 2	14,552,000	559,692	26
	# 3	11,955,000	498,125	24
	# 4-A	2,147,300	82,588	26
	# 4-R	6,577,000	226,793	29
	# 5	12,630,000	421,000	30
TOTAL		53,505,300		
FEBRUARY	# 1	5,521,000	212,346	26
	# 2	14,171,000	566,840	25
	# 3	11,606,000	464,240	25
	# 4-A	2,075,500	83,020	25
	# 4-R	6,040,000	215,714	28
	# 5	11,424,000	408,000	28
TOTAL		50,837,500		
MARCH	# 1	6,447,000	238,778	27
	# 2	15,555,000	598,269	26
	# 3	13,046,000	483,185	27
	# 4-A	2,166,300	83,319	26
	# 4-R	6,598,000	212,839	28
	# 5	12,786,000	412,452	30
TOTAL		50,151,300		

APRIL	# 1	6,760,000	260,000	26
	# 2	15,603,000	577,889	27
	# 3	13,090,000	503,462	26
	# 4-A	340,000	56,767	6
	# 4-R	7,906,000	263,533	30
	# 5	11,828,000	394,267	30
TOTAL		55,527,000		
MAY	# 1	7,083,000	236,100	30
	# 2	15,648,000	539,586	29
	# 3	12,931,000	461,821	28
	# 4-A	2,940,900	108,922	27
	# 4-R	6,636,000	214,065	31
	# 5	12,358,000	398,645	31
TOTAL		57,596,900		
JUNE	# 1	6,960,000	257,778	27
	# 2	15,644,000	601,692	26
	# 3	13,315,000	512,115	26
	# 4-A	3,279,100	121,448	27
	# 4-R	8,264,000	275,467	30
	# 5	12,498,000	416,600	30
TOTAL		59,960,100		

JULY	# 1	6,929,000	247,464	28
	# 2	15,754,000	562,643	28
	# 3	13,264,000	473,714	28
	# 4-A	2,794,100	107,465	26
	# 4-R	8,258,000	266,387	31
	# 5	12,734,000	410,774	31
TOTAL		59,733,100		
AUGUST	# 1	7,314,000	261,214	28
	# 2	16,665,000	574,655	29
	# 3	14,320,000	511,429	28
	# 4-A	3,059,100	105,486	29
	# 4-R	8,571,000	276,484	31
	# 5	11,887,000	383,452	31
TOTAL		61,816,100		
SEPTEMBER	# 1	6,699,000	231,000	29
	# 2	16,014,000	552,207	29
	# 3	13,446,000	467,103	29
	# 4-A	3,416,400	117,807	29
	# 4-R	8,367,000	278,900	30
	# 5	10,845,000	361,500	30
TOTAL		58,787,400		

OCTOBER	# 1	6,495,000	240,556	27
	# 2	15,434,000	571,630	27
	# 3	12,392,000	458,963	27
	# 4-A	3,498,800	124,957	28
	# 4-R	7,372,000	245,733	30
	# 5	10,666,000	344,065	31
TOTAL		55,857,800		
NOVEMBER	# 1	6,377,000	245,269	26
	# 2	15,722,000	582,296	27
	# 3	12,837,000	475,444	27
	# 4-A	3,382,500	125,278	27
	# 4-R	8,171,000	272,367	30
	# 5	10,759,000	358,633	30
TOTAL		57,248,500		
DECEMBER	# 1	6,385,000	245,577	26
	# 2	16,220,000	623,846	26
	# 3	13,267,000	510,269	26
	# 4-A	3,375,900	120,568	28
	# 4-R	8,972,000	289,419	31
	# 5	11,158,000	359,935	31
TOTAL		59,377,900		

TOTAL FOR YEAR 680,398,900

RAW WATER PUMPAGE CALENDAR YEAR 2006

MONTH	WELL NUMBER	TOTAL GALLONS	DAILY AVERAGE	DAYS PUMPED
JANUARY	# 1	6,282,000	241,615	26
	# 2	15,678,000	603,000	26
	# 3	12,982,000	499,308	26
	# 4-A	3,509,400	129,978	27
	# 4-R	9,062,000	292,323	31
	# 5	11,324,000	365,290	31
TOTAL		58,837,400		
FEBRUARY	# 1	5,996,000	249,833	24
	# 2	14,890,000	620,417	24
	# 3	12,107,000	504,458	24
	# 4-A	3,573,800	137,454	26
	# 4-R	7,889,000	281,750	28
	# 5	10,215,000	364,821	28
TOTAL		54,670,800		
MARCH	# 1	6,753,000	241,000	28
	# 2	16,889,000	625,519	27
	# 3	13,624,000	504,593	27
	# 4-A	3,553,900	131,626	27
	# 4-R	8,462,000	272,968	31
	# 5	11,149,000	359,645	31
TOTAL		60,430,900		

APRIL	# 1	6,335,000	243,654	26
	# 2	15,393,000	592,038	26
	# 3	12,210,000	488,400	25
	# 4-A	2,525,700	93,544	27
	# 4-R	8,102,000	270,067	30
	# 5	10,496,000	349,867	30
TOTAL		55,061,700		
MAY	# 1	6,745,000	240,893	28
	# 2	16,476,000	588,429	28
	# 3	13,580,000	502,963	27
	# 4-A	2,462,336	94,705	26
	# 4-R	9,201,000	306,700	30
	# 5	11,069,000	368,967	30
TOTAL		59,533,336		
JUNE	# 1	6,371,000	235,963	27
	# 2	16,506,000	611,333	27
	# 3	13,809,000	511,444	27
	# 4-A	2,226,100	85,619	26
	# 4-R	9,205,000	306,833	30
	# 5	11,055,000	368,500	30
TOTAL		59,172,100		

JULY	# 1	6,702,000	239,357	28
	# 2	16,417,000	586,321	28
	# 3	12,596,000	449,857	28
	# 4-A	3,033,200	108,329	28
	# 4-R	7,908,000	255,097	31
	# 5	10,661,000	343,903	31
TOTAL		57,317,200		
AUGUST	# 1	6,780,000	226,000	30
	# 2	17,764,000	612,552	29
	# 3	14,447,000	498,172	29
	# 4-A	2,964,000	102,207	29
	# 4-R	9,191,000	296,484	31
	# 5	11,677,000	376,677	31
TOTAL		62,823,000		
SEPTEMBER	# 1	5,917,000	219,148	27
	# 2	15,459,000	594,577	26
	# 3	12,338,000	474,538	26
	# 4-A	2,836,000	109,108	26
	# 4-R	8,071,000	278,310	29
	# 5	10,768,000	358,933	30
TOTAL		55,389,000		

OCTOBER	# 1	6,034,000	223,481	27
	# 2	16,804,000	600,143	28
	# 3	13,263,000	473,679	28
	# 4-A	61,000	30,500	2
	# 4-R	8,627,000	278,290	31
	# 5	11,217,000	361,839	31
TOTAL		56,006,000		
NOVEMBER	# 1	6,136,000	227,259	27
	# 2	16,388,000	630,308	26
	# 3	13,062,000	483,778	27
	# 4-A	0	0	0
	# 4-R	7,880,000	271,724	29
	# 5	10,410,000	347,000	30
TOTAL		53,876,000		
DECEMBER	# 1	5,710,000	219,615	26
	# 2	14,904,000	596,160	25
	# 3	11,767,000	490,292	24
	# 4-A	208,200	69,400	3
	# 4-R	7,026,000	250,929	28
	# 5	10,255,000	330,806	31
TOTAL		49,870,200		

TOTAL FOR YEAR 682,987,636

RAW WATER PUMPAGE CALENDAR YEAR 2007

MONTH	WELL NUMBER	TOTAL GALLONS	DAILY AVERAGE	DAYS PUMPED
JANUARY	# 1	6,342,000	234,889	27
	# 2	16,315,000	604,259	27
	# 3	12,477,000	462,111	27
	# 4-A	0	0	0
	# 4-R	6,069,000	195,774	31
	# 5	10,248,000	330,581	31
TOTAL		51,451,000		
FEBRUARY	# 1	5,894,000	235,760	25
	# 2	14,820,000	592,800	25
	# 3	10,402,000	433,417	24
	# 4-A	0	0	0
	# 4-R	4,565,000	182,600	25
	# 5	9,105,000	337,222	27
TOTAL		44,786,000		
MARCH	# 1	6,394,000	228,357	28
	# 2	15,609,000	578,111	27
	# 3	10,456,000	402,154	26
	# 4-A	0	0	0
	# 4-R	4,644,000	165,857	28
	# 5	9,883,000	318,806	31
TOTAL		46,986,000		

APRIL	# 1	5,931,000	237,240	25
	# 2	14,657,000	586,280	25
	# 3	10,691,000	427,640	25
	# 4-A	143,800	71,900	2
	# 4-R	5,156,000	190,963	27
	# 5	9,686,000	334,000	29
TOTAL		46,264,800		
MAY	# 1	6,808,000	252,148	27
	# 2	16,384,000	606,815	27
	# 3	11,392,000	421,926	27
	# 4-A	2,729,600	113,733	24
	# 4-R	4,606,000	153,567	30
	# 5	10,388,000	335,097	31
TOTAL		52,307,600		
JUNE	# 1	6,216,000	239,077	26
	# 2	15,294,000	611,760	25
	# 3	11,482,000	459,280	25
	# 4-A	2,683,600	111,817	24
	# 4-R	5,931,000	204,517	29
	# 5	9,984,000	332,800	30
TOTAL		51,590,600		

JULY	# 1	6,436,000	229,857	28
	# 2	15,862,000	566,500	28
	# 3	12,405,000	443,036	28
	# 4-A	0	0	0
	# 4-R	7,098,000	236,600	30
	# 5	10,246,000	330,516	31
TOTAL		52,047,000		
AUGUST	# 1	6,658,000	246,593	27
	# 2	17,118,000	611,357	28
	# 3	13,354,000	494,593	27
	# 4-A	0	0	0
	# 4-R	8,413,000	280,433	30
	# 5	9,178,000	305,933	30
TOTAL		54,721,000		
SEPTEMBER	# 1	6,044,000	232,462	26
	# 2	14,823,000	570,115	26
	# 3	10,727,000	466,391	23
	# 4-A	603,700	86,243	7
	# 4-R	6,749,000	232,724	29
	# 5	8,470,000	313,704	27
TOTAL		47,416,700		

OCTOBER	# 1	6,299,000	242,269	26
	# 2	16,103,000	619,346	26
	# 3	13,300,000	511,538	26
	# 4-A	0	0	0
	# 4-R	6,863,000	221,387	31
	# 5	9,644,000	332,552	29
TOTAL		52,209,000		
NOVEMBER	# 1	5,928,000	219,556	27
	# 2	14,836,000	593,440	25
	# 3	11,970,000	478,800	25
	# 4-A	278,600	69,650	4
	# 4-R	6,775,000	225,833	30
	# 5	8,523,000	304,393	28
TOTAL		48,310,600		
DECEMBER	# 1	6,102,000	226,000	27
	# 2	15,301,000	588,500	26
	# 3	12,252,000	471,231	26
	# 4-A	0	0	0
	# 4-R	6,327,000	204,097	31
	# 5	9,072,000	312,828	29
TOTAL		49,054,000		
TOTAL FOR YEAR		597,144,300		
		85,843,336		

TABLE 3
MONTHLY POTABLE WATER USAGE FOR THE YEARS 2003 THROUGH 2007
PERDUE FARMS, INC.
ACCOMAC, VIRGINIA

2003 Monthly Water Usage

Month	total	Processing	Sanitation	Condensers	Boiler Feed/ Ice	Sanitary	Rendering
January	60,326,100	21,717,396	15,081,525	10,858,698	4,222,827	2,413,044	6,032,610
February	53,502,700	19,260,972	13,375,675	9,630,486	3,745,189	2,140,108	5,350,270
March	50,284,300	18,102,348	12,571,075	9,051,174	3,519,901	2,011,372	5,028,430
April	55,708,300	20,054,988	13,927,075	10,027,494	3,899,581	2,228,332	5,570,830
May	56,860,200	20,469,672	14,215,050	10,234,836	3,980,214	2,274,408	5,686,020
June	57,929,800	20,854,728	14,482,450	10,427,364	4,055,086	2,317,192	5,792,980
July	56,833,300	20,459,988	14,208,325	10,229,994	3,978,331	2,273,332	5,683,330
August	56,455,000	20,323,800	14,113,750	10,161,900	3,951,850	2,258,200	5,645,500
September	51,562,600	18,562,536	12,890,650	9,281,268	3,609,382	2,062,504	5,156,260
October	57,572,600	20,726,136	14,393,150	10,363,068	4,030,082	2,302,904	5,757,260
November	49,367,000	17,772,120	12,341,750	8,886,060	3,455,690	1,974,680	4,936,700
December	55,568,000	20,004,480	13,892,000	10,002,240	3,889,760	2,222,720	5,556,800
Totals	661,969,900	238,309,164	165,492,475	119,154,582	46,337,893	26,478,796	66,196,990
		36.00%	25.00%	18.00%	7.00%	4.00%	10.00%

TABLE 3 CONTINUED

2004 Monthly Water Usage

Month	total	Processing	Sanitation	Condensers	Boiler Feed/ Ice	Sanitary	Rendering
January	57,499,500	20,699,820	14,374,875	10,349,910	4,024,965	2,299,980	5,749,950
February	51,655,200	18,595,872	12,913,800	9,297,936	3,615,864	2,066,208	5,165,520
March	50,603,400	18,217,224	12,650,850	9,108,612	3,542,238	2,024,136	5,060,340
April	54,775,600	19,719,216	13,693,900	9,859,608	3,834,292	2,191,024	5,477,560
May	49,413,000	17,788,680	12,353,250	8,894,340	3,458,910	1,976,520	4,941,300
June	58,393,917	21,021,810	14,598,479	10,510,905	4,087,574	2,335,757	5,839,392
July	56,364,900	20,291,364	14,091,225	10,145,682	3,945,543	2,254,596	5,636,490
August	56,907,200	20,486,592	14,226,800	10,243,296	3,983,504	2,276,288	5,690,720
September	55,318,700	19,914,732	13,829,675	9,957,366	3,872,309	2,212,748	5,531,870
October	58,442,200	21,039,192	14,610,550	10,519,596	4,090,954	2,337,688	5,844,220
November	52,708,200	18,974,952	13,177,050	9,487,476	3,689,574	2,108,328	5,270,820
December	55,016,000	19,805,760	13,754,000	9,902,880	3,851,120	2,200,640	5,501,600
Totals	657,097,817	236,555,214	164,274,454	118,277,607	45,996,847	26,283,913	65,709,782
		36.00%	25.00%	18.00%	7.00%	4.00%	10.00%

TABLE 3 CONTINUED

2005 Monthly Water Usage

Month	total	Processing	Sanitation	Condensers	Boiler Feed/ Ice	Sanitary	Rendering
January	53,505,300	19,261,908	13,376,325	9,630,954	3,745,371	2,140,212	5,350,530
February	50,837,500	18,301,500	12,709,375	9,150,750	3,558,625	2,033,500	5,083,750
March	50,151,300	18,054,468	12,537,825	9,027,234	3,510,591	2,006,052	5,015,130
April	55,527,000	19,989,720	13,881,750	9,994,860	3,886,890	2,221,080	5,552,700
May	57,596,900	20,734,884	14,399,225	10,367,442	4,031,783	2,303,876	5,759,690
June	59,960,100	21,585,636	14,990,025	10,792,818	4,197,207	2,398,404	5,996,010
July	59,733,100	21,503,916	14,933,275	10,751,958	4,181,317	2,389,324	5,973,310
August	61,816,100	22,253,796	15,454,025	11,126,898	4,327,127	2,472,644	6,181,610
September	58,787,400	21,163,464	14,696,850	10,581,732	4,115,118	2,351,496	5,878,740
October	55,857,800	20,108,808	13,964,450	10,054,404	3,910,046	2,234,312	5,585,780
November	57,248,500	20,609,460	14,312,125	10,304,730	4,007,395	2,289,940	5,724,850
December	59,377,900	21,376,044	14,844,475	10,688,022	4,156,453	2,375,116	5,937,790
Totals	680,398,900	244,943,604	170,099,725	122,471,802	47,627,923	27,215,956	68,039,890
		36.00%	25.00%	18.00%	7.00%	4.00%	10.00%

TABLE 3 CONTINUED

2006 Monthly Water Usage

Month	total	Processing	Sanitation	Condensers	Boiler Feed/ Ice	Sanitary	Rendering
January	58,837,400	24,386,591	11,589,000	10,590,732	4,353,968	2,059,309	5,857,800
February	54,670,800	20,282,867	13,667,700	9,840,744	4,045,639	1,913,478	4,920,372
March	60,430,900	22,419,864	15,107,726	10,877,562	4,471,887	2,115,082	5,438,781
April	55,061,700	22,161,669	11,683,000	9,911,106	4,074,566	1,927,160	5,304,200
May	59,533,336	23,760,702	12,862,000	10,716,000	4,405,467	2,083,667	5,705,500
June	59,172,100	22,182,263	13,551,000	10,650,978	4,378,735	2,071,024	6,338,100
July	57,317,100	22,018,958	12,794,000	10,317,078	4,241,465	2,006,099	5,939,500
August	62,823,000	24,083,053	13,573,000	11,308,140	4,648,902	2,198,805	7,011,100
September	55,389,000	20,873,979	12,109,000	9,970,020	4,098,786	1,938,615	6,398,600
October	56,006,000	21,957,866	11,417,000	10,081,080	4,144,444	1,960,210	6,445,400
November	53,876,000	22,004,824	10,489,612	9,697,680	3,986,824	1,885,660	5,811,400
December	49,870,200	18,601,212	11,769,000	8,976,636	3,690,395	1,745,457	5,087,500
Totals	682,987,536	264,733,848	150,612,037	122,937,756	50,541,078	23,904,564	70,258,253

TABLE 3 CONTINUED

2007 Monthly Water Usage

Month	total	Processing	Sanitation	Condensers	Boiler Feed/ Ice	Sanitary	Rendering
January	51,451,000	18,380,195	11,638,000	10,150,640	3,929,280	1,800,785	5,552,100
February	44,786,000	16,368,772	10,178,348	8,837,790	3,421,080	1,567,510	4,412,500
March	46,986,000	16,780,230	10,580,000	9,126,090	4,085,270	1,644,510	4,769,900
April	46,264,800	16,869,150	11,316,000	9,048,082	3,551,400	1,619,268	3,860,900
May	52,307,600	17,771,324	13,155,000	10,836,670	4,194,840	1,830,766	4,519,000
June	51,590,600	18,121,000	12,623,000	10,943,000	3,420,629	1,805,671	4,677,300
July	52,047,000	20,594,485	10,439,960	10,598,470	3,328,440	1,821,645	5,264,000
August	54,721,000	20,497,990	12,594,000	10,978,835	4,104,840	1,915,235	4,630,100
September	47,416,700	16,811,259	11,755,900	9,086,018	3,749,739	1,659,585	4,354,200
October	52,209,000	19,445,869	12,237,300	10,031,972	3,883,344	1,827,315	4,783,200
November	48,310,600	16,739,882	12,419,800	9,076,135	3,734,712	1,690,871	4,649,200
December	49,054,000	16,634,029	13,855,400	8,825,017	3,607,164	1,716,890	4,415,500
Totals	597,144,300	215,014,185	142,792,708	117,538,719	45,010,738	20,900,051	55,887,900

ATTACHMENT 13
WATER CONSERVATION AND MANAGEMENT PLAN

1. Water Saving Plumbing and Processes

Equipment used in the processing facility is continually upgraded and effectively reduces the amount of water required to perform similar operations in the past. All new equipment is evaluated with regards to its economical use of water, and outside sources are continually brought in to discuss new technologies. Some of the upgrades that Perdue has implemented to save water include the following:

- Installed main shut off valves in key department to aid in quickly turning off water.
- Installed a water pressure control system to regulate the inlet pressure of all potable water users at the facility and control water use.
- 24-hour chart recorder being used to understand water pressure variations and enable adjustments to be made.
- Replaced screens at Offal area which reduced loads to wastewater facility and allowed for more efficient use of water.
- Replaced 90 nozzles on bird washers rated at 1 gpm with nozzles rated at 0.5 gpm (save 45 gpm).
- Installed flow restricting orifices on 16 high pressure hoses in Evisceration, reducing the flow from 12.5 gpm to 7.5 gpm (save 80 gpm).
- Replaced the medium pressure storage tank that was leaking approximately 60 gpm (save 60 gpm).
- Installed check valves on the medium pressure lines which prevented water from overflowing out of the medium pressure tank during the weekends due to gravity
- Installed flow restricting orifices on three wash tables, reducing the flow from 12.5 gpm to 5 gpm (save 22.5 gpm).
- Replaced 12 shower heads rated 2.2 gpm with heads rated 1 gpm (save 14.4 gpm).
- Replaced 30 nozzles in Cut-up belt washers that reduced water usage by 40,000 gallons per day.
- Replaced 35 nozzles in Thigh Deboning that were using 20 gpm with new nozzles which are using only 4.2 gpm (save 15.8 gpm).
- Replaced old cooling towers at Rendering (save 60,000 gallons per day).

Additional water saving efforts being considered by Perdue Farms, Inc. include the following:

- Determine where more dry cleanup can occur.
- Seek alternative process to handle spent ice.
- Inside/Outside Birdwasher water reuse.
- Install additional meters to quantify water use.
- Reuse condenser blowdown water.

- Vacuum product to Offal.
- Use higher pressure water and less volume.
- Processing and Rendering to use heat exchangers, thereby reducing boiler operations and water use.

Should renovations at the facility occur, any domestic plumbing fixtures replaced will meet the most recent Uniform Statewide Building Code for ultra low water consumption.

2. **Water Loss Reduction Program**

To ensure water is used in the most efficient and effective way, Perdue Farms, Inc. formed a Water Conservation Team. Team members include representatives from the different areas of the facility, including First Processing, Further Processing, Maintenance, Sanitation, and all facility department managers. Duties of team members include the following:

- Audit meters and graph water usage daily
- Report leaks
- Report unnecessary use of water
- Turn water on just before start-up
- Turn water off at breaks and lunch
- Turn water off at conclusion of processing day
- End of day report of any water left on
- Report any belt washer or hose that is missing nozzle
- Maintain and monitor heavy water users in each area
- Attend a Water Conservation Team meeting every two weeks

The facility processing and plumbing systems are inspected and maintained on a regular basis. Any leaks are repaired promptly. The plant manager and water system maintenance supervisor are instructed to note areas where changes in the operating procedure and/or equipment setup will help to conserve water, or reduce losses.

3. **Water Use Education Program**

Employees receive instruction as to the importance of efficient water use and conservation methods during their orientation. Ownership by all is stressed.

The Wastewater Manager and Environmental Manager attend production and staff meetings to report on water related activities and concerns. Continued improvements are stressed as part of management goals. All managers within the facility have signed a water economy pledge stating: **We as managers of our areas support efforts to use water in the most efficient and effective way. It is realized that our customers will not pay for our inefficiencies. We will strive to be the leaders in water conservation within the industry.**

Perdue Farms, Inc. has a water conservationist to expedite reductions in water use at the facility. Meters have been installed to quantify water use in various areas of the facility including:

- Entry points to Processing Plant
- Rendering
- Chiller water
- Inside/Outside Birdwasher machines
- Medium pressure pumps
- High pressure pumps
- Breast Debone Room
- Thigh Debone Room
- Evisceration chlorinated lines
- GIB systems
- Garage
- Wastewater discharge
- Sanitation

Individual departments graph and chart water use in their areas, and graphs and charts of facility water use are posted daily. Additional meter locations are pending.

- **Evaluation of Potential Water Reuse Options**

Process wastewater is collected and pumped to the facility wastewater treatment plant where it is treated and is either discharged to nearby Parker Creek, or is reclaimed for use (average 1,370,000 gpd) in the facility yard washdown, rendering area, offal operation, first wash down of Live Receiving areas, and in the wastewater treatment area as dilution water in the lime mixer and wash water on the sludge belt presses. Wastewater from sinks and restrooms at the facility also drains to the wastewater treatment plant.

Various projects have been undertaken to reduce water use at the facility, and Perdue Farms, Inc. is committed to identifying areas where additional treated wastewater can be reused.

- **Requirements for Mandatory Water Use Reductions**

Perdue Farms, Inc. will comply with any mandatory water use reductions during water shortage emergencies declared by the State government, local governing body, or the Director of VA DEQ. This will include provision of requirements for mandatory water use restrictions to employees and prohibiting all non-essential uses. Perdue Farms, Inc. agrees to pay any penalties assessed for failure to comply with mandatory water use restrictions during water shortage emergencies declared by the State government, local governing body, or the Director of VA DEQ.

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT
TRAILS END CAMPGROUND. HORNTOWN – ACCOMACK COUNTY, VA

ATTACHMENT (Section 5).

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Nature of Activity Utilizing Water and Documentation of Beneficial Use

The Trails End Campground is located approximately one mile southeast of Horntown, Virginia and has been in existence for at least the last 30 years. It consists of 2,600 sites for campers and trailers. Of these sites, there are 173 permanent sites (according to VDH records) and 2,427 transient sites at the facility. Permanent sites account for 6.7% of all sites. The transient sites accommodate trailers and campers of differing size with electrical and water hook-ups. Transient sites are used for a variable duration throughout the year. Some may be used for a weekend; others for months, and some sites remain unused for years.

Geographic expansion of the facility is not a possibility. The facility, in the past, owned all of the land and all of the 2,600 lots that were sold as individual parcels. The development corporation that initially constructed the site no longer owns lots for sale. All current sales are either by private parties that elect to sell their individual parcel or by the resale of foreclosed properties[1]. As such, the Trails End Utility Company does not have knowledge of current private sales unless they don't receive the required dues.

Normal operations at the facility require potable water for drinking and cooking, showers, washing (dishes, clothes, pool refilling, and occasional cleaning of boats, trailers, and campers, etc.), and minimal to no irrigation practices. Firefighting water may be supplied by the water distribution system, however the local creeks are outfitted for rapid withdrawals.

According to annual water use reports, the facility currently utilizes an average of approximately 15.05-MG/y[2]. The maximum annual use over the reviewed time period (1996-2004) was 16.45-MG/y and the minimum being 8.668-MG/y[3]. Typical high use events occur in the summer when occupancy is at a maximum[4]. Estimates of use can be assessed on historical usage and not by an approximate basis which would include site occupancy and time. These variables change throughout the year/s, and are difficult to forecast or predict.

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[1] The Trails End Utility Company maintains records on dues owed to the utility company. If annual dues are not paid in full, the property is considered abandoned and is to be foreclosed upon by the Chincoteague Bay Trails End Association Inc.

[2] Please review attached tabular data and graphs. The average use data was corrected: data for 2000 was excluded, as it was incomplete.

[3] See figure 3.a for tabular data

[4] See figure 3.c for usage distribution

Water Demand Projections and Justification of Withdrawal Request

** NOTE: Water use and projections are based on best available data. There are no facility records that support actual site usage or actual attendance. All values are based on the lowest known, approximated, site occupancy which is approximated to be 3.3 people at approximately 100 individual sites. There is NO ABSOLUTE methodology to estimate a reliable projected withdrawal as there is no known base unit other than total withdrawal data. The following items are known:

- Annual withdrawal records are available, and are reliable
- There are no records of attendance, hence there is no known, accurate, basic attendance unit
- There are no unique records of billing held by the utility company; dues are based on over-all demand and billed to all lots occupied or not
- Individual site metering is not practiced; no specific per-site usage detail exists
- Of 2,600 designed sites, some have been converted to full-time, year round residences
- The only reliable method of projection is based on regression analysis and compounding usage

The facility does not practice any landscape irrigation. There is no municipal water supply that may be used in lieu of groundwater. There are no onsite ponds and regional creek water is not a suitable source for potable water. Groundwater has been historically withdrawn at this facility for potable water and is the only reliable source.

Trails End Utility Company management has reviewed the current operation, water demand, and economy as it pertains to the resale of sites at the facility. This review led to a projection of water needs over the next 10-years. The following paragraph outlines the projected needs relative to the beneficial use described above.

The facility has a designed capacity of 2,600 campsites/lots. All 2,600 lots are outfitted with water service but not all have sewage. There are 26 "Comfort Stations" placed throughout the facility (must be within 800' of campsites) to accommodate the sanitary needs of those who do not have permitted sewage available at their individual site. According to the Virginia Department of Health, the facility has 175 individually permitted septic systems[5]. In addition to the comfort stations, there is a general store located within the facility that is open year-round and utilizes some water.

Projecting the facilities' groundwater needs ten years out, requires understanding of potential resale development of the facility. Resale opportunities are not a function of the Management and cannot be forecasted accurately. According to utility company dues are owed on an annual basis; approximately 500 of the 2,600 sites have been dormant since they have not produced their annual dues. According to the utility management company, there has been an increase in campsite resale as they have

[5] These systems do not correlate with permanent residents. Some permanent residents do not have on-site sewage and elect to use the comfort stations. About 30 sites are occupied throughout the year

been receiving more annual dues. On average, about 2,100 sites have accounted for the current water use. Water use over the last five years is believed to be dependent upon these 2,100 sites.

The average consumption from the last nine years (1998-2005) is approximately 15.5-MG/y[6]. Considering this average maximum, annual water consumption and the number of active connections, the current average water demand is equivalent to 7,372-gpy (20.2-gpd) per connection[7],[8]. These low averages indicate that the majority of the water use at the facility is used seasonally as figure 3.c clearly illustrates a seasonal use regime. Actual water use and consumption cannot be accurately assessed on a per person scale, as there is no known attendance log.

There are three variables that change from year to year; 1.) Number of permanent residents is increasing, 2.) The resale and reuse of sites is increasing, 3.) General vacation stays are becoming longer.

Please review the associated usage charts contained herein[9]. They depict the actual reported values since 1998. The annual distribution of use is a month-by-month comparison of water usage. The summer months are clearly the highest usage months. These charts can be used together to assist in the approximation of future withdrawals. Figure 3.f is a simple chart depicting the usage of water from 2001-2005. A linear regression shows that steady growth will yield in withdraws of about 26 million gallons by 2014.

Two methods may be used to estimate the future water demand of the facility. The first method is simple calculation of need based on current usage and known site occupancy. For example, according to 2004 totals, approximately 2,100 site were used for that year. From figure 3.e we calculated an average per site, per day allotment of 20.2 gallons. If this number is expanded out to 2,600 sites the yield is higher:

$$\frac{15.48MG}{(365_{days} \times 2{,}100_{sites})} = 20.2_{gallons}$$

$$20.2_{gallons} \times 365_{days} \times 2{,}600_{sites} = 19.17MG$$

[10]

This yield of 19.17MG/year is a gross approximation. The above approximation does not account for many variants. Therefore, the above-calculated method of determination is not considered accurate and does not model the facilities actual use.

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6 See Figure 3.a

7 See figure 3.e

8 This average is calculated by utilizing the facilities reliable occupancy of about 2,100 sites. Individual site occupancy is virtually unknown, but is assumed to be at least 2 people (the majority of land owners are of retirement age).

9 See figures 3.a through 3.e

10 Use estimate approximation method #1. These values are gross approximations. They are not considered accurate, as they cannot account for variables such as fluctuating occupancy, sublets, seasonal use, additional guest occupancy, and other pre-paid site plans.

A secondary method utilizing a differential approach is needed in order to extend the future approximations more accurately. *There are no documents available that can account for the number of occupants any given moment.* However, the utility company staff and on-site security both agree that during the peak off-season about 100 people are still present. The facility believes that this number of occupants is a tangible number. Assuming that no less than 100 occupants are present, that value can be utilized as the facilities lowest recorded withdrawal amount. The correlating number yields the following gallon-per-person-per-day amount:

$$\frac{\dfrac{\left(205{,}600^{Jan2000}_{gallons}\right)}{100_{occupants}}}{31_{days}} = 68.32_{gpd/perperson}$$

This value is commensurate with the Virginia Department of Health's' 75gpd/pp value. This value can be used to extrapolate the number of users that may be present throughout any given month at this facility. It is important to state that the facility cannot furnish attendance records: all calculations are based on interviews and reported withdrawals.

To better understand site usage, a method had to be established to better understand the use distribution throughout the months. Please refer to figure 3.g for calculations. In general, an annualized monthly usage value had to be established. In figure 3.g line 1 is an annualized average of use based the values tabulated in figure 3.a. Line 3 is derived from the Gallon Per Day value calculated from the Actual Use Heading of figure 3.e. Line 3 is divided by the average site occupant value (line 4) to yield the approximate sites used from the beginning of the month to the end.

$$\frac{\dfrac{\dfrac{GPM_{annualized}}{68.32_{gal/person}}}{DAYS_{permonth}}}{Occupants_{persite}} \times Days_{permonth} = Sitedays_{permonth}$$

In order to establish the variation of attendance, the total amount of "site-days" is calculated by multiplying the number of sites used by the number of days in the month. Please refer to the following algorithm:

$$\frac{\dfrac{\dfrac{608{,}568_{GPM}}{68.32_{gal/person}}}{31_{DaysJan}}}{3.3_{Occupants}} \times 31_{DaysJan} = 2{,}699_{sitedays}$$

The term "sitedays" refers to the total amount of occupancy that occurs through a calendar month (based on reported withdrawal). Because weekends typically experience increased occupancy (minimum 50% greater than weekdays)[11], the siteday calculation method allows for numerical realignment of data so that a more reliable occupancy value is available. This method effectively illustrates the variable weekday occupancy.

- Step 1 Siteday normalization

$$\frac{2{,}699_{sitedays}}{7_{days}} = 385.61_{sitedays/day}$$

- Step 2 Weekday/weekend allotment

$$385.61_{sitedays/day} \times 3_{days\_fir-sun} = 1{,}156.83_{sitedays\_weekend}$$

$$385.61_{sitedays/day} \times 4_{days\_mon-thr} = 1{,}542.44_{sitedays\_weekday}$$

$$1{,}542.44_{sitedays\_weekday} \times 50\%_{increase\_weekend\_occupancy} = 771.22_{sitedays\_50\%\_additional\_weekend}$$

$$771.22_{sitedays\_50\%\_additional\_weekend} + 1{,}153.83_{sitedays\_weekend} = 1{,}928.05_{sitedays\_weekend\_total}$$

$$2{,}699_{Sitedays\_total} - 1{,}928.05_{sitedays\_weekend\_total} = 770.95_{siteday\_weekdays}$$

- Step 3 Weekday occupancy

$$\frac{770.95_{siteday\_weekdays}}{17.33_{weekdays/month}} = 44.48_{weekday\_sites\_January}$$

$$44.48_{sites\_January} \times 3.3_{occupants/site} = 146.80_{people}$$

- Step 4 Weekend occupancy

$$\frac{1{,}928.05_{siteday\_weekend}}{13_{weekend\_days/month}} = 148.31_{weekend\_sites\_january}$$

$$148.31_{weekend\_sites\_january} \times 3.3_{occupants/site} = 489.42_{people}$$

Using the annualized January data we can extrapolate that on any given weekend in January, at least 146 Sites are occupied. An important note is that when evaluated the estimated monthly withdrawal, tenants calculated as weekday occupants are assumed to be present during the weekends. This method of calculation works for estimating occupancy throughout the whole year.

Weekend and Holiday occupancy in the peak months is typically greater and is often in the 4-5 people per site range. Facility crews have seen as many as 12 occupants per site during the summer months. It is plausible that as the facility continues its current resale trend, site occupancy will likely remain near its calculated norm. However, in

[11] Actual site occupancy can not be determined. The occupancy balance can only be substantiated by visual observations. The facilities security group only has the ability to collect the number of times a vehicle has passed the gate. There is no methodology established to differentiate the number of repeat entries by any one vehicle. The per-site occupancy approximations are based on visual inspections by the security group. There are no records to support actual occupancy. The occupancy rates used in this document are best-faith estimates. The distribution of seasonal occupancy is correlated with the facilities historical water distribution. The siteday methodology is the best approximation possible to estimate the variance of withdrawal seen during the increased usage seasons.

estimating future withdrawals, accounting for increased site occupancy provides room for withdrawal growth. Reliance on calculated occupancy estimates limits the projected water demand with respect to site resale. Site occupancy estimated must be accepted in order to effectively model projected demand.

From figure 3.g, lines 17-20 can be used to effectively expand withdrawal allotments. Redistributing the occupancy values of line 17 (compared to line 4) to mimic the seasonal distribution curve illustrated in figure 3.c provides a requested annual total of withdrawal of 40.435 million gallons.

The distribution allotment can be determined by normalizing the withdrawal data in terms of minimum site occupancy. The 1998-2004 averaged values can be used to extrapolate the approximate number of occupants believed to be onsite for any given withdrawal volume.

The first step is to weigh the number of calculated usage percent per month as a percentage of the annual averaged (1998-2004) withdrawal data. This step ensures that we see a significant distribution pattern based upon the time of year and by the number of occupants believed to be on site. The resultant percentages can be used to determine the amount of occupants required to withdrawal the corresponding averaged volume of water.

$$\frac{603{,}568_{Jan\_avg}}{14{,}507{,}049_{annual\_avg\_GWW}} \times 100\% = 4.16\%_{Jan\%\_annual\_GWW}$$

Percentage of annual withdrawal

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
603,568	670,255	874,699	1,020,794	1,388,241	1,913,449	2,143,560	1,852,615	1,456,100	1,155,335	868,350	560,083
4.16%	4.62%	6.03%	7.04%	9.57%	13.19%	14.78%	12.77%	10.04%	7.96%	5.99%	3.86%

Now, the calculated percentages are weighed against the January occupancy percentage to achieve a percent difference allotment. This percent difference allotment is used to reestablish the amount of occupants required to utilize the corresponding monthly withdrawal:

$$\frac{4.16\%_{Jan} - 4.16\%_{Jan}}{4.16\%_{Jan}} = 0.00\%_{Jan\_difference} \Rightarrow \frac{7.04\%_{Apr} - 4.16\%_{jan}}{4.16\%_{Jan}} = 69.13\%_{Apr\_difference}$$

$$3.3_{Min\_occupancy} + \left(0.00\%_{Jan\_difference} * 3.3_{Min\_occupancy}\right) = 3.30_{Jan\_occupants} \Rightarrow \therefore$$

$$3.3_{Min\_occupancy} + \left(69.13\%_{Apr\_difference} * 3.3_{Min\_occupancy}\right) = 5.58_{Apr\_occupants}$$

This table is a summary of time weighted difference of site occupation.

	January	February	March	April	May	June
GWW *avg*	603,568	670,255	874,699	1,020,794	1,388,241	1,913,449
% usage	0.00%	11.05%	44.92%	69.13%	130.01%	217.02%
# Occup.	3.30	3.66	4.78	5.581	7.59	10.46
	July	August	September	October	November	December
GWW *avg*	2,143,560	1,852,615	1,456,100	1,155,335	868,350	560,083
% usage	255.15%	206.94%	141.25%	91.42%	43.87%	-7.20%
# Occup.	11.71	10.12	7.96	6.311	4.74	3.06

The values of occupants derived from the above table can be used to estimate the amount of water that will be used on a seasonal basis. The calculated withdrawals from line 20 fig 3.g shows that the requested volume of 29.48 MG/yr is within the range of the calculated total of line 24 which is 40.435 MG/yr.

Due to anticipated growth for campsite resale, increased water consumption is imminent. The current permitted water usage may not be sufficient to supply the water necessary for normal operation in the future. Also, the highest three usage years have been within the last four years[12], is it more than likely that this rate of increase shall continue. Starting from just under the maximum current withdrawal, the projected maximum withdrawal from all 2,600 connections may increase to 29.48-MG/y within 10-years.

From figure 3.f, a graph of withdrawal data from 2001 through 2005 is displayed. There are two correlations that can be made: year to year percent increases and over-all increases. A steady growth of use can be seen. An overall average of increases from 2001 through 2005 provides an average year to year growth of 4.72% per year. This appears to be a sustainable value. This percent of increase, as it is standardized, may be used to calculate future demand. A standard compounding equation can be used. The root value will be the last annual value reported to the DEQ.

$$P = 18{,}591{,}200^{2005}_{gallons/yr}\left(1+\frac{4.72\%_{increase/yr}}{1_{increase/yr}}\right)^{1_{increase/yr}\times 10_{years}} = 29{,}485{,}191^{2015}_{Gallons/yr}$$

This compounded projection value is the most reliable. Although the site usage method allows a maximum withdrawal 40.435 million gallons per year, the statistics do not support that level of withdrawal. The facility requests the projected demand of 29.49 MG/year.

On a monthly basis, the facility should not exceed 4.35-MG/m.

[12] Growth for the last several years (2001-2005) has been 4.88%, 2.78%, 4.55%, and 11.5% respectively.

Apportionment of Withdrawal to Individual Wells

The permitted yield will be produced from three existing wells. Each well is monitored and yields differing amounts of water in order to fill the same storage tank.

[1]APPORTIONMENT OF WITHDRAWALS	**Well-#1** (DEQ #100-453)	**Well-#2** (DEQ #100-803)	**Well-#3** (DEQ #100-899)	Totals
Schedule	[2] Q-MAX	[2] Q-MAX	[2] Q-MAX	
January	*437,331*	*370,719*	*418,808*	*1,226,736*
February	*485,651*	*411,680*	*465,081*	*1,362,275*
March	*633,786*	*537,252*	*606,941*	*1,777,802*
April	*739,644*	*626,986*	*708,315*	*2,074,737*
May	*1,005,887*	*852,676*	*963,281*	*2,821,562*
June	*1,386,441*	*1,175,266*	*1,327,717*	*3,889,035*
July	*1,553,174*	*1,316,603*	*1,487,387*	*4,356,729*
August	*1,342,362*	*1,137,901*	*1,285,504*	*3,765,390*
September	*1,055,056*	*894,356*	*1,010,368*	*2,959,484*
October	*837,129*	*709,622*	*801,671*	*2,348,188*
November	*629,186*	*533,352*	*602,536*	*1,764,898*
December	*405,823*	*344,011*	*388,634*	*1,138,354*
Annual Estimated Usage				***~29,485,191***
[1] Estimates of projected maximum water use in gallons. [2] Q-max= These values are based on the seasonal use illustrated in graph 3.c and numerical values within 3.g; in conjunction with the well yield percentages revealed in 3.d. The calculated withdrawals are contained in 3.g lines 25-29.				

FIGURE 3.a Well Usage Totals

1998	January	February	March	April	May	June	July	August	September	October	November	December
Well #1	139,100	120,200	170,400	249,900	348,600	433,800	697,600	643,900	350,300	215,900	206,300	154,000
Well #2	188,200	10,900	195,500	186,900	270,400	56,600	1,335,200	799,000	445,400	280,600	251,400	195,000
Well #3	165,900	181,200	231,500	289,900	523,800	585,600	1,000,300	965,000	540,300	345,100	295,500	234,800
Total	493,200	312,300	597,400	726,700	1,142,800	1,076,000	3,033,100	2,407,900	1,336,000	841,600	753,200	583,800
						13,304,000						

1999	January	February	March	April	May	June	July	August	September	October	November	December
Well #1	204,800	269,700	331,700	318,000	512,000	626,487	495,000	506,813	86,600	10,611	11,700	8,900
Well #2	268,800	333,600	426,100	413,600	669,500	807,555	665,000	672,645	350,300	279,600	222,400	103,100
Well #3	331,400	393,300	509,200	495,700	800,300	966,058	790,421	792,421	404,200	314,000	301,800	368,500
Total	805,000	996,600	1,267,000	1,227,300	1,981,800	2,400,100	1,950,421	1,973,879	841,100	604,211	535,900	480,500
						15,063,811						

2000	January	February	March	April	May	June	July	August	September	October	November	December
Well #1	5,100	74,600	80,200	90,300	120,140	160,000	680,000	390,300	459,300			
Well #2	192,800	100,050	100,200	150,900	201,055	230,020	669,100	419,400	419,300			
Well #3	7,700	50,100	400,500	400,110	704,100	1,303,866	401,000	457,124	401,600			
Total	205,600	224,750	580,900	641,310	1,025,295	1,693,886	1,750,100	1,266,824	1,280,200	0	0	0
						8,668,865						

2001	January	February	March	April	May	June	July	August	September	October	November	December
Well #1	250,000	245,000	355,000	292,100	225,140	865,150	131,100	1,229,910	1,260,000	600,000	599,800	219,900
Well #2	271,000	235,000	241,400	156,750	202,050	232,100	876,000	860,000	1,128,700	505,900	245,000	130,000
Well #3	275,000	265,600	271,600	350,100	615,000	820,110	250,000	179,990	51,000	34,800	26,900	20,200
Total	796,000	745,600	868,000	798,950	1,042,190	1,917,360	1,257,100	2,269,900	2,439,700	1,140,700	871,700	370,100
						14,517,300						

2002	January	February	March	April	May	June	July	August	September	October	November	December
Well #1	210,000	290,000	451,000	1,000,800	1,224,000	1,341,300	2,150,800	1,800,700	1,086,900	690,700	425,000	140,000
Well #2	167,600	220,000	284,600	314,000	294,000	468,200	30,400	25,100	5,100	732,000	366,000	122,000
Well #3	15,700	16,800	20,100	30,000	34,500	35,300	25,000	2,000	1,000	704,100	400,100	138,100
Total	393,300	526,800	755,700	1,344,800	1,552,500	1,844,800	2,206,200	1,827,800	1,093,000	2,126,800	1,191,100	400,100
						15,262,800						

2003	January	February	March	April	May	June	July	August	September	October	November	December
Well #1	219,000	219,900	251,000	287,000	427,300	958,500	867,170	583,780	184,450	359,800	285,800	204,300
Well #2	332,500	332,500	283,700	325,800	486,700	1,099,000	969,190	652,460	221,150	404,400	315,600	244,400
Well #3	250,500	280,500	382,400	436,000	456,100	0	714,140	480,760	895,600	534,500	402,700	350,800
Total	802,000	832,900	917,100	1,048,800	1,370,100	2,057,500	2,550,500	1,717,000	1,301,200	1,298,700	1,004,100	799,500
						15,699,400						

2004	January	February	March	April	May	June	July	August	September	October	November	December
Well #1	205,250	246,300	369,450	377,200	461,880	692,820	754,440	502,960	514,900	359,000	298,500	193,200
Well #2	229,650	275,580	413,370	428,600	469,320	703,980	416,460	277,640	604,900	59,600	114,400	229,800
Well #3	294,975	530,955	353,970	551,900	671,800	1,007,700	1,086,600	724,400	781,700	501,400	441,200	303,500
Total	729,875	1,052,835	1,136,790	1,357,700	1,603,000	2,404,500	2,257,500	1,505,000	1,901,500	920,000	854,100	726,500
						16,449,300						
2005						18,591,200						
Annualized	603,568	670,255	874,699	1,020,794	1,388,241	1,913,449	2,143,560	1,852,615	1,456,100	1,155,335	868,350	560,083
DAYS	31	28	31	30	31	30	31	31	30	31	30	31
People, perday	284	349	412	497	653	931	1,009	872	708	544	422	264
Calculated occpancy	3	3	3	3	3	3	3	3	3	3	3	3
Sites used	86	106	125	150	198	282	306	264	215	185	128	80

	January	February	March	April	May	June	July	August	September	October	November	December
Minimum	205,600	224,750	580,900	641,310	1,025,295	1,076,000	1,257,100	1,266,824	841,100	604,211	535,900	370,100
Maximum	805,000	1,052,835	1,267,000	1,357,700	1,981,800	2,404,500	3,033,100	2,407,900	2,439,700	2,126,800	1,191,100	799,500
Average	603,568	670,255	874,699	1,020,794	1,388,241	1,913,449	2,143,560	1,852,615	1,456,100	990,287	744,300	480,071

Average 15,555,416

FIGURE 3.b Cummulative Totals

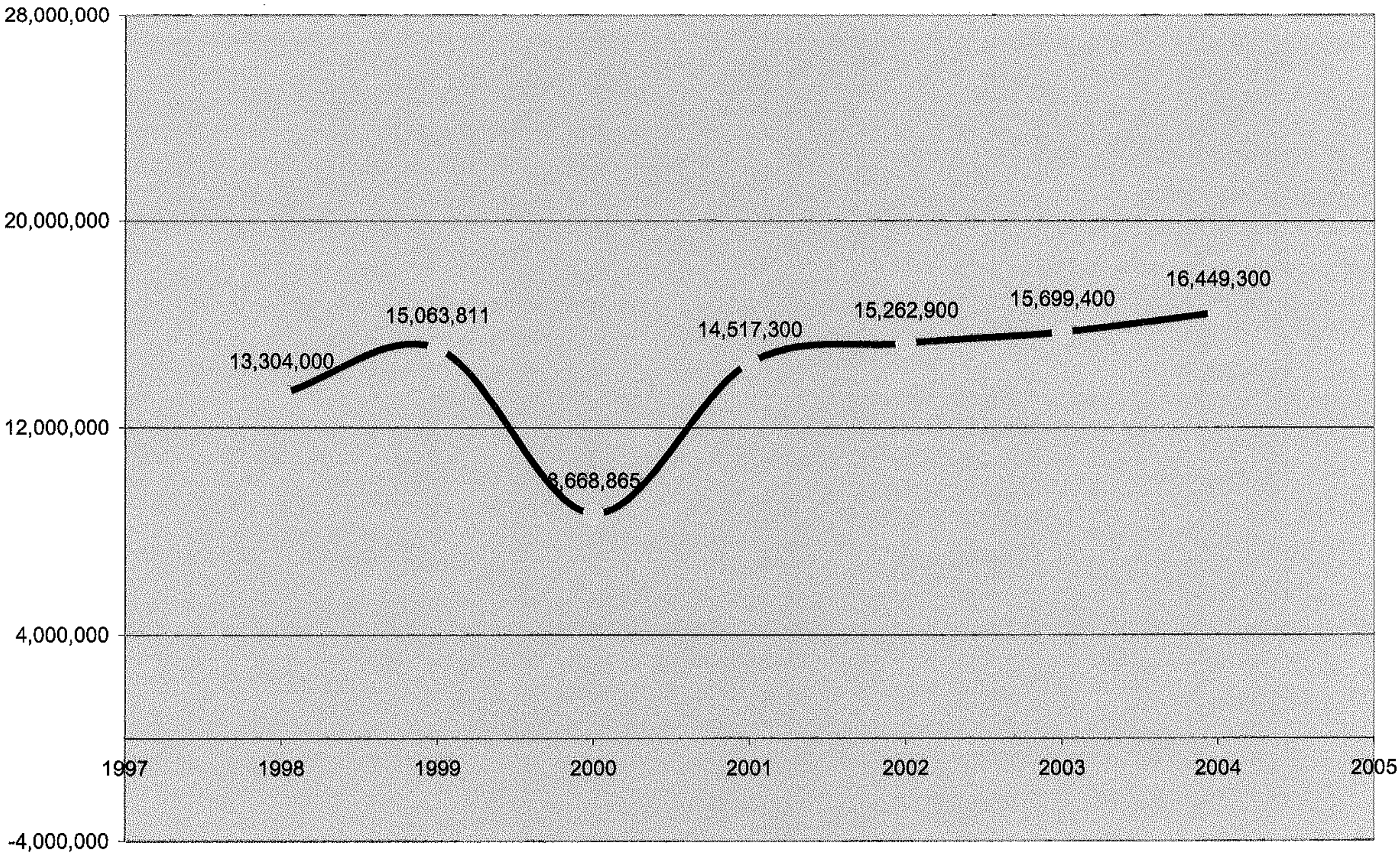


FIGURE 3.c Annual Distribution of Use (1998-2004)

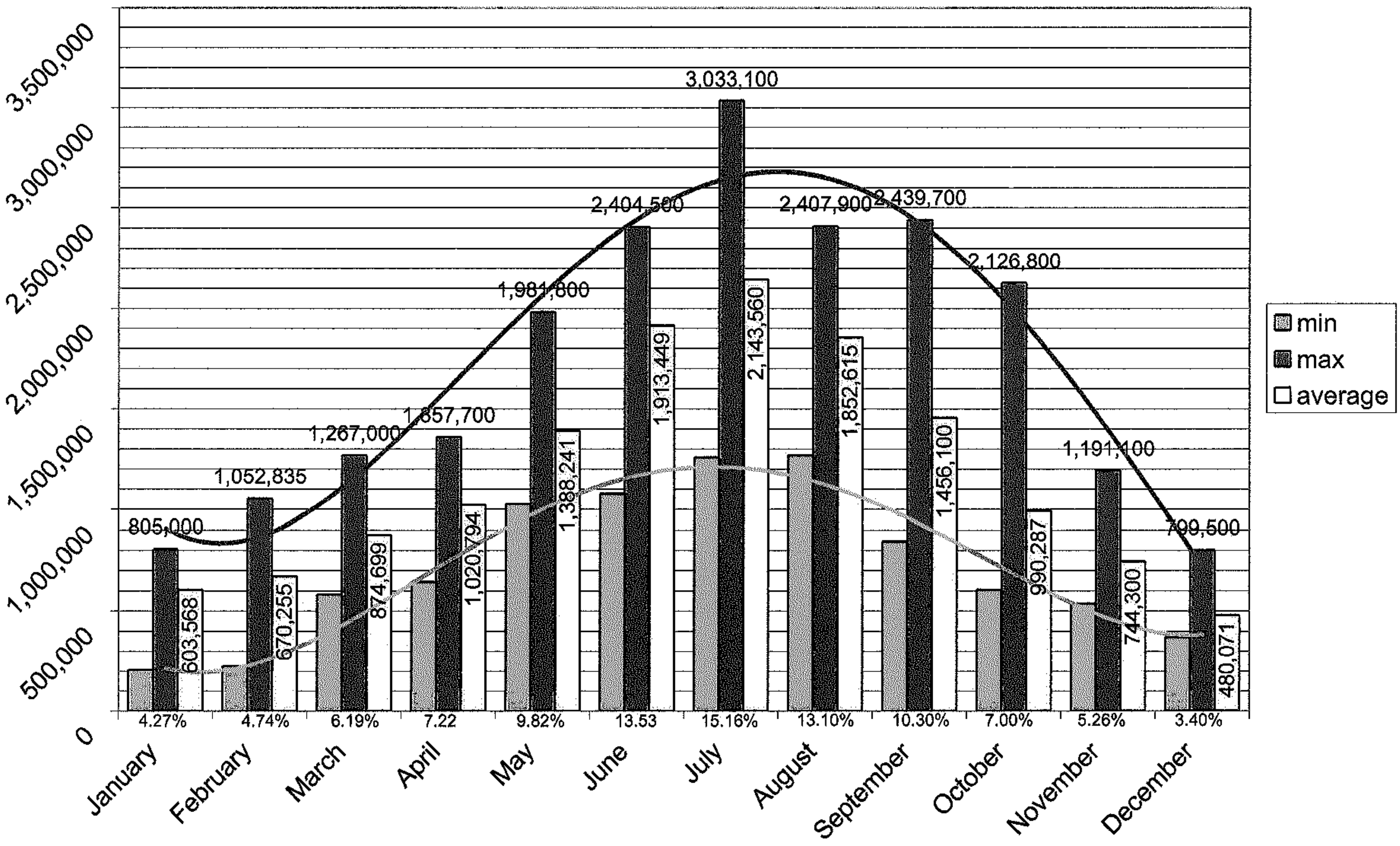


FIGURE 3.d Pumping Contribution (1998-2004)

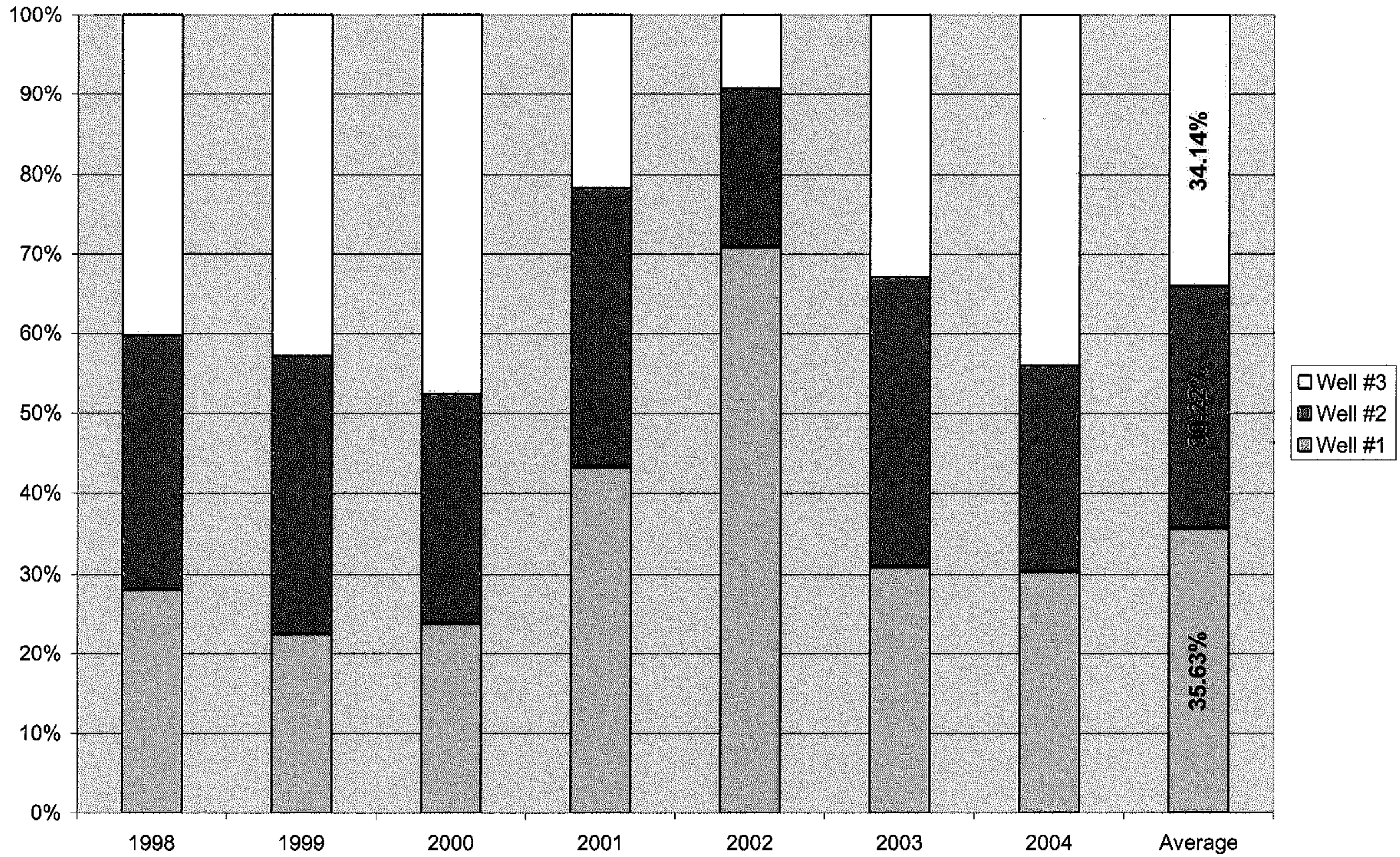


FIGURE 3.e

ASSUMED USAGE

Average use 2001-2004	15,482,225 gallons
Number of sites estimated to have annual service	2100 sites
Gallons per site per year	7372.488095 Gallons per site
Gallons per site per day	20.19859752 GPD

General algorithm

$$\boxed{\frac{\left(\frac{\frac{(14.52MG_{2001} + 15.26MG_{2002} + 15.69MG_{2003} + 16.45MG_{2004})}{4_{years}}}{2{,}100_{occupiedsites}}\right)}{365_{days/year}} = 20.2GPD}$$

ACTUAL USAGE

Lowest reported use (January 2000)	205,600 gallons
Lowest known facility occupancy (January and Febuary 2000-2004)	100 occupants
Per Person, per day use	68.53 gpd

$$\boxed{\frac{\frac{\left(205{,}600^{Jan2001}_{gallons}\right)}{100_{occupants}}}{31_{days}} = 68.53_{gpd/perperson}}$$

FIGURE 3.f Projected use totals

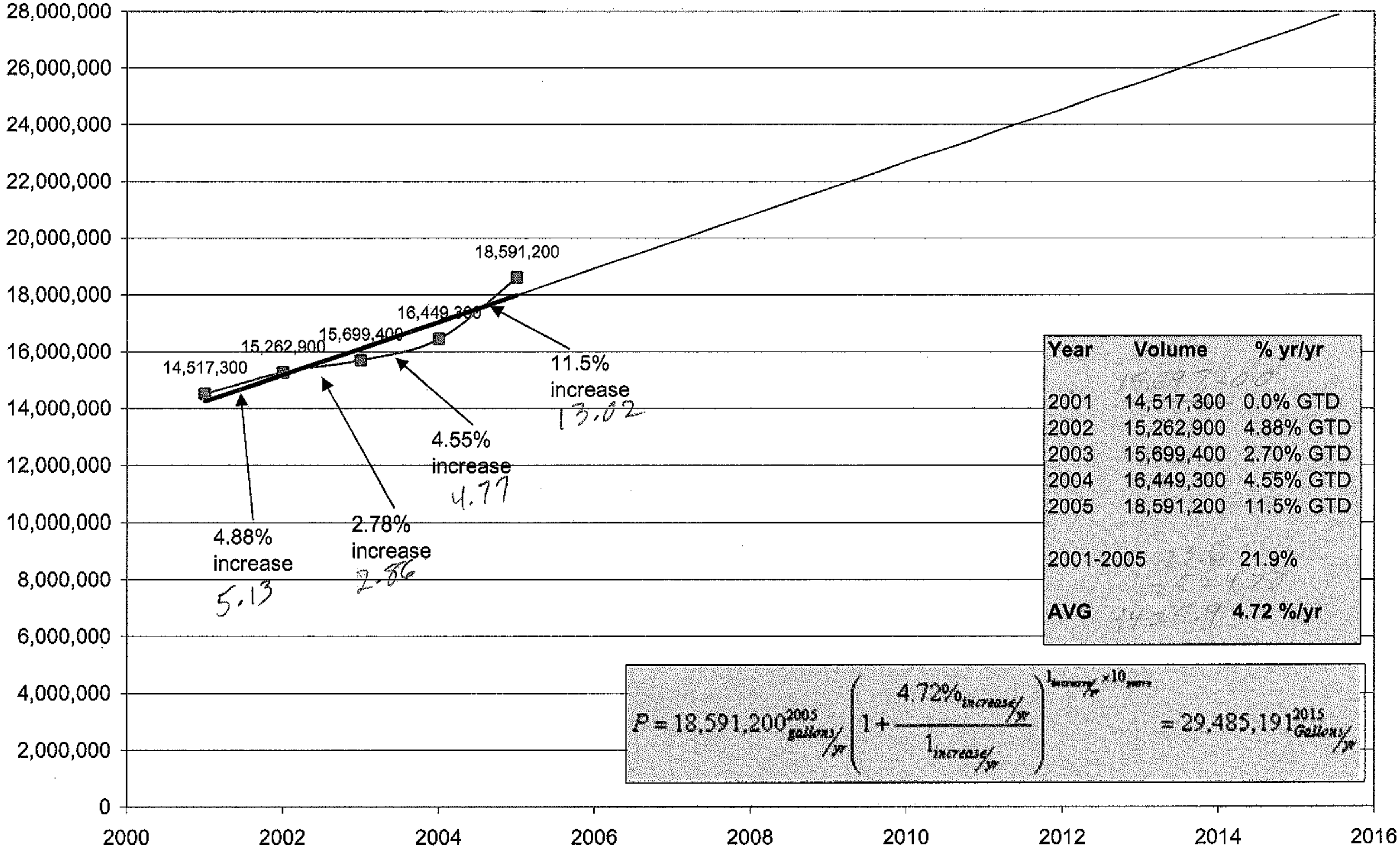


FIGURE 3.f Projected use totals

Update for 2006 Usage

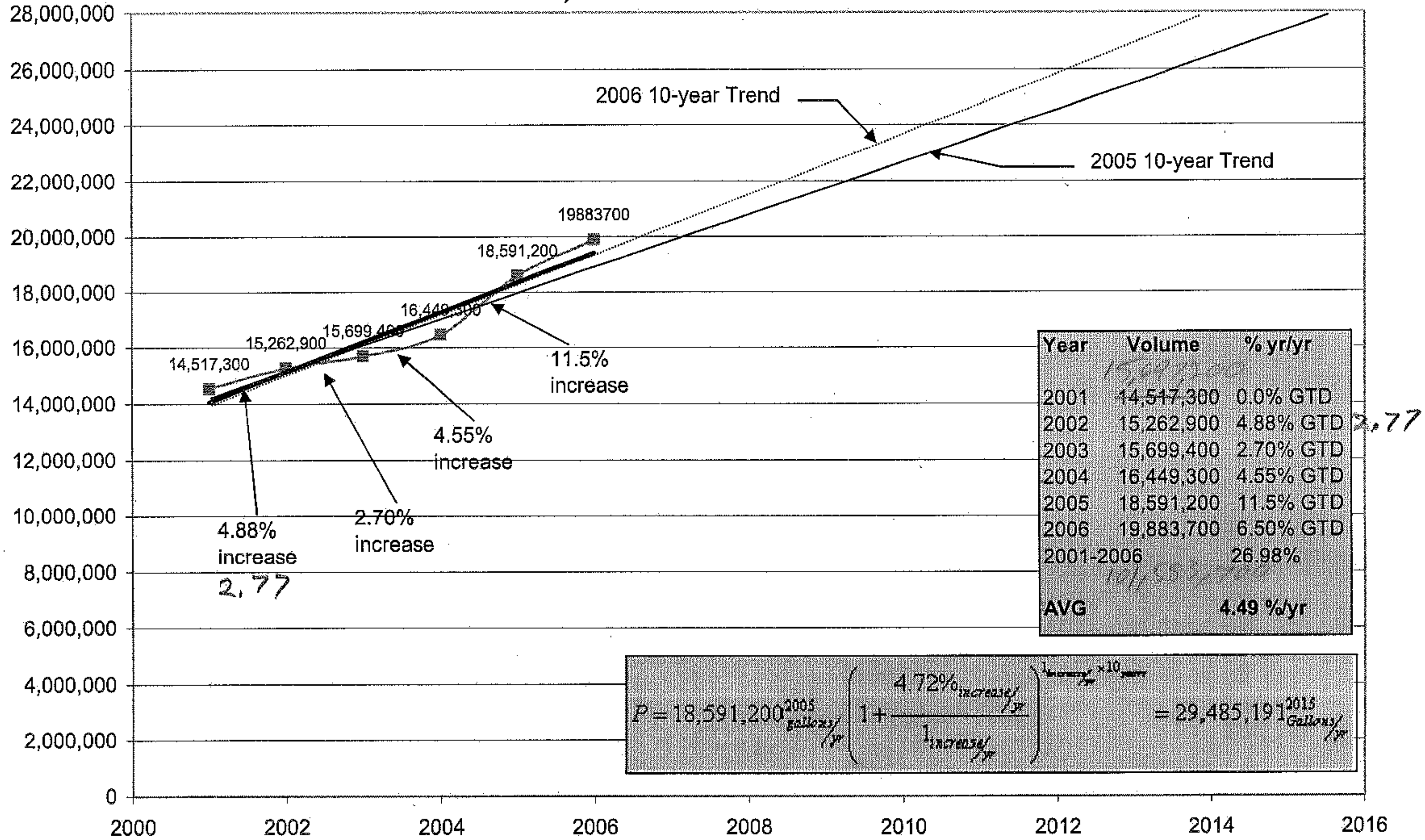
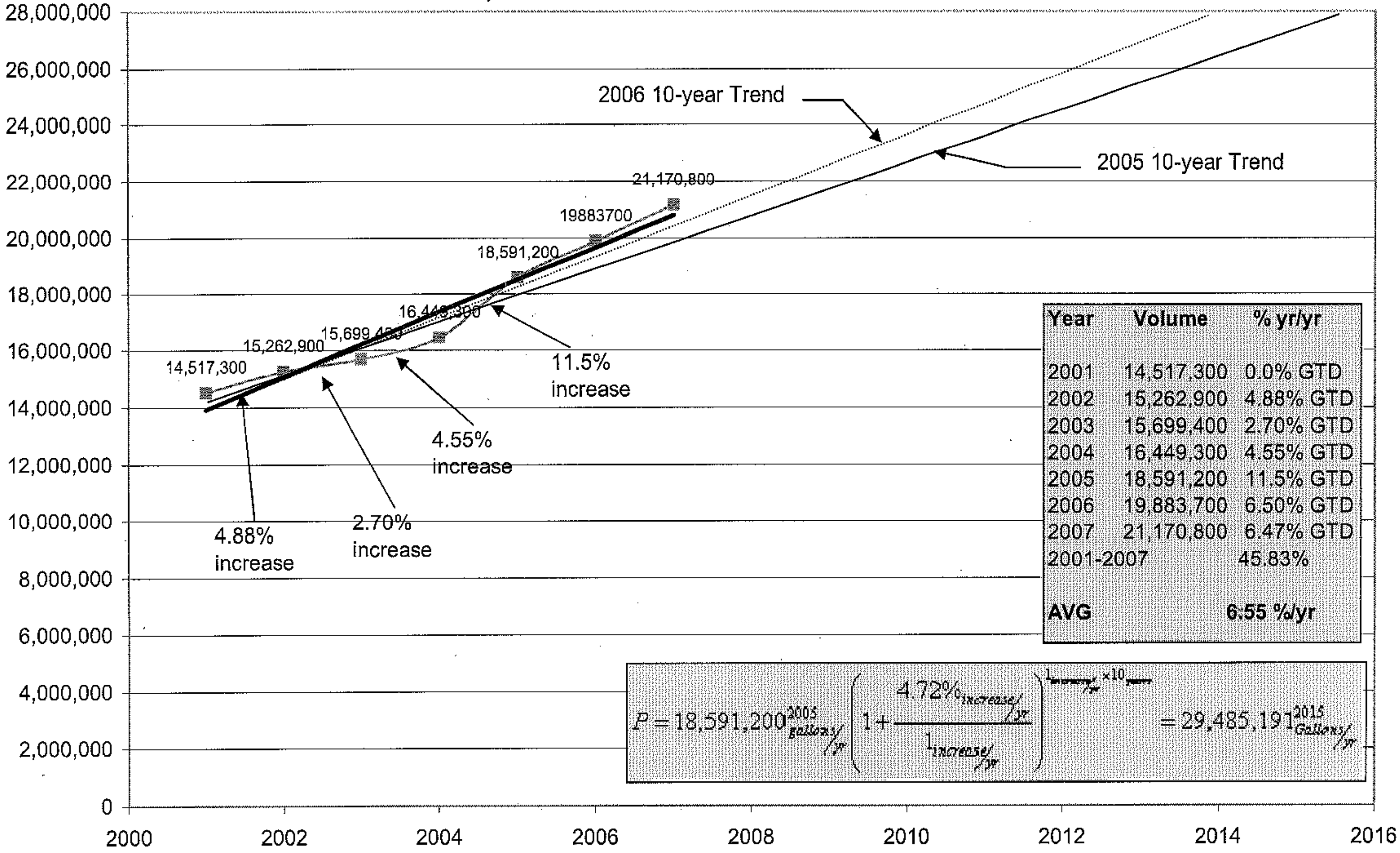


FIGURE 3.f Projected use totals

Updated 2007 Usage



Year	Volume	% yr/yr
2001	14,517,300	0.0% GTD
2002	15,262,900	4.88% GTD
2003	15,699,400	2.70% GTD
2004	16,449,300	4.55% GTD
2005	18,591,200	11.5% GTD
2006	19,883,700	6.50% GTD
2007	21,170,800	6.47% GTD
2001-2007		45.83%
AVG		6.55 %/yr

$$P = 18{,}591{,}200^{2005}_{gallons/yr}\left(1+\frac{4.72\%_{increase/yr}}{1_{increase/yr}}\right)^{1_{increase/yr}\times 10_{years}} = 29{,}485{,}191^{2015}_{Gallons/yr}$$

FIGURE 3.g

	January	February	March	April	May	June	July	August	September	October	November	December
1 Annualized monthly averag	603,568	670,255	874,699	1,020,794	1,388,241	1,913,449	2,143,560	1,852,615	1,456,100	1,155,335	868,350	560,083
2 DAYS	31	28	31	30	31	30	31	31	30	31	30	31
3 People, perday	284	349	412	497	653	931	1,009	872	708	544	422	264
4 Calculated occpancy	3	3	3	3	3	3	3	3	3	3	3	3
5 Sites used, per month*	86	106	125	150	198	282	306	264	215	165	128	80
6 Site days, total	2,669	2,964	3,868	4,514	6,139	8,461	9,479	8,192	6,439	5,109	3,840	2,477
7 Attendance on weekends	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
8 site days	381.27	423.40	552.54	644.83	876.94	1,208.72	1,354.08	1,170.29	919.81	729.82	548.53	353.80
9	1,143.81	1,270.19	1,657.63	1,934.49	2,630.83	3,626.15	4,062.23	3,510.86	2,759.43	2,189.46	1,645.60	1,061.41
10 site day weekends	1,906.35	2,116.98	2,762.71	3,224.15	4,384.72	6,043.58	6,770.38	5,851.44	4,599.05	3,649.10	2,742.66	1,769.01
11 Site day, weekday	762.54	846.79	1,105.09	1,289.66	1,753.89	2,417.43	2,708.15	2,340.57	1,839.62	1,459.64	1,097.06	707.60
12 % of years total	4.16%	4.62%	6.03%	7.04%	9.57%	13.19%	14.78%	12.77%	10.04%	7.96%	5.99%	3.86%
13 Weekly site days (m-t)	4	4	4	4	4	4	4	4	4	4	4	4
14 Weekend site days (f-s)	3	3	3	3	3	3	3	3	3	3	3	3
15 Sites on weekends	146.6425634	162.84484	212.5163546	248.0117008	337.2863127	464.8907755	520.7983667	450.1104019	353.7733729	280.6996901	210.9739086	136.0775839
16 sites on weekdays	44.0012308	48.8628488	63.76716929	74.41782135	101.2053564	139.4940584	156.2695618	135.0590935	106.1524258	84.22610435	63.3043465	40.83112731
17 Seasonal Occupancy	3.30	3.66	4.78	5.58	7.59	10.46	11.72	10.13	7.96	6.32	4.75	3.06
18 Occupancy on weekends	483.9204593	596.763018	1016.339047	1384.198063	2560.066998	4863.576528	6103.699206	4559.235178	2816.463844	1773.118505	1001.639387	416.7034302
19 Occupancy on weekdays	145.2040616	179.063341	304.9603603	415.3392919	768.1678241	1459.353603	1831.461966	1368.033637	845.1016729	532.0378665	300.5496142	125.0350743
20 Estimated water withdrawal	719,579	801,499	1,511,274	1,991,877	3,806,764	6,998,742	9,076,069	6,779,484	4,052,923	2,636,589	1,441,370	619,629
21 Well #1	256,386	285,574	538,467	709,706	1,356,350	2,493,652	3,233,803	2,415,530	1,444,057	939,417	513,560	220,774
22 Well #2	217,457	242,213	456,707	601,945	1,150,404	2,115,020	2,742,788	2,048,760	1,224,793	796,777	435,582	187,252
23 Well #3	245,664	273,632	515,949	680,027	1,299,629	2,389,370	3,098,570	2,314,516	1,383,668	900,131	492,084	211,541
	719,507	801,419	1,511,123	1,991,678	3,806,384	6,998,042	9,075,161	6,778,806	4,052,518	2,636,325	1,441,226	619,567
24 estimated total	40,435,801											
25 projected total	29,485,191											
26 % of projected total (App)	1,226,736	1,362,275	1,777,802	2,074,737	2,821,562	3,889,035	4,356,729	3,765,390	2,959,484	2,348,188	1,764,898	1,138,354
27 Well #1 (35.65%)	437,331	485,651	633,786	739,644	1,005,887	1,386,441	1,553,174	1,342,362	1,055,056	837,129	629,186	405,823
28 Well #2 (30.22%)	370,719	411,680	537,252	626,986	852,676	1,175,266	1,316,603	1,137,901	894,356	709,622	533,352	344,011
29 Well #3 (34.14%)	418,808	465,081	606,941	708,315	963,281	1,327,717	1,487,387	1,285,504	1,010,368	801,671	602,536	388,634
	145.2040616	179.063341	304.9603603	415.3392919	768.1678241	1459.353603	1831.461966	1368.033637	845.1016729	532.0378665	300.5496142	125.0350743
	479.1734034	656.197515	1458.443623	2318.083549	5830.539283	15267.40969	21464.5315	13857.01609	6728.031245	3360.766755	1426.917354	382.8885172
	624.377465	835.260856	1763.403983	2733.422841	6598.707107	16726.76329	23295.99347	15225.04973	7573.132918	3892.804622	1727.466969	507.9235915
171007496.6	1326446.218	1602731.94	3746228.323	5619644.018	14018491.34	34388552.65	49490707.4	32344552.4	15569603.97	8269990.922	3551499.341	1079048.115

* This value assumes an even distribution of use throughout the month.

14,507,049	603,568	670,255	874,699	1,020,794	1,388,241	1,913,449	2,143,560	1,852,615	1,456,100	1,155,335	868,350	560,083
	182,899	203,108	265,060	309,332	420,679	579,833	649,564	561,398	441,242	350,102	263,136	169,722
	3.3	3.66461115	4.78240392	5.58118048	7.590189409	10.46176174	11.7198893	10.12914867	7.961209238	6.316781129	4.747693182	3.062248889
	1,208,921											

WATER CONSERVATION AND MANAGEMENT PLAN

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT:
SECTION 13 ATTACHMENT

TRAILS END CAMPGROUND
5360 TRAILS END DRIVE
HORNTOWN, VIRGINIA

ACCOMACK COUNTY, VIRGINIA

FEBRUARY 2005

Table of Contents

1.0 GENERAL INFORMATION

The Trails End Campground and Utility Company, herein referred to as the "facility", is an annually operated campground facility with a growing populations of year round residents. The facility is currently located on an approximately 500-acre site south east of Horntown, Accomack County, Virginia. Normally, the facility is primarily used from the late spring to the early fall and provides facilities/utilities for camping to include water hookups for recreation vehicles. However, the facility is occupied on an annual basis.

Normal operation of the facility requires production and consumption of variable amounts of groundwater from wells located on facility property. Because this property is located within the Eastern Shore Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the facility and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide Trails End management in responsible operation and policy management decisions. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a

plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provides guidance to implement water management and conservation measures.

2.0 WATER DEMAND

Water demand for the facility is primarily used for potable public water. This water is used for typical residential purposes such as human consumption, washing, laundry, and bathing.

The facility provides water hookups for campsites, recreational vehicles, and permanent water supply for the limited year-round residents. Potable water use will vary depending on the amount of visitors present at the facility during the year. The spring through fall season is the greatest use period. For the limited number of year round residents' potable water use will vary dependent upon the number of persons per household and by the water management practices and water conservation facilities available to and utilized by those residences. The facility does not engage in any irrigation practices, however, some of the permanent residences will irrigate small lawns or landscaped areas.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the project site. There is no municipal water system or surface water body in the vicinity that could provide potable quality water to the facility.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the relative geographic proximity of Trails End. This region receives approximately 42 inches of precipitation per year, thus only surface water and groundwater occur in sufficient quantity or regularity to be economically viable sources for supply. Much of the aquifer recharge occurs during wet winter and the early spring months when the facility is closed to visitors and will only require water for the limited permanent residents located on site. Conversely, the operational season (late spring to early fall), which is typically dryer with several weeks in the late summer having ambient temperatures above 90°F, is the period when the facility will experience an influx of campers and will use the majority of its' annual load.

During periods of anticipated peak demand, surface water resources are not reliable as a result of high rates of evapotranspiration and low inputs from precipitation. In addition, surface water supplies under these conditions tend to be unreliable in quality – especially with respect to higher levels of organic substances. Thus, groundwater is the most reliable source – being buffered by slow recharge through downward infiltration and possibly upward seepage.

The confined upper Yorktown-Eastover Aquifer is the target aquifer for the facilities supply of potable water. Analytical modeling of the confined upper Yorktown-Eastover Aquifer will reveal that there are sufficient quantities of water available in the target aquifer to meet facility demand without creating an adverse impact to water levels. Two wells in the Columbia aquifer are used for to supplement water withdrawals.

4.0 WATER CONSERVATION MEASURES

The following conservatory measures will be implemented with regard to the potable water supply.

- All permanent lavatory facilities contain fixtures that are of the water conserving type, typically 2.5-gpf toilets and low-flow showerheads that use mechanical actuators allowing the water to flow only when depressed.

- Water saving plumbing fixtures will be installed in all new or renovated existing facilities in accordance with Unified Statewide Building Code recommendations

- The facility will not use water for irrigation purposes.

- Some permanent residents may irrigate small landscaped areas or lawns during the growing season. The overall land represented by these areas is insignificant due to the limited number of homes and the lot size the homes are on. Nevertheless the residents are encouraged to exercise good judgment when irrigating these areas.

- Water Reuse Evaluation: in that most of the water is utilized for potable purposes, there is little water that could be reclaimed for reuse. Should a water use arise that involves non-potable water, then a Water Reuse Evaluation will be conducted and resultant plan be implemented.

5.0 WATER MANAGEMENT MEASURES

The following management measures will be implemented with regard to the potable water supply.

- The facility has been designed to use Xeriscapic (little to no artificial irrigation required) landscaping and thus does not practice irrigation.

- Water Loss Reduction:
  - (a) The facility conducts weekly records review to find excessive usage that may indicate a leak in the system.
  - (b) The facility will conduct routine inspection of all above ground potable water piping systems and storage tanks for any indication of leaks.
  - (c) The facility will conduct routine observations along underground potable water piping systems for indications of leaks.
  - (d) Any leak discovered in the potable water storage/supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water.

- Encourage permanent residents to conserve water through the use of regular conversational reminders, notices issued with water utility statements, and posters or bulletins posted in message areas or bulletin boards.

- Encourage campground guests and visitors to conserve water through conversation and handouts during camper registration, and using posters or bulletins posed in message areas or bulletin boards.

- No unnecessary groundwater withdrawal will be permitted.

- Mandatory water use restrictions will be implemented during water shortage emergencies declared the local governing body or the Director of DEQ. During these periods, permanent residents will be restricted from conducting irrigation activities, automobile or trailer washing, or other such non-essential use of water. In addition, facility personnel will be prohibited from general washing of buildings, paved surfaces, or equipment. Campground guests and visitors will be instructed to conserve water and advised of any water use restrictions that may be in place. The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.

- Staff education within the Utility Company shall include the following protocols;
  - Review and understanding of the groundwater withdrawal permit as issued by the DEQ.
  - New staff shall be indoctrinated with knowledge of how the distribution system functions and how it is monitored to better evaluate system failures.
  - A system of logging and reporting all system failures and needed repairs so that management may act accordingly.
  - Review of water use/restriction agreements established between the utility company and the Chincoteague Trails End Association and DEQ.

Tyson Foods

3100-001 / NEW

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

APPLICATION FOR A GROUND WATER WITHDRAWAL PERMIT (FOR USE IN GROUND WATER MANAGEMENT AREAS)

PREAPPLICATION CONFERENCE DATE: 05/29/03

1. APPLICANT INFORMATION: FIN/SSN: 71-0225165

Applicant: Tyson Foods, Inc. Phone: 757-824-3471

Applicant Address: 11224 Lankford Highway, Temperanceville, VA 23442
(Street, City, State, Zip Code)

2. FACILITY INFORMATION:

Facility/System Name: Tyson Foods, Inc., Temperanceville, VA

Facility Address: 11224 Lankford Highway, Temperanceville, VA 23442
(If Applicable, Street, City, State, Zip Code)

Contact Name: David Redinger Title: Env. Manager Phone: 410-641-3046

Fax: 757-442-3741

Location of Withdrawal Well or Well System: Accomac, Temperanceville
(County/City)

3. TYPE OF APPLICATION:

This application is for:

(X) Existing withdrawal, not previously permitted (*Old SWCB Permit No. 35A, 8/13/81*)
( ) New withdrawal
( ) Expand or enlarge existing permit No. ____________
( ) Modification of permit No. ____________
( ) Minor amendment of permit No. ____________
( ) Renewal of existing permit No. ____________ with modification
( ) Renewal of existing permit No. ____________ without modification

OCT 2008 RECEIVED DEQ TIDEWATER REGIONAL OFFICE

Existing withdrawal permit amount -- gallons per -- (Day,Month,Year)

Date of expiration of existing Ground Water Withdrawal Permit --

Requested withdrawal amount **358.7 MG** gallons per year, **37.44 MG** gallons per month

4. TYPE OF USE: (Check all that apply)

USE	%USE		%USE
(X) Public Water Supply	1	( ) Aquaculture	
(X) Industrial	99	( ) Golf Course Irrigation	
( ) Commercial		( ) Landscape Irrigation	
( ) Fire Protection		( ) Nursery	
( ) Drought Relief		( ) Crop Irrigation	
( ) Livestock Watering		( ) Other ______	

If type of use is public water supply;

Estimate the percentage of the withdrawal for human consumptive use 1 %;

Attach a complete copy of the Virginia Department of Health Water Works Operation Permit and Engineering Description Sheets or equivalent.

OFFICE USE ONLY Application # GW0049900

Date Application Received 9/2/05 Date Fee Received 2/24/05 Amount 6,000

Notice Date ________ LGOF Date ________ Returned 5/18/05 Date Complete ________

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT
TYSON FOODS, INC. TEMPERANCEVILLE – ACCOMACK COUNTY, VA

ATTACHMENT (Section 5).

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Nature of Activity Utilizing Water and Documentation of Beneficial Use

The Temperanceville, Virginia Tyson Foods plant is a poultry processing operation located near the town of Temperanceville in Accomack County. Primary facility operations include poultry processing, byproduct rendering, and hatchery. The facility has been operation for at least 30-years.

The Virginia State Water Control Board originally issued the facility a Permit to Withdrawal Groundwater (35-A) in August 1981. The permitted volume of withdrawal was not to exceed 1.8 million gallons per day from five wells with no annual or monthly maximum. Since that time, the facility has expanded its processing and rendering operations as well as implemented an onsite hatchery.

Normal operation of the facility requires water for the chicken hatchery, poultry processing, byproduct rendering, facility cleaning/maintenance, and potable water for employee use and consumption. No water is designated for irrigation practice, although a landscaped area in front of the Administration Building may be occasionally watered for aesthetic purposes. Firefighting water is stored in an onsite vertical above ground storage tank.

Currently, the operation utilizes water that that is withdrawn from a network of five wells. According to annual water use reports over the past seven years (Jan 2001 – Sept 2007) the facility withdrew an average groundwater volume of 6.56-MG/week and 341.12-MG/year. The minimum and maximum weekly volume during this timer period were 4.03 MG/week and 8.53 MG/week, respectively. As the facility operates year round, there are virtually no seasonality effects observed in the withdrawal data (Chart 1, see next page).

Water Demand Projections and Justification of Withdrawal Request

Because Tyson Foods, Inc. is a global corporate entity, the Temperanceville Processing plant adheres to all corporate mandates, policies and programs regarding its environmental stewardship. As this facility's various activities are monitored and permitted by various state and federal agencies, it is their practice that each facility manage its operation by not only meeting, but exceeding any environmental expectations of protection intended by the issuance of these permits. Because of this commitment to environmental protection, each facility operated by Tyson Foods acts in a proactive manner. As a result, all Tyson facilities routinely implement new technologies and procedures that support the goal of sustainable environmental stewardship (see attached – Tyson Foods, Inc. 2007 Sustainability Report).

The Temperanceville facility actively, like all Tyson's operations, upgrades and enhances its production procedures and technologies to ensure that it remains in accordance with the corporate sustainability program. As such, the facility is constantly evaluating all production processes in order to identify, alter, and implement changes as needed. Because of this proactive stance, it is of little purpose to characterize the facility's equipment and procedures with respect to water use. Yet, if such a characterization were to be generated its value would be minimal. Equipment and procedures used today should not be used to model consumption as these items are in a perpetual state of evolution.

In light of the above, the facility can effectively estimate its peak demands based on statistical methods. Withdrawal data collected from January 2000 through September 2007 has been evaluated in order to establish upper limits of both monthly and annual maximums. The water used during this time period serviced all points of consumption which shall remain in service during the next permit cycle. These usage end points include: production/processing, protein rendering, hatchery, sanitary, and wastewater treatment.

Statistical Evaluation and Demand Calculations

Weekly withdrawal data was collected between January 2000 and September 2007 and is summarized here:

Table 1: Basic Metrics

GALLONS	2000	2001	2002	2003	2004	2005	2006	2007
Average, weekly	6,685,044	6,646,008	7,093,905	6,504,703	6,637,002	6,030,111	6,363,257	6,486,064
Average, Monthly	26,968,526	28,799,370	30,740,257	28,187,048	28,747,343	26,130,484	27,574,118	28,106,280
Maximum, weekly	8,367,720	7,704,960	8,534,780	7,836,360	7,947,710	7,455,080	7,511,430	7,915,150
GPP, weekly	2.04	2.08	2.03	1.82	1.73	1.51	1.58	1.64

The entire series of withdrawal data was further evaluated to include all data generated for the evaluation period, representing a total of 404 weeks:

Table 2: Whole Averages

Weekly Withdrawal Summary 2000-2007	
Average, weekly	6,556,544
Average, Monthly	28,482,193
Maximum, weekly	8,534,780
GPP, weekly	1.81

The data was further evaluated in order to determine the modes of distribution and to determine the most reliable maximum probable extents of withdrawal on an annual and monthly basis. Because the methods in which water is used are constantly changing, this statistical approach of weighted distribution treats the data as a whole rather than discriminating water consumption by any one process. The withdrawal data was first evaluated with general statistics, then further processed to determine the distribution of that data.

Basic Statistics

Table 3: Descriptive Statisitcs

January 2000 – September 2007	
Mean	6556544.4
Standard Error	34590.4
Median	6506805.0
Mode	#N/A
Standard Deviation	695257.6
Sample Variance	483383179354.0
Kurtosis	0.5
Skewness	-0.1
Range	4501550.0
Minimum	4033230.0
Maximum	8534780.0
Sum	2648843954.4
Count	404.0
Confidence Level(95.0%)	68000.1

Histogram Statistics

Table 4: Histogram Metrics

Deviation	Bins	Occurrence	Percentage of total	Number of Weeks	Volume anticipated	Cumulative Total
-4	3,775,514	0	0%	0.00	-	0
-3	4,470,772	1	0%	0.13	575,446	575,446
-2	5,166,029	11	3%	1.42	7,314,279	7,889,725
-1	5,861,287	40	10%	5.15	30,176,922	38,066,647
0	6,556,544	166	41%	21.37	140,089,336	178,155,983
1	7,251,802	117	29%	15.06	109,207,831	287,363,814
2	7,947,060	60	15%	7.72	61,373,332	348,737,146
3	8,642,317	9	2%	1.16	10,011,397	358,748,544
4	9,337,575	0	0%	0.00	-	358,748,544
SUM	**-**	**404**	**100%**	**52**	**-**	**358,748,544**

The table above uses a weighted distribution to determine the probable maximum of water to be withdrawn. To derive this number, 404 weekly volumes are distributed about the mean (Deviation 0) and then multiplied by the percentage of their occurrence during any one year period. The "Bins" column is created by adding or subtracting a single or multiple of the standard deviation about the mean. This column is then used to create and distribute the actual data about the mean (Occurrence column). As the 3rd deviation accounts for 99% of a data sets population there is evidence that there are no outlying or extremely variant numbers within the recorded data set.

The next step is to determine the percentage of occurrence based on the total of 404 data points. The "Percentage(s) of total" column generated is then used to redistribute the number of weeks per year expected to utilize the corresponding "Bin" volume. The number of weeks column is multiplied by the Bin column to produce the "Volume Anticipated" column. This column is a real representation of what the facility is likely to utilize during the next permit period. The cumulative total of 358.7 million gallons per year is the maximum volume expected to be withdrawn. See Chart 3 for Histogram Output.

Additional Statistical Support

The general statistics also provide Kurtosis and Skewness values. Because the Kurtosis is found to be positive, this indicates that data analyzed is tightly distributed about the mean. This indicates that an extreme or diminimus withdrawals are not probable. Also, the negative skewness value indicates that the data does trend towards higher withdrawals rather than to lesser withdrawals. As more data is observed on the right side of the histogram, this provides evidence that decreased withdrawals are not probable.

Additional observations can be made. In Chart 2 "Tyson's Gallons Per Pound Produces January 2000 – September 2007" three metrics are plotted; Gallons used, Pounds Produced and Gallons per Pound Produced. Clear trends of increasing production and decreasing consumption are observed. A slightly decreasing trend is observed over this time frame. However, since 2005 water consumption has slightly increased. Despite the increased productivity, the facility has steadily decreased its water consumption as indicated by the "Gallons per Pound Produced" (GPP) ratio. Although this ratio is directly affected by the pounds produced, the clear decreasing trends of both the GPP and Gallons Used especially within the presence of notable increased production indicates that the facility has clearly made conservation of resources a priority. Future conservation efforts may be made, however, they will not serve to decrease the consumption rate. New technologies will offer the facility the ability to operate at the same consumption rates but at higher production capacities. For example, current production may require 1.6 Gallons per Pound. If more high speed production lines are implemented, the volume of production will increase without increasing water consumption. A direct observation of this will be indicated by a continued decrease of the GPP ratio; a new rate of 1.4 Gallons per Pound may result.

Requested Volumes

From table 4 (above) a maximum annual volume of 358.8 Million Gallons was demonstrated to be statistically valid. Because this evaluation utilized tangible data, this requested volume is believed to be sufficient for the next permit period. The maximum monthly volume anticipated is limited by the upper extent of the Histogram data. In general the highest anticipated monthly withdrawal would be four weeks of consumption at the maximum probable consumption rate:

$$8.64^{Weekly\_Maximum}_{gallons/week} \times \frac{52_{weeks}}{12_{months}} = 37.44^{Maximum}_{gallons/month}$$

The following Maximum Volumes are Requested:

358.8 Million Gallons per Year

37.44 Million gallons per Month

Chart 1: Tyso's Gallons Used January 2000 - September 2007

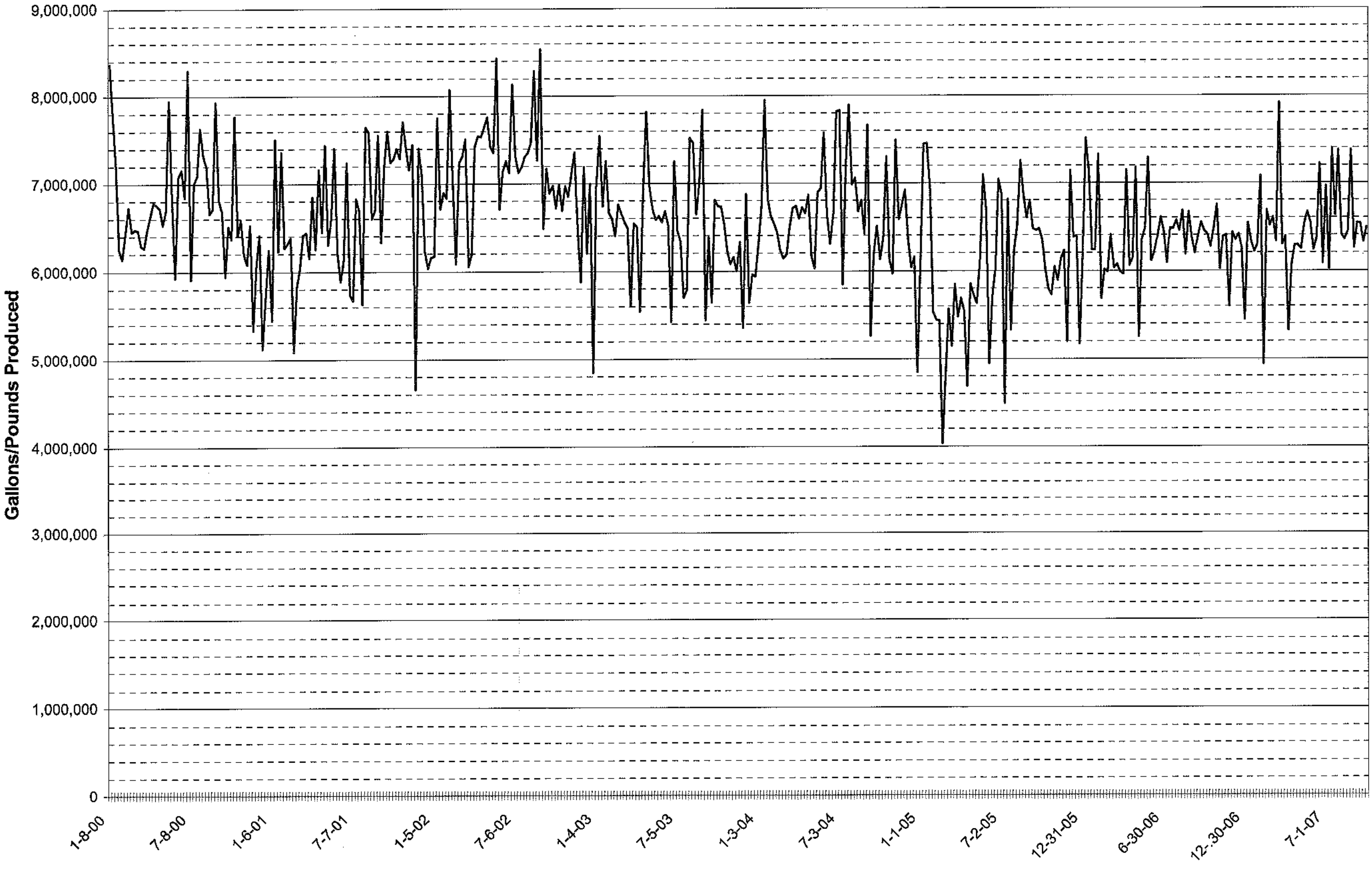


Chart 2: Tyson's Gallons Per Pound Produced January 2000 - September 2007

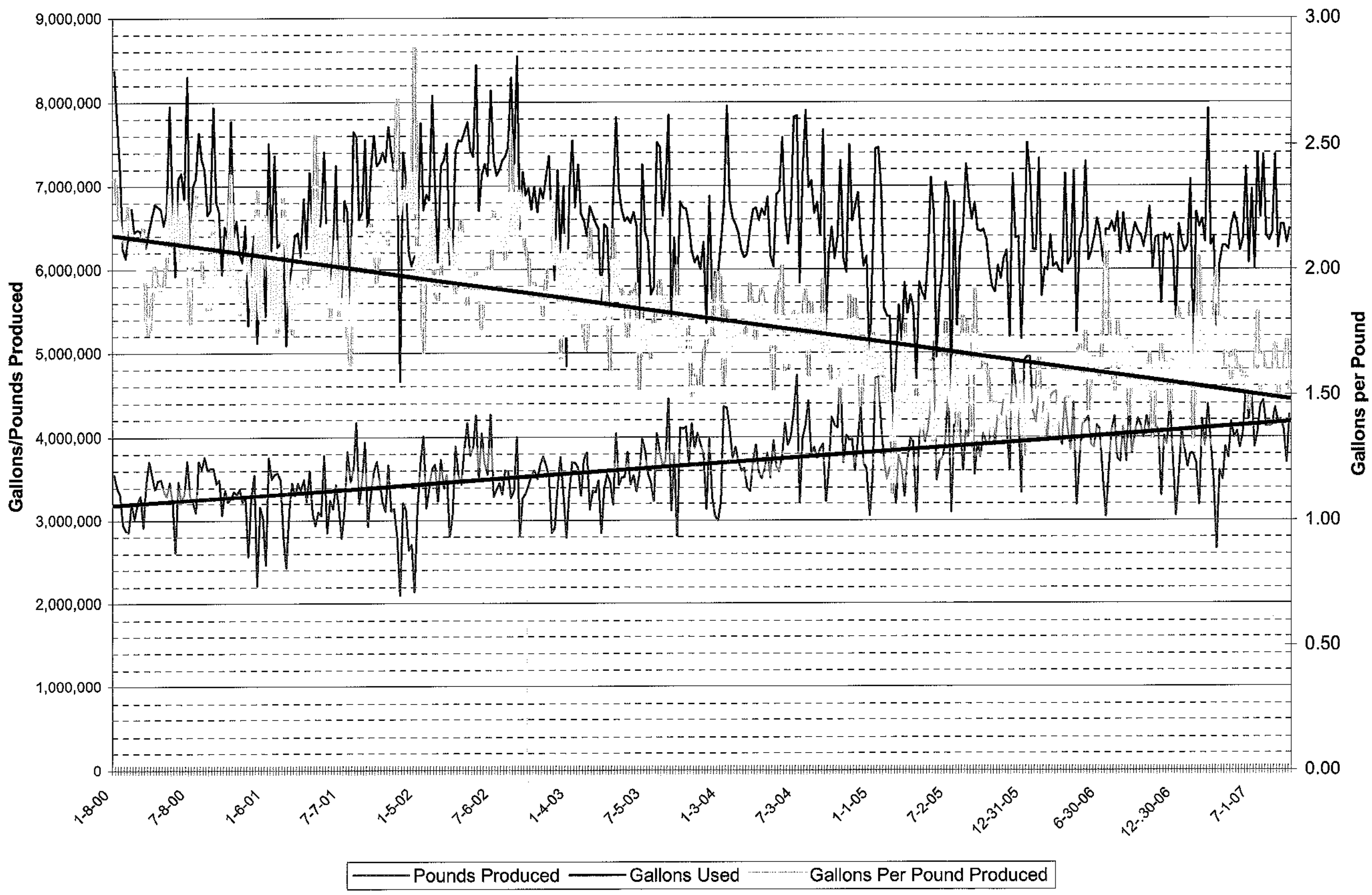
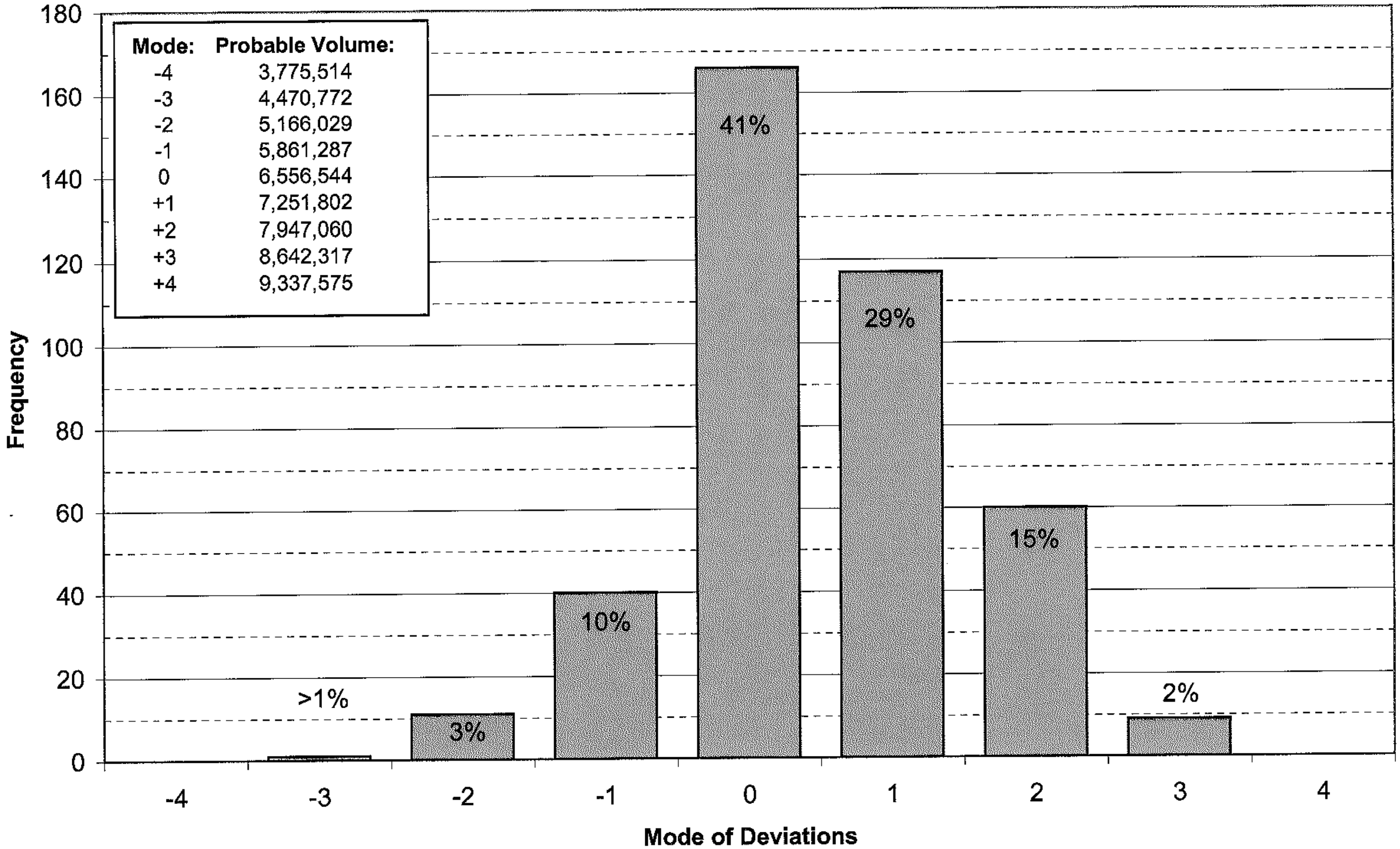


Chart 3: Tyson's Probable Annual Withdrawal Histogram
Based on a Weighted Distribution (2000-2007 data)



Water Conservation and Management Plan

Application For Groundwater Withdrawal Permit:
Section 13 Attachment

Tyson Foods Temperancville, Virginia Plant
Tyson Foods, Inc.
11224 Lankford Highway
Temperanceville – Accomack County, Virginia

Accomack County, Virginia

March 2005

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1.0 GENERAL INFORMATION

The Tyson Foods, Inc. Temperanceville, Virginia Plant, herein referred to as the "facility", is a year-round poultry processing and packaging facility located in the Town of Temperanceville – Accomack County, Virginia. The facilities' operational yard occupies approximately two-thirds of a 170-acre tract of land. All of the produced water is required to be of potable quality. Most of the water is used in the processing and packaging of poultry while a small percentage is used for potable connections.

Current normal operation of the facility requires production and consumption of fairly consistent amounts of groundwater from a field of five active wells located across the facility property along an east-west line. Because this property is located within the Eastern Shore Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the facility and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide the Tyson Foods, Inc. Temperanceville Plant management in responsible operation and policy management decisions. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provides guidance to implement water management and conservation measures.

2.0 WATER DEMAND

There is opportunity to conserve water wherever it is used and can be managed. Water demand for the facility is for a variety of industrial purposes for processing and packaging of poultry as-well-as for facility potable uses. This use includes, but is not limited to, water for washing poultry during the various phases from receiving, cleaning, processing, rinsing and packaging of the poultry and in waste rendering processes, washing and rinsing of the facility equipment and processing rooms, washing and cleaning of facility structures and equipment.

The USDA has established a requirement for minimum water use to maintain sanitary conditions requires that processing plants utilize a fixed number of gallons per bird.

The water is also used for potable purposes that include personnel bathroom and washing facilities and the employee cafeteria.

Apportionment of the facilities' water use is graphically depicted on the attached line diagram.

3.0 WATER SUPPLY

The following sections present a general overview of water resources available to the facility. Currently, the facility is served by a well field of five (5) deep groundwater wells. Additional production wells are planned to provide supply redundancy and to help spread out impacts to water levels in the target aquifers.

The facility is located in a rural area that is predominantly used for agricultural practices with scattered residential and commercial development. There is no municipal water supply system in the vicinity that could provide the required water.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the geographic proximity of the facility. This region receives approximately 42 inches of precipitation per year; however, there are no fresh surface water bodies onsite or on adjacent properties that could be used to store precipitation for supplying the required volume and rate of fresh water.

Groundwater has been used at this facility for at least 40-years without problems in quality or availability. No other sources of water are available. Thus, groundwater is the best available and reliable source of potable quality water.

4.0 WATER CONSERVATION MEASURES

The following conservatory measures will be implemented with regard to the water supply including groundwater from the facilities' well as-well-as municipal potable water.

- No unnecessary groundwater withdrawal will be permitted.
- Wherever possible, treated reclaimed water is recycled by using it in facility processes that allow use of such water.
- Facility management periodically reviews water use and will implement changes where possible and practical to better manage water use and increase water conservation.
- All lavatory facilities and water connections contain fixtures that are of the water conserving type. This includes, but is not limited to, low-flow fixtures, 2.5-gpf toilets, 10-gpm spray nozzles for hoses, automatic shut-off hip valves, and water restrictors (where permitted by VDH and USDA) in water lines throughout the plant.
- Any non-conserving fixtures discovered during repair or maintenance activities will be replaced with the conserving type as indicated above.
- Any new fixtures that are installed in new or renovated facilities will be of the water conserving type and in accordance with Unified Statewide Building Code (USBC) recommendations.
- As a matter of practice, the facility neither has an irrigation system nor practices routine irrigation. There is a small landscaped area in front of the Administration Building that may, depending upon weather conditions, be manually watered for aesthetic reasons..

- Water is conserved by implementing a Water Reuse Program. For most facility activities and processes, government stipulations (concerning the quality of water used in poultry processing operations) limit the potential for use of recovered and recycled water. Nevertheless, some of the water used at this facility is reclaimed and reused in facility processes such as in the rendering plant. Water reuse is evaluated in Section 5.0 of this document.

5.0 WATER MANAGEMENT MEASURES

The following management measures will be implemented with regard to the water supply including groundwater from the facilities' production wells.

- Water Loss Reduction Program:

  (a) Water meter readings are recorded on an hourly basis to identify the amount of water being used.

  (b) The facility conducts monthly review of meter reading records to find excessive usage that may indicate a leak in the system or significant change in operations. Potential excessive water usage will be immediately investigated and action taken where necessary to remediate any leaks or process problems.

  (c) The facility will conduct routine inspection of all above ground water piping systems and storage tanks for any indication of leaks.

  (d) The facility will conduct routine observations along underground potable water piping systems for indications of leaks.

  (e) Any leak discovered in the water storage/supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water.

- Water Use Education Program:

  (a) A Water Use Team, composed of supervisors, managers, and employees will investigate potential management techniques which can be used to reduce water demand in all work stations in the facility.

  (b) The Water Use Team will present findings, recommended work practice changes, and institute adopted changes at the facility.

  (c) Employees will be encouraged to conserve water through the use of regular conversational reminders and posters or bulletins displayed in message areas or bulletin boards.

  (d) New employees will be provided with a Water Conservation Awareness document as part of the employee orientation program.

- Water Reuse Program: The USDA imposes strict guidelines on the quality of water used in food processing. In addition, the Virginia Department of Health (VDH) imposes stricter regulations for drinking water than the Federal government does on the use of water for poultry processing. The USDA also has a requirement (recently modified) for the amount of processing water used per bird during processing and packaging. Since the facility contains a single water supply system, all potable water must at least meet Federal criteria for food processing as-well-as VDH standards for drinking water.

Some other processes that require water may be able to utilize recycled water.

(a) The facility employs water reuse technologies to the greatest extent possible relative to current government regulations and water requirements of the facility. The primary reuse potential lies with the rendering plant. This includes: recovering, treating, and reusing wash down water, air scrubber water, and pump seal water.

(b) The facilities' Water Use Team will investigate potential system and equipment modifications to increase the reuse of reclaimed and recycled water at the facility.

(c) The Water Use Team will present recommendations for system and equipment modifications and institute approved changes where practical.

- The facility utilizes a wastewater collection and treatment system to recover and treat, wastewater and a portion of the facility stormwater. All of the treated water that can be utilized for facility operations is currently being used for non-potable, non-sanitary purposes.

- In most areas where water may be spilled or wash water released to the ground surface, curbing, berms, swales, pavement, and grading are all utilized to collect and drain water to the wastewater treatment system for treatment, recycling, and reuse.

- A portion of the site has been graded and curbed or bermed to facilitate collection of stormwater runoff. This water is routed to the wastewater treatment system for use.

- Mandatory water use restrictions will be implemented during water shortage emergencies that are declared the local governing body, Director of DEQ, or the Governor. During these periods, the facility will terminate all uses of water that are considered non-essential in performance of facility business. Facility personnel will be prohibited from general washing of buildings, paved surfaces, or equipment and will not apply water to landscaped areas.

- The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.

Virginia Landing Campground

3100-001 / NEW

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT
VIRGINIA LANDING CAMPGROUND. QUINBY – ACCOMACK COUNTY, VA

ATTACHMENT (Section 5).

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Nature of Activity Utilizing Water and Documentation of Beneficial Use

The Virginia Landing Campground is located south of the Town of Quinby on Upshur Neck and has been in existence for at least the last 30 years. It consists of 617 designed sites for campers and 10 rental cabins (1 single and 9 duplex efficiencies). There are also 213 lots reserved for year-round trailers (10 occupied year-round). NACO/Virginia Landing does not own many of these permanent lots.

Normal operations at the facility that require water include potable water for drinking and cooking, showers, washing (dishes, clothes, boats, trailers, and campers, etc.), and minimal to no irrigation practices. Firefighting water is stored in an onsite pond.

According to annual water use reports, the facility currently utilizes an average of approximately 3-MG/y. The maximum annual use over the reviewed time period was 4.81-MG/y and the minimum being 2.1-MG/y. The typical high use month is approximately 0.8-MG although the average for that month over a 6-year period is approximately 0.5-MG. Please review the attached table and Water Withdrawal Reports.

Water Demand Projections and Justification of Withdrawal Request

The facility does not practice any landscape irrigation. There is no municipal water supply that may be used in lieu of groundwater. The onsite pond water is neither reliable nor a suitable source for potable water. Groundwater has been historically withdrawn for this facility for potable water and is the only reliable source.

Virginia Landing management has reviewed the current operation, water demand, and economy as it pertains to expansion of the facility. This review led to a projection of water needs over the next 10-years. The following paragraph outlines the projected needs relative to the beneficial use described above. A letter from Virginia Landing management is also attached to supplement justification of the withdrawal request.

The facility has a listed capacity of 617 campsites/lots. Of those, there are 307 lots and 10 cabins that currently have water service for a total of 317 connections. Potential water needs for the remaining 300 campsites/lots <u>are not included</u> in the estimates for future water demand. Only 160 of the 317 existing connections are currently actively used. In projecting the facilities' groundwater needs ten years out, facility management reviewed current business and considered potential future expansion of the operation.

Those plans include expansion of the number of active campsites to include 317 total connections. The average consumption from the highest two years (1997 and 2001) is approximately 3-MG/y. Considering this average maximum annual water consumption and the number of active connections, the current average water demand is equivalent to 25,000-gpy (68-gpd) per connection. By increasing the number of active connections from 160 to 317, t he ant icipated av erage w ater dem and c ould increase by near ly twofold (1.98-times) to 7.87-MG/y. If monthly use increases at the same rate, then the facility could increase maximum monthly production to approximately 1.58-MG.

The resident managers' house contains 3-bedrooms. Using one-half of the standard rate used by the Virginia Department of Health (150-gpd per bedroom) for sewage system design, the house should at least utilize 75-gpd/bedroom for a total of 225-gpd. This rate translates to 82,125-gpy. Water demand from this connection is not expected to change over the next 10-years and should continue to use the same quantity.

Due to anticipated demand for campsites at the facility, expansion is imminent. The current water usage will not be sufficient to supply the water necessary for normal operating procedures to continue. Starting from just under the maximum current withdrawal, the projected maximum withdrawal from all 317 connections may increase to 7.87-MG/y within 10-years. Adding in the 82k-gallons from the manager's house raises the total to 7.95-MG/y to cover existing and future needs. Therefore, the facility is requesting a permit to withdraw up to 8-MG/y. On a monthly basis, the facility should not exceed 1.58-MG/m.

Apportionment of Withdrawal to Individual Wells

The permitted yield will be produced from two existing wells. P-1 is the main production well and will produce a majority of the water consumed under this permit (98%). The other two percent will be withdrawn from the manager's house well (P-2). Review the following table for more information on apportionment.

[1]APPORTIONMENT OF WITHDRAWALS	P-1 (DEQ #100-439)	P-2 (DEQ #100-965)	Totals
Schedule	[2]M - PRN	M – PRN	
January	400,000	6,850	406,850
February	500,000	6,850	506,850
March	500,000	6,850	506,850
April	537,800	6,850	544,650
May	600,000	6,850	606,850
June	700,000	6,850	706,850
July	800,000	6,850	806,850
August	1,580,000	6,850	1,586,850
September	800,000	6,850	806,850
October	600,000	6,850	606,850
November	500,000	6,850	506,850
December	400,000	6,850	406,850
Annual Estimated Usage	*7,917,800*	*82,200*	*8,000,000*

[1] Estimates of projected maximum water use in gallons.
[2] M-PRN = pumped monthly as needed.

WATER CONSERVATION AND MANAGEMENT PLAN

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT:
SECTION 13 ATTACHMENT

VIRGINIA LANDING
SECONDARY ROUTE 605 – UPSHUR NECK
QUINBY, VIRGINIA

QUINBY – ACCOMACK COUNTY, VIRGINIA

JULY 2003

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1.0 GENERAL INFORMATION

The Virginia Landing, herein referred to as the "facility", is a seasonally operated campground facility with a small number of year round residents. The facility is currently located on an approximately 850-acre site at the southern end of the Upshur Neck peninsula in the town of Quinby, Accomack County, Virginia. Normally, the facility is open to visitors from the late spring to the early fall and provides facilities/utilities for camping to include water hookups for recreation vehicles.

Normal operation of the facility requires production and consumption of variable amounts of groundwater from wells located on facility property. Because this property is located within the Eastern Shore Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the facility and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide Virginia Landing management in responsible operation and policy management decisions. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provides guidance to implement water management and conservation measures.

2.0 WATER DEMAND

Water demand for the facility is primarily used for potable public water. This water is used for typical residential purposes such as human consumption, washing, laundry, and bathing.

The facility provides water hookups for campsites, recreational vehicles, and permanent water supply for the limited year round residents. Potable water use will vary depending on the amount of visitors present at the facility during the spring to fall season. For the limited number of year round residents potable water use will vary dependent upon the number of persons per household and by the water management practices and water conservation facilities available to and utilized by those residences. The facility does not engage in any irrigation practices, however, some of the permanent residences will irrigate small lawns or landscaped areas. The total maximum monthly consumption of groundwater from the target aquifer over the permitting period is 800,000 gallons, while the annual total over that duration will not exceed 8 MG.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the project site. There is no municipal water system or surface water body in the vicinity that could provide potable quality water to the facility.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the relative geographic proximity of the Virginia Landing. This region receives approximately 42 inches of precipitation per year, thus only surface water and groundwater occur in sufficient quantity or regularity to be economically viable sources for supply. Much of the aquifer recharge occurs during wet winter and the early spring months when the facility is closed to visitors and will only require water for the limited permanent residents located on site. Conversely, the operational season (late spring to early fall), which is typically dryer with several weeks in the late summer having ambient temperatures above 90°F, is the period when the facility will experience an influx of campers and will use the majority of its' annual load.

During periods of anticipated peak demand, surface water resources are not reliable as a result of high rates of evapotranspiration and low inputs from precipitation. In addition, surface water supplies under these conditions tend to be unreliable in quality – especially with respect to higher levels of organic substances. Thus, groundwater is the most reliable source – being buffered by slow recharge through downward infiltration and possibly upward seepage.

The confined upper Yorktown-Eastover Aquifer is the target aquifer for the facilities supply of potable water. Analytical modeling of the confined upper Yorktown-Eastover Aquifer will reveal that there are sufficient quantities of water available in the target aquifer to meet facility demand without creating an adverse impact to water levels.

4.0 WATER CONSERVATION MEASURES

The following conservatory measures will be implemented with regard to the potable water supply.

- All permanent lavatory facilities contain fixtures that are of the water conserving type, typically 2.5-gpf toilets and low-flow showerheads that use mechanical actuators allowing the water to flow only when depressed.

- Water saving plumbing fixtures will be installed in all new or renovated existing facilities in accordance with Unified Statewide Building Code recommendations

- The facility will not use water for irrigation purposes.

- Some permanent residents may irrigate small landscaped areas or lawns during the growing season. The overall land represented by these areas is insignificant due to the limited number of homes and the lot size the homes are on. Nevertheless the residents are encouraged to exercise good judgment when irrigating these areas.

- Water Reuse Evaluation: in that most of the water is utilized for potable purposes, there is little water that could be reclaimed for reuse. Should a water use arise that involves non-potable water, then a Water Reuse Evaluation will be conducted and resultant plan be implemented.

5.0 WATER MANAGEMENT MEASURES

The following management measures will be implemented with regard to the potable water supply.

- The facility has been designed to use Xeriscapic (little to no artificial irrigation required) landscaping and thus does not practice irrigation.

- Water Loss Reduction:

  (a) The facility conducts weekly records review to find excessive usage that may indicate a leak in the system.

  (b) The facility will conduct routine inspection of all above ground potable water piping systems and storage tanks for any indication of leaks.

  (c) The facility will conduct routine observations along underground potable water piping systems for indications of leaks.

  (d) Any leak discovered in the potable water storage/supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water.

- Encourage permanent residents to conserve water through the use of regular conversational reminders, notices issued with water utility statements, and posters or bulletins posed in message areas or bulletin boards.

- Encourage campground guests and visitors to conserve water through conversation and handouts during camper registration, and using posters or bulletins posed in message areas or bulletin boards.

- No unnecessary groundwater withdrawal will be permitted.

- Mandatory water use restrictions will be implemented during water shortage emergencies declared the local governing body or the Director of DEQ. During these periods, permanent residents will be restricted from conducting irrigation activities, automobile or trailer washing, or other such non-essential use of water. In addition, facility personnel will be prohibited from general washing of buildings, paved surfaces, or equipment. Campground guests and visitors will be instructed to conserve water and advised of any water use restrictions that may be in place. The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.

LARGE AGRICULTURAL SELF-SUPPLIED WATER USERS

3100-001 / NEW

East Coast Brokers and Packers

3100-001 / NEW

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT
EAST COAST BROKERS AND PACKERS. MAPPSVILLE, VIRGINIA

ATTACHMENT (Section 5).

JUSTIFICATION FOR THE AMOUNT OF WITHDRAWAL REQUESTED

Nature of Activity Utilizing Water and Documentation of Beneficial Use

The East Coast Brokers and Packers production plant located in Mappsville, Accomack, Virginia has been in operation as this location for 5-years (since 1999). This industrial facility manages the harvesting and preparation of tomatoes for shipping and retail. The standard industrial classification (SIC) code for this operation is 0723. According to the 2004 quarterly withdrawal reports, approximately twenty-eight percent of the water at the facility is used solely for production purposes. The remainder of the water is used as potable water for sanitation and domestic use.

The facility has traditionally operated with one production-line (wash flume) and eight seasonal labor homes. During the 2003 season, an additional production line (flume) and six new labor homes were built and/or put into production. Consequently, the ability for the facility to double its historical production volume was now possible if enough picking and harvesting were to occur. Additionally, for the past several years, the facility has gained additional production acreage. Future expectations are to gain an additional 40%-50% more tomato production acreage in addition to the facilities currently held 1200 acres.

Facility expansion is scheduled to occur in the summer of 2005. One additional production line has been proposed. This line will be used to process grape tomatoes only. As the facilities #2 line currently processes grape and cherry varieties, the proposed third line will separate the two varieties allowing for more streamlined production. As the facility will be processing the same volume of tomatoes, no net increase in production will be encountered; the efficiency of production will be increased. This line is not expected to have any effect on water withdrawal/usage demands.

Water is used in production as a cleaning agent in conjunction with an additional sodium hypochlorite solution. Tomato process water is mixed as needed on a daily basis during the operational season. The production of wastewater may range from 0 to 30,000 gallons per day. The VPA permit has conditions that limit how much and when wastewater can be applied (i.e. not during rain events, or to exceed a specific land application rate), there are some days in which wastewater is not created at all. As a result there are days that need to supplement lost time/production; hence more daily waste may be generated but shall not surpass the facility weekly max.

Current (2004) water use and production data shows that an average of 17,050 gallons of wastewater was generated per day during the production season (July 1 – October 30). An average production season is approximately 140 days during the summer and early fall. As much as 2.75 Million gallons of wastewater could have been produced if the facility operated all 140 days. Weather and mid-season production-lag truncate maximum production to limit the number of actual production days.

Also, crop yield directly influences the amount of water needed for withdrawal. If the yield is high, more water is needed to accommodate the additional tomatoes. The 2004 season was approximately down by 58% according to the facilities desired yield of 2000 bushels per acre (see references R-1, R-2, and R-3 for justification). Production increases towards target-production rate will increase water demand by that percentage difference.

The remainder of the water withdraws is used to support the facilities employees. The number of employees varies throughout the year. During off-season times, the year-round staff is approximately one seventh that during the main processing season (July – October).

In general the water usage by the employees remains constant from year to year. There are currently 14 labor camp/homes at the facility. Of these homes, 12 are used seasonally. Occupancy of the homes is dependant upon which phase of production is in effect. For example, the planting season during spring does not require as many employees as the harvesting season of the fall. The homes are at full occupancy during the months of July through September. As production develops and curtails, small alterations to the staff are made in order to process the tomatoes. Water usage by personnel, on average, is constant through the year. The 2004 season has shown that an average per-home use of 23,644 gallons is used per month on an annual average (for 14 homes).

Accessory sanitation/potable use (from well 100-855, within the production facility) can be assessed on an annual average. This portion of water services the needs of employees while at the production plant. 1.62 MG was used during the 2004 season. This calculates to an average of approximately 11 gallons per day, per employee (per 30 days). This number is expected to be the normal expected use for two reasons: 1.) the facility is not expected to expand its operation anymore 2.) the number of new employees at this facility is not expected to increase as well.

Water Demand Projections and Justification of Withdrawal Request

The main production well (100-855) is purposefully divided into numerous veins in order to 1) provide the production facility with raw water, for use as a washing agent, 2) provide the production facility with potable water for consumption and sanitation, 3) and to provide three labor homes potable water for consumption and domestic use.

<u>Production Use</u>. The facility is a vegetable processing operation. Tomatoes are harvested and transported to the facility for washing, sorting, and packing. Water is withdrawn and temporarily held in a storage tank in conjunction with the addition of the washing agent (sodium hypochlorite). The wash water is than introduced into two separate production lines. Incoming tomatoes are dumped into the wash bin by the gondola. Gondolas are of differing size, but they are multiple bushels in capacity.

Water is introduced as quickly as it is used. As wet tomatoes leave the wash bin by roller-belt, adherence water is allowed to drip into collection features for removal. Periodically, the entire washbasin is emptied and washed and then refilled. This volume of water is approximately 1,000 gallons, per flume/line. This only happens when washing is not needed however; during peak production washing is constant. In light of this, wastewater is generated and removed as needed throughout the day. The need is based on two parameters: how dirty the water becomes from soil, and how much water escapes the wash system through use. More or less, the water in the wash flumes shall be considered a constant flow. As wastewater is introduced into the facilities VPA holding tanks, "make-up" water is added to the flumes.

Year to year production use has been inconsistent over the last five years, so it is difficult to describe what is, or will be, "normal". Projected water use is difficult to assess at this facility using any data generated prior to 2004. Some historical data is available however, it is affected by rapid growth (facility added new production line), quick loss (hurricanes and natural disasters), and/or general development (facility expansion). For example:

- To demonstrate the effect of natural disasters According to the 2003 VPA report, just less than 700,000 gallons of waste-water had been applied. If the 2003 volume had been doubled and then compared to the single production line average of 950,000 gallons, then doubled, the 1999-2002 projected total would be 1.9 MG in 2003. This value is close to the 1.4 MG that could have been generated if production were able to elapse over an entire production season during 2003.

- During the past five years, one variable or another has changed; limiting the ability to accurately predict withdraws. Increased production rates, additional production spaces, and increased staff housing have all been added at different phases throughout the past years. Other short term impacts have been experienced as well either limiting water use or exceeding expected water use: Hurricane Isabel truncated the 2003 season limiting use, and early construction during that same year utilized more water than expected.

The facility is projecting a 40-50% increase in production (by acreage acquisitions) over the next 10-year period according to facility owners. This increase is based on the total crop acreage that is likely to be purchased by the facility. Expanded acreage affects the total possible amount of water to be needed for production purposes in that more tomatoes will be processed. Currently the facility owns 1,200 acres operates an additional 400 acres owned by second parties (which is 20% greater than the previous two seasons and 100% greater than 1999). Future production use can be assessed on two variables; target yield and acreage. Please see attached spreadsheets to understand the following calculations (R-1, R-2, R-3).

It is estimated that the facility could use 13.5 MG per year over the next ten years if production is at target yield. The requested monthly maximum is 2.4 MG. This maximum monthly volume is based upon the forecast apportionment table below. All calculations may be reviewed in the following sections. This volume of water will not be used if the actual yield is below the target yield. System losses (leaks, evaporation) are assumed to be negligible, as they have not been encountered yet (past five years).

Reference Section R-1

ECBP 2004 Production Values

The 2004 production season was a fully utilized. At ECBP there are two independent growing and harvesting events. The first event is roughly June to August and then August to October. In each of these cycles the facility plants, picks and packs roughly 1,600 acres, twice.

These 1,600 acres is the combination of 1,200 owned by King Tomato and roughly 400 acres not owned by King Tomato. The facility tracks production in terms of finished boxes. These finished boxes are 25# boxes that are ready for distribution directly to the end user. Each box is approximately 47% of a bushel.

The facility reported shipping a total of 2,420,220 boxes in 2004 (with approximately 3,000 left over (0.12% unused)). Also in 2004, a total of 23,939 bushels of cull was produced. This Cull represents approximately 2.1% not packaged. The following shall reveal the Bushels Per Acre Value the facility produced.

$$
\begin{array}{l}
2{,}420{,}220_{boxes} \times 25\#_{/box} = 60{,}505{,}500\#'s_{produced} \\
\downarrow \\
60{,}505{,}500\#'s_{produced} \div 53lbs_{/Bushel} = 1{,}141{,}613_{Bushelsproduced} \\
\downarrow \\
23{,}939_{cullbushels} + 1{,}141{,}613_{Bushelsproduced} = 1{,}165{,}552_{totalBushels} \\
\updownarrow \\
\dfrac{23{,}939_{cullbushels}}{1{,}141{,}613_{totalBushels}} \bullet 100 \cong 2.10\%_{cull}
\end{array}
$$

In 2004 the total number of bushels picked was 1,165,552 according disposal and distribution records. Total weight produced is approximately 61,776,116 pounds. In order to reveal the facilities BPA value, the following calculations should be reviewed:

$$1{,}165{,}552_{bushels} \div 1{,}600_{acres} = 728_{BPA_{season}}$$

$$728_{BPA} \div 2_{events} = 364.2_{BPA_{event}}$$

$$\frac{\left(364.2_{BPA_{event}} - 950_{USDAbpa}\right)}{950_{USDAbpa}} \bullet 100 = -61.7\%_{USDA_{max}}$$

$$61.7\% * X_{t\arg etBPA} = 728_{BPA_{season}}$$

$$X_{t\arg etBPA} = \frac{728_{BPA_{season}}}{61.7\%} = 1{,}179_{BPA_{taret}}$$

The math above supports the premise that the facility under produced in 2004.

The calculated BPA value for 2004 could have been as high as 1,179 BPA if the facility had experienced ideal production conditions. As the USDA production maximum is known to be around 950 BPA for a one-cycle planting season, ECBP was approximately 61.7% below this maximum, supporting the premise that this facility can and should be able to produce more tomatoes in the next ten years. Please review Reference R-2.

Reference Section R-2

USDA Reported Production and Estimates

The facility currently holds 1200 acres and receives tomatoes from an additional acreage increasing total producible acres as much as 25%. In total the facility processed 1600 acres in 2004. The following URL is provided by Cornell University: http://usda.mannlib.cornell.edu/data-sets/specialty/92010/tab065.xls. It contains the data for tomato producing states since 1960.

Current production targets were established on USDA statistics. There are data available from 1960 to 2002. Analysis of this 'reported production' shows statistical maxima, minima, and average yields. Please see attached chart and graph of reported production. An important note: production yields have been affected by improved staffing methods, technology and site management. The USDA reported production graph does not show the acreage influence (reference chart R-2-1). The attached standardized USDA production chart better illustrates this influence in terms of bushels per acre produced (reference chart R-2-2). Comparison of the three charts also shows three distinct time frames where production yields were static: 1960-1973, 1973-1986, and 1987-2002.

The Maximum Bushel Per Acre (BPA) value was found to be 950. This is a value based on one planting season. Most Eastern Shore tomato growers plant two times a year. Therefore the maxima value in reference to ECBP and others would be around 1,900 BPA.

To generate the USDA BPA value:

The table is divided into yield and production. For the purposes of this application, production values are used. The USDA has published a production weight (in 1,000's CWT) for the acreage reported from 1960-2002. As each year contains a different production value based on variable acreage, the values had to be standardized to a BPA value:

Step 1. Each value listed in the "Production" column is listed in *1,000 cwt.* A CWT is an agricultural unit also called a "hundredweight". This weight is approximately 112 pounds. Each value in the Production column was first multiplied by 1,000 to show values of proper magnitude.

Step 2. Each new CWT value is than multiplied by 112 pounds to give a value of total pounds.

Step 3. The pounds value is than divided by 53 pounds to give a value of Bushels Produced.

Step 4. The number of bushels produced is then divided by the column which reports the acres harvested. This final value is the BPA for each year listed.

General	1980
$\mathrm{Pr}\,oduction_{1,000cwt} * 1{,}000 = production_{CWT}$	$590_{1,000cwt} * 1{,}000 = 590{,}000_{cwt}$
$\mathrm{Pr}\,oduction_{CWT} * 112_{lb's} = pounds_{total}$	$590{,}000_{cwt} * 112_{lb's} = 66{,}080{,}000_{lb's}$
$Pounds_{total} \div 53_{lb's/bushel} = bushels_{total}$	$66{,}080{,}000_{lb's} \div 53_{lb's/bushel} = 1{,}246{,}792_{bushels}$
$Bushels_{total} \div Acres_{harvested} = bushels/acre$	$1{,}246792_{bushels} \div 4{,}200_{acres} = 296_{BPA}$

Each year is calculated separately to reveal a year-specific BPA. From this list of data, the maximum, minimum and average is easily calculated. The minimum and average values are considered in consequential as they represent low production, variable acreage, and other anomalies. The maximum value BPA that has been established is considered a known target of production. An additional 10 percent should be added for continued growth (see reference graph R-2-2).

A linear regression was performed on the data. Plotted and then extended an additional 10 years (2015), a value of 1,060 Bushels Per Acre can be expected if growth (due to technology advances and management) increase at this steady rate.

Results

A maximum of 950 BPA has been proven. Linear growth supports that as much as 1060 BPA can be expected in 2015. To date this fits well with the facilities target expectations of 2,000 BPA. If the maximum is doubled, 1,900 BPA is the result. The value is doubled because the USDA data reflects one harvest cycle. ECBP has two planting/harvesting cycles per year.

Synthesis Section R-3

Projections

Understanding the above two subsections (R-1 and R-2) the number needed to calculate future water demand are possible. From reference sheet R-1 (spreadsheet), 1.76 gallons per bushel is a standard number not expected to alter more than 5%. Understanding the target BPA allotment and future land holdings, it is possible to forecast water need.

Domestic and sanitary usage at the facility are assumed to be at sustained level and are not anticipated to change within the next 10 years as the facilities domestic complement is already at a maximum (fully staffed during 2004).

Examine the following math and review spreadsheet R-3 for projection calculations:

GALLONS OF WASHWATER NEEDED

$$1200_{2004acresECBP} + 50\%_{increase} = 1{,}800_{acresECPB} + 20\%_{additionalACRES} = 2{,}160_{acresTOT}$$
$$\Downarrow$$
$$2{,}160_{2015acres} * 2{,}000_{bushels/acre} = 4{,}320{,}000_{Bushels} * 1.76_{gallons/bushel} = 7{,}603{,}200_{2015gallonsTOT}$$

GALLONS OF DOMESTIC WATER NEEDED

$$3{,}764{,}306_{HomesTOT} + 1{,}628{,}312_{SanitaryTOT} = 5{,}392{,}618_{DomesticTOT}$$

GALLONS OF WATER NEEDED 2015

$$7{,}603{,}200_{production} + 5{,}905{,}158_{domestic} = 13{,}508{,}358_{Tot} \Rightarrow 13.50\ {}^{MG}\!/_{Year}$$

A need of 13,500,000 gallons per year is anticipated by 2015.

Apportionment

Sanitary Use Water for sanitation purposes is provided by all wells. As this facility is seasonal, each month will differ in terms of total usage. The production facility and each house will be able to support the number of workers the facility employs. The table below is a general schedule of onsite employees throughout the year on a home occupancy basis.

Usage	January	February	March	April	May	June
Homes	2	2	4	6	6	6
Occupants	48	48	96	144	144	144
Volume	0.08 MG	0.08 MG	0.16 MG	0.24 MG	0.24 MG	0.24 MG
Year totals	0.08 MG	0.16 MG	0.32 MG	0.56 MG	0.8 MG	1.04 MG
Usage	July	August	September	October	November	December
Homes	14	14	14	14	6	2

Occupants	336	336	336	336	144	48
Volume	0.44 MG	0.44 MG	0.44 MG	0.44 MG	0.24 MG	0.08 MG
Year totals	1.48 MG	1.92 MG	2.36 MG	2.8 MG	3.04 MG	3.12 MG

Virginia Department of Health provides standard design parameters based on a per-person-per-day allotment suggesting approximately 90 gallons per-day-per-person for sanitary, domestic and general use reasons. Utilizing the above schedule, the VDH suggests that 5.9 MG per year is required (64,000 gallons per house per month). As there are several years of actual use data (according to DEQ GWW Quarterly reports), the anticipated actual usage is significantly less than the suggested per-person allotment. On average, 2.8 MG per year for all homes was observed. In the 2004 season all homes were occupied and potable withdraws are expected to be at their maximum levels. The 2004 withdrawal volume for the 11 individual houses was 2.957 MG. A statistical mean for the three homes using 100-855 can be approximated using the data from the 11 homes. As mentioned before, annual occupancy is not experienced in 12 of the 14 homes.

The sum of all 14 homes is approximately 3.764 MG. This is approximately 50% of the total withdrawal. This volume of water produces a mean of 23,644 gallons per month per house on an annual scale. (note: the homes that are not occupied all-year-round we evaluated only on the months that they were occupied).

Potable Use Domestic water use at this facility is provided by all wells in accordance to with the above usage schedule. The majority of the water is used at each of the homes. There is a portion of the water that is withdrawn from 100-855 that services the needs of the production plant with respect to potable usage. Domestic use includes food preparation, laundry, and hygienic use. Future potable use is not expected to deviate past current and historical usage. This is due, in part, that the during the 2004 production year, the facility was at full occupancy.

Projected potable use for the facility and homes is basic. The future need shall not exceed current need because the variables of expanding the potable need are fixed. The facility is currently at the maximum level of domestic expansion. There is no additional room on the property to accommodate additional homes. Since the staff can not grow beyond its current capacity, the production facility itself is currently at its maximum level. 72% of all water used at the facility is for personal use. This number shall decrease as production increases. It is estimated that in 2014 54% off all water use will be for production purposes as opposed to today's 26%.

Landscape Irrigation. The facility does not utilize any landscape irrigation.

Apportionment of Withdrawal to Individual Wells

The permitted yield will be produced from 12 existing wells. Only one well is used for production. The production well itself as well as the other 11 are used to service the labor homes on site. These wells will produce all of the water consumed under this permit (100%). Review the following table for more information on apportionment.

[1]APPORTIONMENT OF WITHDRAWALS	100 855	100 871	100 872	100 873	100 874	100 875	100 876	100 877	100 878	100 879	100 880	100 881	Totals
Schedule	[2]M – PRN												
January	0.05 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.13 MG
February	0.05 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.13 MG
March	0.1 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.26 MG
April	0.16 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.40 MG
May	0.17 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.41 MG
June	1.5 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	1.74 MG
July	1.9 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	2.34 MG
August	1.9 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	2.34 MG
September	1.7 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	2.14 MG
October	1.5 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	1.94 MG
November	1.3 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	1.54 MG
December	0.05 MG	0.04 MG	0.04 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.0 MG	0.13 MG
Annual Estimated Usage													*13.5 MG*

[1] Estimates of projected maximum water use in gallons. Actual use will vary.
[2] M-PRN = monthly withdrawal pumped as needed.

Summation

RCB

In total, the requested withdraw amount is 13.5 MG per-year over the next 10 years. A maximum withdrawal volume is approximately ~~3.5~~ 2.4 MG per month. This volume of water is likely to be needed in 2014. This allotted amount of water shall provide enough water to support the facility without breaching the newly requested amount.

Notes:

- Water use of 100-855 is divided into numerous veins (domestic, production sanitation, and production)
- The percentage of domestic and sanitation use should not increase very much in the next several years. The volume can only increase if more homes and employees are added, which is not anticipated.

CURRENT USAGE**

2004 Water usage		Percentage
Water from Production well	**4,481,989**	**60**
Water from Homes (11)	**2,957,669**	**40**
Total water withdrawal	7,439,658	100

Home Well Break-out (2004)*,**,***	Sum	Mean	Percentage
Total	**2,957,669**	**268,879**	**40**
100-871	413,388	34,449	14
100-872	276,452	23,038	9
100-873	453,405	37,784	15
100-874	255,310	21,276	9
100-875	453,012	37,751	15
100-876	317,398	26,450	11
100-877	177,677	14,806	6
100-878	136,487	11,374	5
100-879	162,564	13,547	5
100-880	250,469	20,872	8
100-881	239,753	19,979	8
Home use from 855 ~~(all 3)~~ (each)	268,879	22,407	
Home use from 855 ~~(each)~~ (all 3)	806,637	67,220	
Total domestic Use	3,764,306	23,644	

Production well break-out (100-855)**		Percentage
Water from Production well	**4,481,989**	**100**
Waste Water Applied (a.)	2,046,000	46
Average home use (b.)	806,637	18
Sanitation (c.)	1,628,312	36
Sanitation (c.) (per month)	135,693	
Sanitiation per month per employee	339	

3,674,312

NOTES:

a. This volume of water is gauged according to requirements set by the facilities VPA permit. This volume of water is generated during the processing of tomatoes.

b. There are three labor dormitories connected to the facilities main production well. The volume usage of these homes are commensurate to the facilities 11 independent homes. The value used in this table is the average volume of water used by the 11 homes multiplied for three homes over a six month period (peak production season).

c. The main production facility utilizes the remainder of water withdrawn from the main production well. This water supports the staff while the production facility is active. lesser amounts of water are used for offsite potable use.

d. This is water used per employee per day on an annual average. The long shifts are essentially double that of any VDH estimates for emplyees work-day support.

* This usage is considered to be constant from year to year. There are no statistical indicators that suggest water usage will exceed the mean by more than 10%.

** Values as reported in 2004 quarterly DEQ reports.

*** Home usage is not anticipated to waiver as maximum occupancy average values were used for calculations

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CURRENT PRODUCTION (Reference R-1)

Current Acreage Holdings by ECBP	1,200	acres
Current Accessory Acreage not held by ECBP (g.)	400	acres
Total production acres for 2004 season	1,600	acres
End of season production, boxes of tomatoes (BOT)	2,420,220	boxes
Total pounds of 1 packaged box (a.)	25	pounds
Total pounds of production season (b.)	60,505,500	pounds
Pounds per bushel	53	pounds
Total production Volume (c.)	1,141,613	Bushels
Percentage to Cull fields	2.10	percent
Total Picked Volume of Tomatoes (d.)	1,165,530	Bushels
Bushels per acre	728	Bushels per acre
Target bushels per acre (e.)	2,000	Bushels per acre
Departure from target (f.)	-64	Percent, %
Gallons of wastewater per bushel (from current use chart)	1.76	Gallons per bushel

NOTES:

a. Each produced box weighs 25 pounds. Also known as a half bushel (47% bushel per box)

b. Total boxes produced multiplied by pounds per box

c. The total production volume is what is officially accounted for by the management. It is referred to in terms of produced boxes rather than bushels

d. The total picked volume of tomatoes is based on the actual produced volume of tomatoes multiplied by a 2.1% loss to cull (poor quality/unsaleable tomatoes) and then added to the actual produced volume

e. Target bushels is an achievable volume of tomatoes that can be produced from one acre if all ideal growing parameters are experienced in a given year. This effectively represents a "target" for production if the growing season is free from negative losses. According to the USDA, the maximum BPA has been 950 on an increasing trend. This value is explaned in R-1

f. The departure from target is a percentage value that is based on what was actually picked divided by the target. This number represents a net loss or net gain in terms of actual production numbers

g. An unknown of end of season availability of other growers tomatoes. This acreage is processed by the facility although it is not owned by the facility. This averages about 20% additional acreage per year if pursued and available.

PROJECTIONS (Reference R-3)

Current land holdings (from Current Production form)	1200	acres
Projected expansion of current holdings	50	percent
Total projected land holdings of King Tomato	1800	acres
Total Projected Acreage held and not held by King Tomato	2160	acres

NOTE: In order to calculate future use, two methods Could be used. One method is based on current, 2004 production numbers. The second method is based on ideal conditions (target) as mentioned in item e of the Current production form.

NOTE: A desired Target volume is attempted every year. During Ideal Conditions a volume of 2000 bushels per acre is attempted. To assess a volume of water that could have been needed for a given year, the difference between 'Target' production and 'actual' production is assessed.

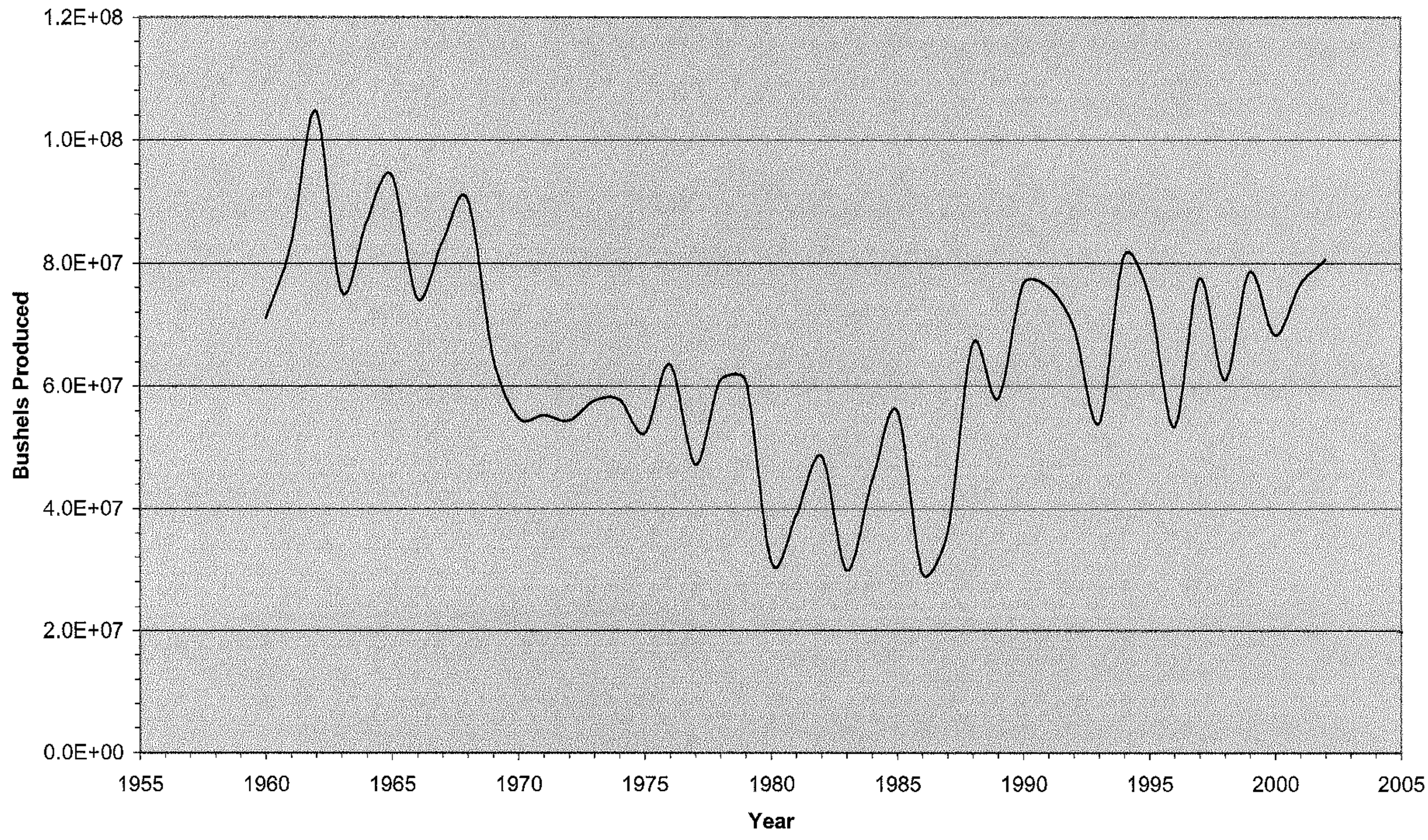
10-year Projection based on 2004 production		
Current bushel per acre volume	728	bushels per acre
Total bushels	874,148	Bushels
Total volume of water used	1,534,500	Gallons
Gallons per bushel	1.76	gallons per bushel
Adjustment factor for target production		
Adjustment based on target production	61.7	percent
Total volume of water used (adjusted)	2,481,287	Gallons

Method: Target production volume		
Total Projected Acreage held and not held by King Tomato	2,160	acres
Target Bushels per Acre volume	2,000	bushels per acre
Total bushels, 2014	4,320,000	bushels
Gallons needed to process 2014 bushels	7,603,200	gallons

Future need		
Current wastewater usage from 100-855	1,534,500	gallons
Current accessory usage of 100-855	2,947,489	gallons
Current usage by all 11 homes	2,957,669	gallons
Current total	7,439,658	gallons
Future total	13,508,358	gallons

Note: The future totals are based target production volumes added to current usage. Current accessory usage of non-production water from 100-855 and the 11 homes shall remain at the same values over the next 10 years as their 2004 volumes were at the maximum capacity. Their current summed averages were used in conjunction with the forecasted production volumes based on two forecasting methods.

Refernece Chart R-2-1
Reported Prodcution (1960-2002)



Reference Chart R-2-2
USDA Reported Prodcution
1 Cycle

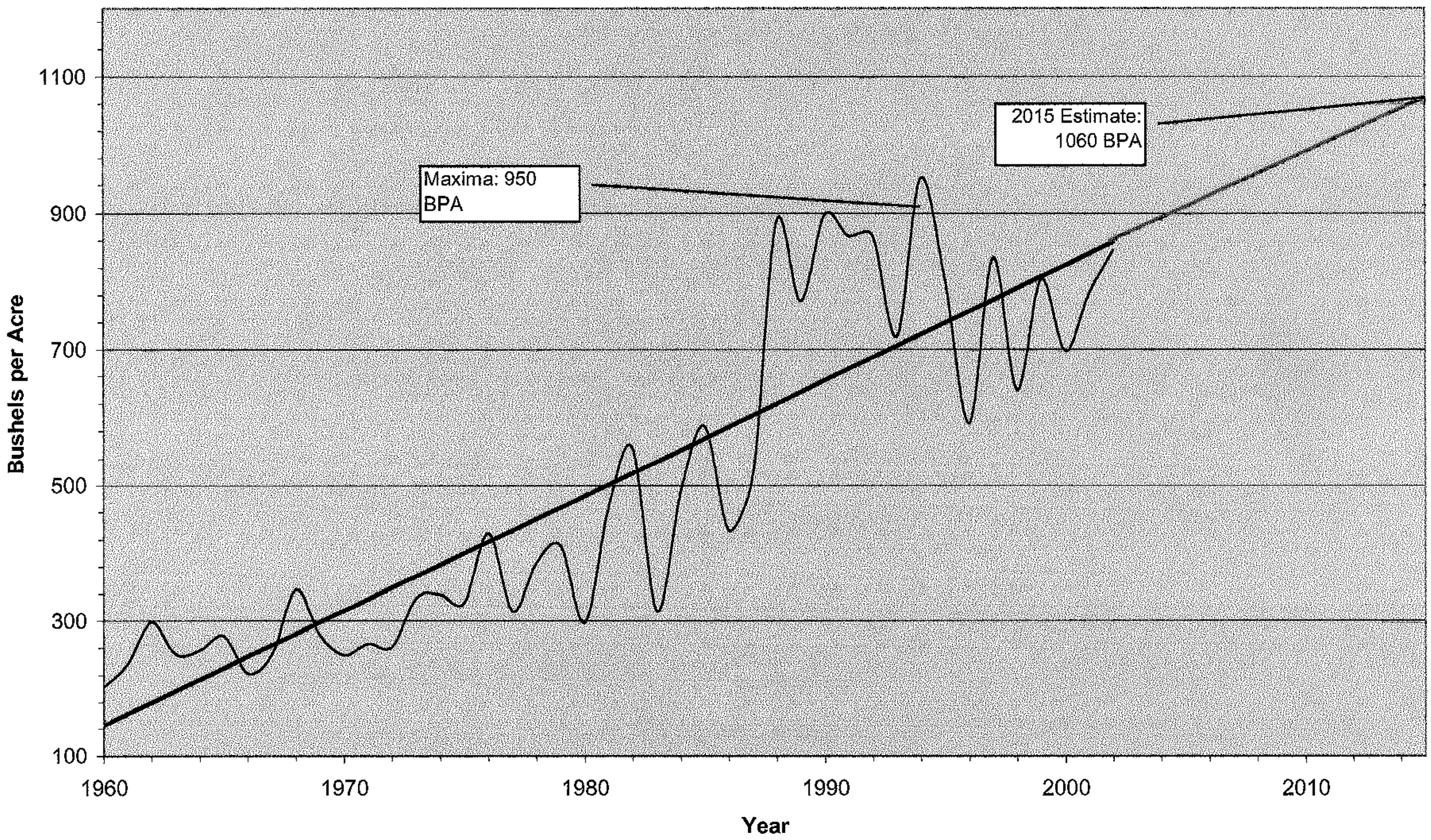


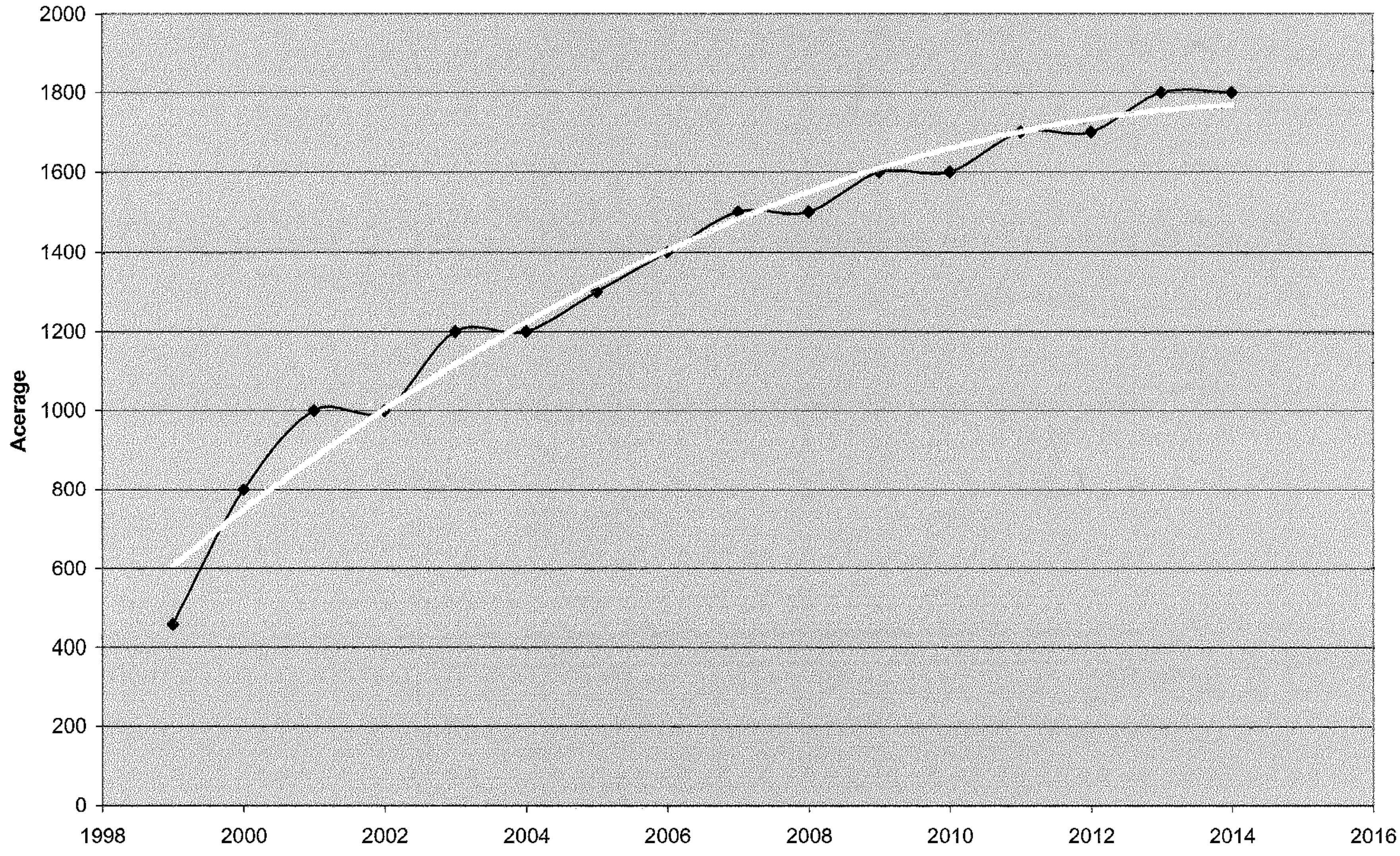
Table 65--Virginia total tomatoes: Acreage, yield, production, and value, 1960-2002 1/

Year	Acreage		Yield	Production	Farm value	
	Planted	Harvested			Per unit	Total
	Acres		*Cwt*	*1,000 cwt*	*$/cwt*	*$1,000*
1960	14,000	14,000	96	1,339	2.17	2,899
1961	14,000	14,000	112	1,568	1.99	3,128
1962	14,000	14,000	141	1,975	3.06	6,045
1963	12,200	12,000	119	1,422	2.67	3,794
1964	13,700	13,500	121	1,638	2.67	4,372
1965	13,900	13,500	132	1,778	3.41	6,058
1966	13,400	13,300	105	1,400	4.60	6,439
1967	13,500	13,300	118	1,574	4.28	6,741
1968	12,100	10,400	164	1,702	3.73	6,354
1969	10,000	9,200	132	1,217	3.30	4,019
1970	9,100	8,800	118	1,036	3.79	3,928
1971	8,600	8,300	126	1,045	4.46	4,657
1972	8,900	8,300	124	1,028	4.26	4,378
1973	7,300	6,900	158	1,088	5.20	5,660
1974	7,000	6,800	160	1,090	6.01	6,555
1975	6,600	6,400	155	989	7.15	7,067
1976	6,000	5,900	203	1,199	6.52	7,813
1977	6,200	6,000	149	893	7.33	6,544
1978	6,700	6,300	183	1,150	6.64	7,631
1979	6,400	5,900	194	1,147	7.11	8,150
1980	4,400	4,200	141	590	10.58	6,242
1981	3,400	3,300	223	735	14.45	10,623
1982	3,700	3,500	263	919	11.93	10,962
1983	3,900	3,800	149	565	14.57	8,237
1984	3,800	3,600	233	840	21.18	17,793
1985	4,000	3,800	278	1,056	12.91	13,631
1986	2,800	2,700	205	554	28.70	15,900
1987	2,900	2,800	245	686	21.80	14,955
1988	3,000	3,000	420	1,260	32.10	40,446
1989	3,200	3,000	365	1,095	36.40	39,858
1990	3,500	3,400	425	1,445	29.90	43,206
1991	3,800	3,500	410	1,435	23.10	33,149
1992	3,400	3,200	410	1,312	31.00	40,672
1993	3,300	3,000	340	1,020	33.50	34,170
1994	3,500	3,400	450	1,530	31.10	47,583
1995	3,800	3,700	380	1,406	31.00	43,586
1996	3,800	3,600	280	1,008	24.70	24,898
1997	3,900	3,700	395	1,462	33.80	49,415
1998	4,000	3,800	303	1,151	35.00	40,285
1999	4,200	3,900	380	1,482	28.00	41,496
2000	4,100	3,900	330	1,287	24.00	30,888
2001	4,000	3,900	370	1,443	22.00	31,746
2002	3,900	3,800	400	1,520	27.00	41,040

1/ 1960-85 include fresh and processing. 1986-2002 are fresh only.

Source: National Agricultural Statistics Service, U.S. Dept. of Agriculture.

Projected Growth



MSA, P.C.
5033 Rouse Drive, Virginia Beach, VA 23462-3708
(757) 490-9264 • (757) 490-0634 (FAX) • www.msaonline.com
Offices in Virginia Beach and Eastville, VA
Environmental Sciences • Planning • Surveying • Engineering • Landscape Architecture

January 4, 2005

Mr. Bob Smithson
VPA Program
Department of Environmental Quality
5636 Southern Boulevard
Virginia Beach, VA 23462

RECEIVED JAN 2005 DEQ TIDEWATER REGIONAL OFFICE

RE: Annual Report for 2004
Virginia Pollution Abatement Permit VPA01057
East Coast Brokers & Packers, Inc.
MSA Project #99167

Dear Mr. Smithson,

The following is the 2004 Annual Report for the East Coast Brokers & Packers, Inc. facility located in Mappsville, Virginia. This facility operates a spray irrigation system to discharge wastewater under Permit No. VPA01057. This report is the first under the newly awarded permit. New parameters and requirements are stated in the new permit. As such, this report contains additional chemical information not required by the expired permit.

Spraying operation began this year on July 2 and terminated by October 30. Total annual volume of production water applied to the irrigation field was 2.046 MG; an overall increase of approximately 66.03% from 2003.

This year both production lines were used. Approximately 2.5 million boxes of tomatoes had been packed (1.41 million bushels including cull). 1.4 gallons of wastewater was created per bushel. This wastewater was land applied through the facilities irrigation system onto the dedicated 3.35-acre VPA waste field.

Application of wastewater was calculated to average 1.406 in/wk or 0.025 in/hr. The maximum rate of application was calculated to be 2.125 in/wk or 0.038 in/hr. The highest rate did temporarily exceeded the permitted limit of 2.0 in/wk but not 1.0 in/day, or 0.25 in/hr. The slowest infiltration rate of the season (in the Munden Series) was 0.88 in/hr during the beginning of the season. As the same location was tested resulting in a faster rate during the end of the season, infiltration rates did improve. However, do to very steady production and application of wastewater, the fields did cease to accept water temporarily. It is assumed that in some areas the infiltration rate decreased below the application rate in some portions of the spray field.

The cover crop for the application field was pasture grass. The grass looked healthy with exception to areas that were saturated. It was mowed on a regular basis as required by the permit.. The calculated PAN for this season (24.85 lb/ac) was slightly higher than the previous year (23.95 lb/ac), however it is still less than the recommended PAN for the crop. No excess nitrogen was applied to the irrigation field.

The average concentration of chloride in wastewater (220.4 mg/L) was found to be lower than the previous season (665.0 mg/L). This concentration reflects the chloride levels in the wastewater holding tank at the time of sample collection but does not necessarily comprise the level of chloride in wastewater at the time of its application. Some amount of chloride will volatize during the wastewater's residence time within the holding tank. After dilution from precipitation, the annualized load of chloride in wastewater applied to the irrigation field was calculated to be 45.51 mg/L. This represents a dilution rate of 79%, which is slightly less that the dilution rate during the previous season.

The pH in all of the monitoring wells, including the up gradient background well, was lower than the range specified in the permit (6.0-9.0). These levels are not unusual for water table groundwater in this area and do not indicate any impact to groundwater. MW-4 was damaged during the later half of the 2003 season. This well had been marginally repaired to allow sampling access. However, accurate elevation data was not available.

Soil samples were collected from two areas chosen to represent each of the two identified soil series located within the spray field. This season, the whole 3.35 acres of application area was used. A site map is included to indicate the approximate locations of these soil samples. Life of field estimates with respect to addition of metals from wastewater suggest that there would be 62-years remaining for introduction of copper and 156-years remaining for introduction of zinc at the 2004 season rates. These rates are elevated in contrast to last year.

We believe that the information reported herein is accurate. It has been recognized that some improvements are to be made (and have been completed) to bring the facility back to full compliance:

- The irrigation system will be expanded for the 2005 season to more evenly spread water to prevent flooding and pooling.
- Rain gauges have been installed.
- A concrete berm is to be built around waste storage tanks to prevent spillage.

If there are any questions regarding this report, please do not hesitate to contact me.

Sincerely,

Matt Reed
Environmental Project Manager

Attachments
Copy: Batista Madonia, Richard Bernard

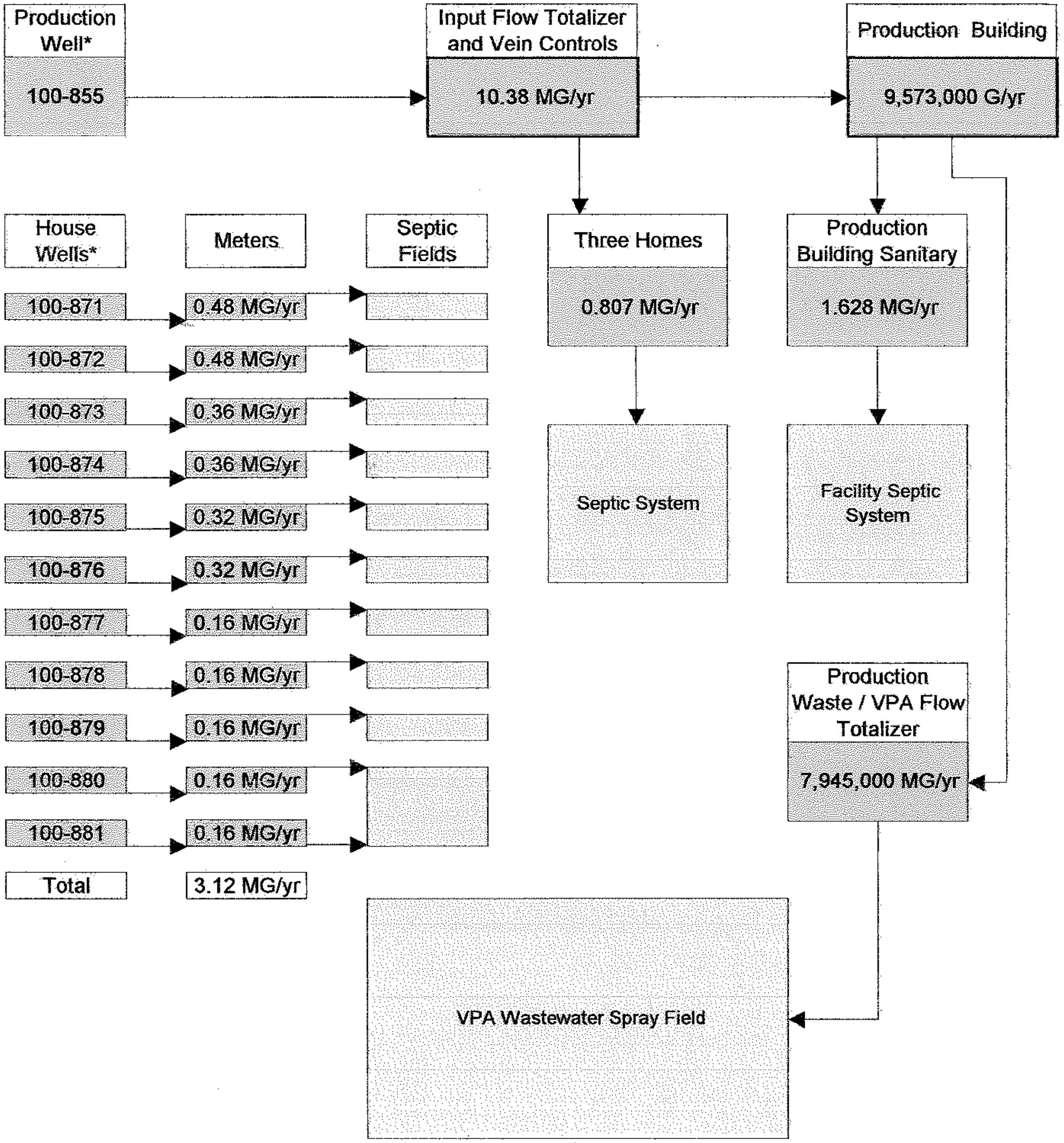
MSA, P.C. ENVIRONMENTAL SCIENCES, PLANNING, SURVEYING, & ENGINEERING	East Coast Brokers and Packers MONTHLY MONITORING: VPA# 01057		
	DATE: 1/3/2005	GRID SCALE: H: -- V: --	MSA JOB #: 99167

Table 4. Calculation of wastewater irrigation application rate.

Month	Application Gallons	Application Rate in/wk	in/day	in/hr	in/wk/ac	in/day/ac	in/hr/ac
January	0	0.000	0.000	0.000	0.000	0.000	0.000
February	0	0.000	0.000	0.000	0.000	0.000	0.000
March	0	0.000	0.000	0.000	0.000	0.000	0.000
April	0	0.000	0.000	0.000	0.000	0.000	0.000
May	0	0.000	0.000	0.000	0.000	0.000	0.000
June	0	0.000	0.000	0.000	0.000	0.000	0.000
July	773,000	2.125	0.304	0.038	0.634	0.043	0.002
August	532,000	1.462	0.209	0.026	0.437	0.030	0.001
September	381,000	1.047	0.150	0.019	0.313	0.021	0.001
October	360,000	0.990	0.141	0.018	0.295	0.020	0.001
November	0	0.000	0.000	0.000	0.000	0.000	0.000
December	0	0.000	0.000	0.000	0.000	0.000	0.000
Annual Volume (gal) =	***2,046,000***						
Highest Rates =		***2.125***	***0.304***	***0.038***	***0.634***	***0.043***	***0.002***
Average rate during irrigation =		***1.406***	***0.201***	***0.025***	***0.420***	***0.029***	***0.001***

Note: hourly application rate based on 8-hr day.

Total area of irrigation fields (ac)= 3.35



Projected Water Use Chart

GROUND WATER WITHDRAW PERMIT APPLICATION

EAST COAST BROKERS & PACKERS

Accomack, Virginia

MSA, P.C.

ENVIRONMENTAL SCIENCES, PLANNING, SURVEYING
ENGINEERING & LANDSCAPE ARCHITECTURE

5033 ROUSE DRIVE
VIRGINIA BEACH, VIRGINIA 23462
(757) 490 - 9264 FAX (757) 490 - 0634
www.msaonline.com

DATE:	SCALE:	MSA JOB #:
6/23/2005	**NTS**	**99167-A**

WATER CONSERVATION AND MANAGEMENT PLAN

APPLICATION FOR GROUNDWATER WITHDRAWAL PERMIT: SECTION 13 ATTACHMENT

EAST COAST BROKERS AND PACKERS
MAPPSVILLE COMPLEX
15141 FINNEY MASON LANE
MAPPSVILLE, ACCOMACK COUNTY VIRGINIA

ACCOMACK, VIRGINIA

APRIL 2004

Table of Contents

1.0 GENERAL INFORMATION

The East Coast Brokers and Packers facility, herein referred to as the "facility", is a seasonal agricultural production facility located in the Mappsville area of Accomack, Virginia. The facility is used to prepare tomatoes for retail and distribution. The standard industrial classification (SIC) code for this operation is 0723. Roughly 25-percent of the water used for production/washing of product whereas the remainder of the water is used for the support of the staff.

Normal operation of the facility requires production and consumption of variable amounts of groundwater from multiple wells located on the facilities property. Because this property is located within the Eastern Virginia Groundwater Management Area – as defined by the Virginia Department of Environmental Quality [VDEQ] – a Water Conservation and Management Plan has been prepared in accordance with the Ground Water Management Act of 1992, Chapter 25 (§62.1-254 et seq.) of Title 62.1 of the Code of Virginia. The purpose of this document is to analyze water supply and demand issues facing the facility and develop a reasoned and justifiable response for water conservation and management. This document is intended to help guide the East Coast Brokers and Packers plant management who is responsible for the operation and policy management decisions of the facility. Lastly, this document will meet the permit requirement by VDEQ for a water conservation and management plan.

Water conservation measures are those physical facilities, equipment, or devices utilized with certain methods, techniques, policies, practices, and procedures, which reduce water consumption, improve water use efficiency, reduce water loss or waste, increase water recycling or reuse and ultimately result in a reduction of water demand. Water management consists of a plan to implement water conservation measures.

This Water Conservation and Management Plan, referred to herein as the "Plan" includes identification of water demand and water source and then provide guidance to implement water management and conservation measures.

2.0 WATER DEMAND

Water demand for the facility is for a variety of purposes in the production of tomatoes. This use includes, but is not limited to, water as an ingredient in the washing of tomatoes and the remainder is used as potable water. There is very limited opportunity to conserve water wherever it is used and can be managed. The following paragraphs describe the water demand by reviewing the different facility uses of it.

Washing tomatoes requires the mixing of water and a sodium hypochlorite solution and directly rinsing the tomatoes in a flue that holds this liquid. The mixture is electronically monitored and maintained at a level of 150 to 200 ppm NaOCl. As the wash water is used it is slowly replaced with fresh solution throughout the day. The wastewater is managed by the facilities existing VPA permit to direct land apply said waste. During periods of heavy production the facility can generate as much as 15,000 gallons of NaOCl enriched wastewater per day.

The rest of the water that is withdrawn at the facility is potable usage. The facility maintains an on-site staff that utilizes water for sanitary and domestic needs. Sanitary waste and domestic usage waste is generated at each of the buildings and consequently handled at each of the buildings. Site specific septic systems were developed to service the plant and the houses alike.

The facility does not engage in any irrigation practices, however, some of the permanent residences that may use a small aliquot of water to maintain small lawns or landscaped areas (less than 0.25 acres). The total monthly consumption of groundwater from the target aquifer over the permitting period is expected to reach but not exceed 3,000,000 gallons, while the annual total over that duration will not exceed 11.5 MG. The water usage is Gaussian distributed. However there is skewness associated with the distribution as the majority of the water used is in late summer and early fall. As the facility becomes more productive, the on-site residences grows to a maximum of about 400 employees. Water usage during the off-season is significantly less than the production season.

3.0 WATER SUPPLY

The following section presents a general overview of water resources available to the facility. As there is no municipal supply pipeline from the County of Accomack, drinking water as well as production water is directly withdrawn at the facility. Due to the nature of water usage, almost all water is used for potable purposes. There are eleven deep wells located within the facility complex that currently supplies adequate quality and quantity of groundwater.

Water occurs in several forms or media (i.e., liquid and solid meteoric precipitation, surface water, and groundwater) in the relative geographic proximity of the ECBP. Although this region receives approximately 46 inches of precipitation per year, the facility is not large enough to be able to support a precipitation collection system and cistern storage system that could supply the required volume and rate of fresh water during normal operations. During periods of peak demand, surface water resources are not reliable as a result of high rates of evapotranspiration and low inputs from precipitation. Other surface water resources include an adjacent pond. This pond is a surficial irrigation reservoir that is owned and operated by private party, and is off-limits to ECBP.

Groundwater has been used for several years without problems with quality or availability. Thus, deep-groundwater is the more reliable source of quality water – being buffered by slow recharge through downward infiltration and possibly upward seepage.

4.0 WATER CONSERVATION MEASURES

The following conservatory measures will be implemented with regard to the groundwater supply.

- No unnecessary groundwater withdrawal will be permitted.

- Facility management periodically reviews water use and will implement changes where possible and practical to better manage water use and increase water conservation:

  - Monthly visual inspection of water loss and leak detection
  - Weekly observation of forwarding pumps, withdraw pumps, and tanks
  - Daily evaluation of water re-use and recycling for production purposes

- All permanent plumbing fixtures throughout the facility (homes and production building) shall contain low-flow fixtures and 2.5-gpf toilets. Older plumbing shall be replaced as needed with newer efficient models as needed within the scope of the Unified Statewide Building Code recommendations.

- The facility will not and does not use water for irrigation purposes.

- Encourage employees to conserve water through the use of regular conversational reminders, and posters or bulletins posted in message areas or bulletin boards.

- *Water Reuse Evaluation*: a significant portion of the water used at this facility cannot be reclaimed and reused. As 75% of the water used is used to support staff, it is managed with a septic system and released into the Water Table Aquifer (Columbia). This conservation and management plan examined all water uses and presents management measures in Section 5.0.

5.0 WATER MANAGEMENT MEASURES

The following management measures will be implemented with regard to the groundwater:

GENERAL MANAGEMENT PRACTICES

- Water Loss Reduction:
  - (a) The facility conducts monthly records review to find excessive usage that may indicate a leak in the system or significant change in operations.
  - (b) The facility will conduct routine inspection of all above ground water piping systems and storage tanks for any indication of leaks.
  - (c) The facility will conduct routine observations along underground potable water piping systems for indications of leaks.
  - (d) Any leak discovered in the potable water storage/supply system will be repaired as soon as is practical or will be bypassed so as to minimize loss of water.
    - Excessive splash protection and water retention measures may be implemented at production lines to better ensure recycling and reuse of production water.

MANDATORY RESTRICIONS

- Mandatory water use restrictions will be implemented during water shortage emergencies declared the local governing body, the Director of DEQ, or the Governor.
- Facility personnel will be prohibited from general washing of buildings, paved surfaces, or equipment. The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions.
- Facility production may be limited in the event that production withdraws exceed temporarily mandated emergency withdraw limits
- Facility occupants will not be permitted to use water for lawn or landscaping purposes.
- Personnel use of washing machines (clothing) shall be limited to full capacity loads only.
- The facility will comply with penalties for demonstrated failure to comply with mandatory water use restrictions

Accomack County
Water Supply Plan

Appendix D

Enacted Ordinances

3100-001 / NEW

Sec. 62-89. Reimbursement of extension costs.

(a) When a water main is extended across the frontage of unimproved parcels for the purpose of providing service to another parcel, the owner of the parcel being served shall be entitled to recover some of the costs of the water main extension. In no case shall this entitle owners or developers of subdivisions to reimbursements.

(b) The original cost of the water main extension shall be divided equally by linear foot to apply to the frontage of property across which the main is being extended. When lots adjoin the water main on two sides, the apportioned cost will further be factored as half of the linear-foot cost. When lots along the main are improved with structures requiring service, the town shall collect the apportioned amount of the original cost of the installation with connection fees from the newly requiring parcels. The parcel owner originally initiating and paying for the extension shall then be reimbursed by the town.
(Code 1977, § 15-4-4; Ord. of 4-5-1999, § 15-4-4)

Secs. 62-90—62-115. Reserved.

DIVISION 4. WATER USAGE PLAN

Sec. 62-116. Normal operation.

The town's water supply and distribution system shall be operated by a qualified operator and division supervisor under the purview of the director of public works and town manager. The supervisor/operator shall report routine operations and daily water usage to the director of public works and town manager. The town manager shall further advise the public works committee of the town council and the mayor.
(Code 1977, § 15-5-1; Ord. of 4-5-1999, § 15-5-1)

Sec. 62-117. Water shortages.

For the purposes of this division, categories of water shortages shall be as follows:

(1) *Category I: major water leaks or mechanical failures.* If a major leak or mechanical failure occurs, repairs shall be immediately initiated by the department, and the town manager shall immediately be notified of such. In conjunction with the town manager and public works committee chair, the waterworks supervisor and the director of public works shall determine if a water shortage will occur as a result of the leak or mechanical failure.

(2) *Category II: serious water shortage.* If, through department review, a serious water shortage will occur, the town manager shall be immediately notified. After consultation with the mayor and public works committee chair, a public announcement shall be made to curtail car washing, lawn watering, garden watering, and usage by swimming pools and other recreational facilities, all on a voluntary basis.

(3) *Category III: critical water shortage.* In critical water shortages the public announcement shall curtail the water usage as provided in subsection (2) of this section and additionally restrict the use by motels, hotels, tourist homes, campgrounds, trailer parks and all commercial establishments. Such establishments shall be required to notify their customers and restrict water usage for bathing and other purposes to a bare minimum. Restaurants and food service establishments will provide water to customers only when requested. All curtailments during the critical water shortage will be mandatory. During critical water shortages a moratorium shall be placed on all new water service connections.

(Code 1977, § 15-5-2; Ord. of 4-5-1999, § 15-5-2)

Sec. 62-118. Public announcements.

All announcements of water shortage shall be made through local radio stations or through the town's EOC established procedures. Announcements shall establish restrictions and assign an effective date for restrictions. Restrictions shall not be removed until so announced by radio.

(Code 1977, § 15-5-3; Ord. of 4-5-1999, § 15-5-3)

Sec. 62-119. Enforcement.

The town police and/or special police shall issue tickets to violators of subsection 62-117(3). Upon conviction, a violator shall guilty of a class 4 misdemeanor, and each incident shall be considered a separate offense.

(Code 1977, § 15-5-4; Ord. of 4-5-1999, § 15-5-4)

Secs. 62-120—62-145. Reserved.

DIVISION 5. CROSS CONNECTION CONTROL AND BACKFLOW PREVENTION

Sec. 62-146. Definitions.

The following words, terms and phrases, when used in this division, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Backflow means the flow of water, liquids, mixtures, gases or other substances into the distribution piping of a potable supply of water from any source.

Connection means the terminal end or a service line from the waterworks. If a meter is installed at the end of the service connection, the connection means the downstream end of the meter.

Consumer: The owner or person in control of any premises supplied by or any manner connected to the waterworks.

Consumer's water system: any water system located on the consumer's premises, supplied by or in any manner connected to a waterworks.

Accomack County

Water Supply Plan

Appendix E

Virginia Drought Monitoring and Contingency Plan

Virginia's Eastern Shore

MALCOLM PIRNIE

Virginia Drought Assessment and Response Plan

Submitted by the Drought Response Technical Advisory Committee

March 28, 2003

Introduction

During the summer of 2002 Virginia experienced significant drought impacts due to precipitation deficits that dated to 1999 in most areas of the Commonwealth. While this drought did not reach the level of severity of the drought of record (1930-1932), increases in water demands when compared to the 1930's resulted in significant impacts to all sectors of Virginia's economy and society.

The intensity of these drought impacts peaked in late August 2002. Wildfire indices were at levels previously unrecorded in Virginia, the vast majority of Virginia agricultural counties had applied for Federal drought disaster designation, streamflows reached period of record lows, and thousands of individual private wells failed. During the third week of August several public water supply systems across the Commonwealth were on the brink of failure. Several large municipal systems, such as Charlottesville and Portsmouth, had less than sixty days of water supply capacity remaining in reservoirs. Several smaller rural systems that rely primarily on withdrawals from free-flowing streams, such as the towns of Farmville and Orange, had at most a few days of water supply available and were forced to severely curtail usage.

On August 30, 2002 Governor Warner took the unprecedented action of declaring a drought emergency in the majority of the Commonwealth by issuance of Executive Order #33. This executive order required the elimination of some non-essential water uses in large areas of the Commonwealth. In addition, this executive order named the Deputy Secretary of Natural Resources as the Commonwealth Drought Coordinator and charged him with the implementation of the water use restrictions. While these emergency actions were necessary in light of the drought impacts within the Commonwealth, they resulted in significant confusion and consternation among water users who were impacted.

On December 13, 2002 Governor Warner issued Executive Order #39, the Virginia Water Supply Initiative. This executive order requires the Commonwealth's Drought Coordinator to develop a formal drought assessment and response plan. In January 2003, the Deputy Secretary of Natural Resources invited a broad coalition of stakeholders to participate in a Drought Response Technical Advisory Committee chaired by the Virginia Department of Environmental Quality. This technical advisory committee was supported by the existing Virginia Drought Monitoring Task Force. Groups and agencies invited to participate or represented on the Drought Monitoring Task Force are listed below.

Mid-Atlantic Car Wash Association
National Spa and Pool Institute
Virginia Rural Water Association
Virginia Agribusiness Council
Virginia Green Industry Council
Virginia Golf Course Superintendent's Association
Virginia Association of Counties
Virginia Section of the American Water Works Association
Virginia Municipal League
Virginia Sports Turf Manager's Association
Virginia Hospitality and Travel Association
Virginia Water Well Association

Virginia Manufacturer's Association
Virginia Farm Bureau
Southern Environmental Law Center
Roanoke River Landowner's Association
Virginia Irrigation Association
City of Portsmouth
Henrico County
Town of Orange
U.S. Navy
U.S. Army Corp of Engineers
Virginia Department of Environmental Quality
Virginia Department of Emergency Management
Virginia Department of Health
Virginia Cooperative Extension Service
Virginia Department of Game and Inland Fisheries
Virginia Department of Agriculture and Consumer Services
Virginia State Climatology Office
Virginia Department of Forestry
U.S. Geological Survey
U.S. Department of Agriculture, Farm Services Agency
National Oceanic and Atmospheric Administration, National Weather Service

The Drought Response Technical Advisory Group met three times in February and March and developed the following drought assessment and response plan for the consideration of the Commonwealth Drought Coordinator. There are several key concepts that must be kept in mind as this proposal is reviewed.

The development of droughts and the development of associated impacts is very complex. The coverage of monitoring points for most drought indicators (precipitation deficits, streamflows, ground water levels, and reservoir storage) is sparse. These two facts work together to preclude the development of a truly automated, objective drought monitoring system. This proposal includes a monitoring framework that relies heavily on the professional judgment of the Virginia Drought Monitoring Task Force in the determination of drought stages in the Commonwealth.

Due to the complexity of drought impacts on differing segments of society, the responses that are proposed at each drought stage are actions that should be considered. The Commonwealth Drought Coordinator will need to evaluate reported drought conditions and the impacts associated with those conditions and decide what actions are necessary. As an example, there will likely be circumstances in the future when actions currently proposed at the drought warning stage should be initiated somewhat earlier.

From a water supply standpoint, the impacts on a particular water supply may be as dependent on the reliability of that supply as it is on the severity of drought conditions at any point in time. As an example, water supply systems that rely on small order free-flowing streams and do not have storage may experience large impacts from relatively small drought events. This variability in reliability exists in all categories of water supplies; public waterworks, large self-supplied industrial and commercial supplies, and individual residential water supplies. Nothing that is proposed in this plan should be viewed as limiting local government or public waterworks from taking more stringent action at any time to respond to local conditions.

Drought Monitoring

The responsibility for monitoring drought conditions in the Commonwealth rests with the Virginia Drought Monitoring Task Force (DMTF), an interagency group of technical representatives from state and federal agencies responsible for monitoring natural resource conditions and the effects of drought on various segments of society. During periods of normal moisture conditions, the Virginia Department of Environmental Quality will monitor the NOAA U.S. Drought Monitor, and will produce information from this report specific to Virginia on a monthly basis. The Virginia drought map will be produced concurrent with the release of NOAA monthly and seasonal outlooks, which usually are released on the Thursday closest to the middle of the month. The DMTF will be activated with the first occurrence of *moderate drought* conditions (D1) in the Commonwealth or the occurrence of smaller scale moisture deficits that may fall beneath the level of resolution of the U.S. Drought Monitor. The DMTF will monitor the advance of drought conditions in the Commonwealth using the drought indicators listed on page 4 as other indicators such as the Standardized Precipitation Index, Palmer Drought Severity Index, Crop Moisture Index, Keetch-Byrum Drought Index, and NOAA monthly and seasonal precipitation outlooks. In addition, the DMTF will monitor the effect of advancing drought conditions on various sectors of society including agriculture, forestry, and recreation. The DMTF will produce a monthly report of current drought conditions and their effects, and will generally remain active until the NOAA U.S. Drought Monitor indicates that all drought impacts in the Commonwealth have subsided to an *unusually dry* level (D0). The DMTF may remain active after all drought impacts have subsided to an *unusually dry* level when small areas beneath the resolution of the U.S. Drought Monitor continue to experience drought impacts. The primary purpose of the drought monitoring system described below is to provide a framework for the DMTF to operate within when preparing recommendations for the declaration of various drought stages. Due to the complex nature of drought development, professional expertise must be applied to the wide range of drought monitoring data in order to develop defensible recommendations.

Drought Evaluation Regions

For the purpose of implementation of this drought response plan the Commonwealth has been divided into thirteen drought evaluation regions. The regions were established based on a consideration of river basins, climatic divisions, physiographic provinces, major geomorphologic features, and service areas of major water supplies. Regional boundaries were chosen to correspond with local government boundaries to simplify the implementation of this plan. While the regional boundaries are somewhat arbitrary, they generally correspond to regions of the Commonwealth that possess similar climatic, ground water, streamflow and water supply conditions. Drought evaluation regions for the Commonwealth are listed below and displayed in Appendix A. Towns and independent cities are only listed when they are on the boundary of a drought evaluation region. Drought evaluation regions included all towns and independent cities located within the region.

Big Sandy Drought Evaluation Region: Lee, Wise, Buchanan, Dickenson, Scott, Russell, Tazewell, Washington and Smyth Counties.

New River Drought Evaluation Region: Grayson, Wythe, Bland, Carroll, Floyd, Pulaski, Giles, and Montgomery Counties.

Roanoke River Drought Evaluation Region: Patrick, Franklin, Roanoke, Henry, Bedford, Pittsylvania, Campbell, Halifax, Charlotte, and Mecklenburg Counties.

Upper James Drought Evaluation Region: Craig, Alleghany, Bath, Highland, Botetourt, and Rockbridge Counties.

Middle James Drought Evaluation Region: Amherst, Lynchburg, Nelson, Albemarle, Appomattox, Buckingham, Fluvanna, Prince Edward, Cumberland, Goochland, Amelia, Powhatan, Chesterfield, Petersburg, Hopewell, Colonial Heights, Henrico, and Hanover Counties.

Shenandoah Drought Evaluation Region: Augusta, Rockingham, Shenandoah, Frederick, Page, Warren, and Clarke Counties.

Northern Virginia Drought Evaluation Region: Fauquier, Loudoun, Prince William, Arlington, and Fairfax Counties.

Northern Piedmont Drought Evaluation Region: Greene, Madison, Rappahannock, Orange, Culpeper, Louisa, Spotsylvania, and Stafford Counties.

Chowan Drought Evaluation Region: Lunenburg, Nottoway, Brunswick, Dinwiddie, Greensville, Sussex, Prince George, Southampton and Surry Counties.

Northern Coastal Plain Drought Evaluation Region: Caroline, King George, King William, King and Queen, Essex, Richmond, Westmoreland, Gloucester, Mathews, Middlesex, Lancaster, and Northumberland Counties.

York-James Drought Evaluation Region: Hampton, Newport News, James City, York, Charles City, and New Kent Counties.

Southeast Virginia Drought Evaluation Region: Suffolk, Isle of Wight, Chesapeake, Virginia Beach, Portsmouth, and Norfolk.

Eastern Shore Drought Evaluation Region: Northampton and Accomack Counties.

Drought Indicators

In order to monitor potential drought conditions in a uniform manner across the Commonwealth, Virginia will use four indicators to evaluate drought severity. The indicators are based on the amount of precipitation and the effect of the precipitation (or lack of precipitation) on the hydrologic system. These indicators include:

- Precipitation Deficits
- Streamflows
- Ground water levels
- Reservoir storage

Indicators will be evaluated by comparing current conditions to long term average conditions. This evaluation will be used to determine if current conditions are within a range of conditions commonly experienced or if significant drought conditions exist.

Precipitation Deficits

Precipitation deficits will be monitored by comparing current precipitation amounts with historical precipitation values as a percent of normal long-term average values. Comparisons will be made for each drought evaluation region using data compiled by the Office of the State Climatologist. Normal long-term average precipitation is defined as the mean precipitation for a thirty-year period of record for the area and time period being evaluated.

Precipitation amounts will be evaluated based on the water year (beginning October 1). Water years are a natural dividing point for water supply drought, as precipitation that falls in the first six months of a water year is analogous to putting money in the bank. Precipitation that occurs during this six month period has the potential to recharge ground water, which will sustain stream flows and support withdrawals from wells during the following six month period when moisture deficits naturally develop as evaporation and plant transpiration generally exceed precipitation. If a precipitation deficit outside of the normal range exists at the end of a water year, the precipitation records will carry forward until a normal condition is reached (i.e. if a precipitation deficit exists on October 1, precipitation records for the previous twelve months will be evaluated until the twelve month deficit is eliminated).

Because the significance of a precipitation deficit changes as the water year progresses, drought response stages will trigger at different percentages of normal depending upon the date of evaluation.

Months Analyzed	**Normal (% of Normal Precipitation)**	**Watch (% of Normal Precipitation)**	**Warning (% of Normal Precipitation)**	**Emergency (% of Normal Precipitation)**
October-December	>75.0	<75.0	<65.0	<55.0
October-January	>80.0	<80.0	<70.0	<60.0
October-February	>80.0	<80.0	<70.0	<60.0
October-March	>80.0	<80.0	<70.0	<60.0
October-April	>81.5	<81.5	<71.5	<61.5
October-May	>82.5	<82.5	<72.5	<62.5
October-June	>83.5	<83.5	<73.5	<63.5
October-July	>85.0	<85.0	<75.0	<65.0
October-August	>85.0	<85.0	<75.0	<65.0
October – September (and previous 12 months)	>85.0	<85.0	<75.0	<65.0

Streamflow
Streamflow gages representing drought evaluation regions will be used to monitor streamflow responses to drought conditions. Representative daily flow values will be compared with historic flow statistics for the period of record. Representative daily streamflows above the 25th percentile for return flow frequency will be defined as normal conditions. Representative daily streamflows between the 10th and 25th percentile for return flow frequencies will be defined as drought watch conditions. Representative daily streamflows between the 5th and 10th percentile for return flow frequencies will be defined as drought warning conditions. Representative daily streamflows below the 5th percentile for return flow frequencies will be defined as drought emergency conditions. (A streamflow that represents the 25th percentile of return flow frequencies indicates that, for the period of record, 75% of streamflows have exceeded the current flow.) Gages were selected on the basis of the availability of real-time data, period of record, and relative location within the drought evaluation region. Typically, gages were selected that monitor moderately large drainage areas on streams without significant regulation. In drought evaluation areas where no appropriate stream gages exist, this indicator will not be utilized. Gages selected to monitor drought severity in each evaluation region are listed below and displayed in Appendix B.

Big Sandy Drought Evaluation Region: Clinch River at Cleveland, USGS Station 03524000

New River Drought Evaluation Region: Reed Creek at Graham Forge, USGS Station 03167000

Roanoke River Drought Evaluation Region: Goose Creek near Huddleston, USGS Station 02059500

Upper James Drought Evaluation Region: Cowpasture River near Clifton Forge, USGS Station 02016000

Middle James Drought Evaluation Region: Appomattox River at Farmville, USGS Station 02039500

Shenandoah Drought Evaluation Region: North Fork Shenandoah near Strasburg, USGS Station 01634000

Northern Virginia Drought Evaluation Region: Accotink Creek near Annandale, USGS Station 01654000

Northern Piedmont Drought Evaluation Region: Rapidan River near Culpeper, USGS Station 01667500

Chowan Drought Evaluation Region: Meherrin River near Lawrenceville, USGS Station 02051500

Northern Coastal Plain Drought Evaluation Region: Mattaponi River near Beulahville, USGS Station 01674500

York-James Drought Evaluation Region: Chickahominy River near Providence Forge, USGS Station 02042500

Southeast Virginia Drought Evaluation Region: No stream gages available to monitor.

Eastern Shore Drought Evaluation Region: No stream gages available to monitor.

Ground Water Levels
Water table ground water monitoring wells representing drought evaluation regions will be used to monitor shallow ground water responses to drought conditions. In areas west of Route 95 it was assumed that wells completed in shallow fractured rock formations are indicative of water table conditions. Measured ground water levels will be compared with historic level statistics for the period of record. Measured ground water levels above the 25th percentile for all historic levels will be defined as normal conditions. Measured ground water levels between the10th and 25th percentiles for all historic levels will be defined as drought watch conditions. Measured ground water levels between the 5th and 10th percentile for all historic levels will be defined as drought warning conditions. Measured ground water levels below the 5th percentile for all historic levels will be defined as drought emergency conditions. Monitoring wells were selected on the basis of period of record and relative location within the drought evaluation region. Monitoring wells selected to monitor drought severity in each evaluation region are listed below and displayed in Appendix C. In drought evaluation regions where no appropriate monitoring wells exist, the ground water indicator will not be used.

Big Sandy Drought Evaluation Region: No water table monitoring wells available to monitor.

New River Drought Evaluation Region: Christiansburg Observation Well, USGS Local Number 27F 2 SOW 019

Roanoke River Drought Evaluation Region: Roanoke-Nelson Observation Well, USGS Local Number 31G 1 SOW 008

Upper James Drought Evaluation Region: Glasgow Observation Well, USGS local Number 35K 1 SOW 063

Middle James Drought Evaluation Region: Buckingham Observation Well, USGS Local Number 41H 3; Virginia Maples Observation Well, USGS Local Number 53K 19 SOW 080

Shenandoah Drought Evaluation Region: McGaheysville Observation Well, USGS Local Number 41Q 1; Blandy Farm Observation Well, USGS Local Number 46W 175
:
Northern Virginia Drought Evaluation Region: Harper's Ferry Observation Well, USGS Local Number 49Y 1 SOW 022; Arlington Cemetery Observation Well, USGS Local Number 54V 3

Northern Piedmont Drought Evaluation Region: Gordonsville Observation Well, USGS Local Number 45P 1 SOW 030

Chowan Drought Evaluation Region: Slade Farm Observation Well, USGS Local Number 57E 13 SOW 094C

Northern Coastal Plain Drought Evaluation Region: George Washington Birthplace Observation Well, USGS Local Number 55P 9

York-James Drought Evaluation Region: Toano Observation Well, USGS Local Number 56H 31 SOW 135B

Southeast Virginia Drought Evaluation Region: Brinkley Observation Well, USGS Local Number 58B 13; Pungo Observation Well, USGS Local Number 62B 1 SOW 098A

Eastern Shore Drought Evaluation Region: P. C. Kellam Observation Well, USGS Local Number 63H 6 SOW 103A; Withams Observation Well, USGS Local Number 66M 19 SOW 110S

Reservoir Storage

Storage in major reservoirs will be used as a fourth drought indicator. Major reservoirs in Virginia support a wide variety of uses that include water supply storage, electric power generation, and flow augmentation to protect water quality. Water supply reservoirs will be evaluated based on the estimated days of available usable storage. Storage of greater than 120 days will represent normal conditions, storage of 90 to 120 days will represent watch conditions, storage of 60 to 90 days will represent warning conditions, and storage of less than 60 days will represent emergency conditions. Useable storage will be calculated as that storage above the level where advanced water treatment will be required.

Several large multi-purpose reservoirs will be evaluated as drought indicators. The criteria for consideration of drought stages are listed below for these reservoirs. Pool elevations of these reservoirs will be compared to benchmark elevations in relation to mean sea level (msl) or U.S. Army Corp of Engineers operating guide curves as indicated in the following table.

	NORMAL	DROUGHT WATCH	DROUGHT WARNING	DROUGHT EMERGENCY
Smith Mountain Lake	>793 feet msl	793 to 791.5 feet msl	791.5 to 790 feet msl	< 790 feet msl
Lake Moomaw	>1565 feet msl	1565 to 1562.5 feet msl	1562.5 to 1560 feet msl	< 1560 feet msl
Lake Anna	> 248 feet msl	248 to 246 feet msl	246 to 244 feet msl	< 244 feet msl
Kerr Reservoir	< 3 feet below the guide curve	3 to 6 feet below the guide curve	> 6 feet below the guide curve	< 288 feet msl

Reservoirs that will be used to monitor drought conditions are listed below. In drought evaluation regions where no appropriate reservoirs exist, this indicator will not be used.

Big Sandy Drought Evaluation Region: Big Cherry Water Supply Reservoir

New River Drought Evaluation Region: No reservoirs will be monitored.

Roanoke River Drought Evaluation Region: Smith Mountain Lake, Kerr Reservoir

Upper James Drought Evaluation Region: Lake Moomaw

Middle James Drought Evaluation Region: Lake Moomaw, Charlottesville Water Supply Reservoir System

Shenandoah Drought Evaluation Region: Switzer Water Supply Reservoir

Northern Virginia Drought Evaluation Region: Occoquan Water Supply Reservoir, Lake Manassas Water Supply Reservoir

Northern Piedmont Drought Evaluation Region: Lake Anna, Spotsylvania Water Supply Reservoir System

Chowan Drought Evaluation Region: Emporia Water Supply Reservoir

Northern Coastal Plain Drought Evaluation Region: Gloucester Water Supply Reservoir

York-James Drought Evaluation Region: Newport News Water Supply Reservoir System

Southeastern Virginia Drought Evaluation Region: Kerr Reservoir, Portsmouth Water Supply Reservoir System

Eastern Shore Drought Evaluation Region: No reservoirs will be monitored.

Other Indicators

The DMTF will evaluate all other available drought information during deliberations related to the development of drought stage recommendations. Other drought indicators that will be considered include the Standardized Precipitation Index, Palmer Drought Severity Index, Crop Moisture Index, and NOAA monthly and seasonal precipitation outlooks.

When streamflows or ground water levels at the selected monitoring sites previously listed indicate drought conditions, the DMTF will monitor other stream gages and ground water monitoring wells that are available.

The DMTF will evaluate the Cumulative Severity Index developed by the Virginia Department of Forestry (VDOF) and the Keech-Byrum Drought Index to determine the potential impact of drought on forests and the potential for wildfire starts. In addition, the DMTF will consider the number of wildfire starts and the number of acres of forest burned as supplied by the VDOF as indicators of drought impacts on forestry.
The DMTF will evaluate information compiled by the Virginia Agricultural Statistics Service to assess the impacts of drought on agricultural interests in the state. The DMTF will also rely on the input of local agricultural extension agents through the Virginia Cooperative Extension Service to document actual drought impacts through the Commonwealth. In addition, the DMTF will evaluate the number of requests for federal

drought disaster designation as reported by the Virginia Department of Agriculture and Consumer Services.

The DMTF will consider operating conditions at public waterworks in the determination of drought recommendations. The Virginia Department of Health (VDH) monitors the conditions of many public waterworks in the Commonwealth on a monthly basis. At a minimum, individual public waterworks typically contact the VDH when they experience water supply problems that are due to drought. VDH will continue to provide support to these waterworks and will continue monthly reporting of water supply problems. These monthly reports will be used as an additional indicator of drought severity in the Commonwealth. In addition, the DMTF will consider the number of private well replacement permits issued by the VDH as an indication of drought impacts to persons served by this type of system.

Declaration of Drought Stages

The DMTF will use the four drought indicators; precipitation deficits, streamflows, ground water levels, and reservoir levels; as the initial indicators to be considered when making a recommendation concerning the declaration of a particular drought stage. When two indicators exceed the threshold for stage determination, the DMTF will evaluate all other drought information and provide a recommendation to the Virginia Drought Coordinator. This recommendation may be to declare a specific drought stage or the recommendation may include an explanation of why the particular drought stage should not be declared at that time. Conversely, the DMTF may recommend the declaration of a particular drought stage prior to the exceedance of threshold levels for two of the four indicators. Recommendations for declaration of specific drought stages will generally be based on the drought evaluation regions previously described. It is likely that conditions may exist where the DMTF may recommend the declaration of a specific drought stage for a portion of a drought evaluation region. Recommendations for declaration of a portion of a drought evaluation region may be based on differing climatic conditions within the area or differences in the ability of specific waterworks to reliably provide water during drought conditions.

As an example, when two of the four drought indicators indicate drought warning conditions, the DMTF will evaluate all other drought information available and, if the majority of information warrants declaration, recommend the declaration of a drought warning in the drought evaluation region where these conditions exist. In all cases, the final decision regarding the declaration of a particular drought stage will be at the discretion of the Virginia Drought Coordinator. Any local government may declare local drought emergencies, adopt emergency ordinances to address those local emergencies and implement those ordinances prior to the declaration of a Drought Emergency by the Governor of Virginia.

The DMTF will use the following general descriptions of four drought stages when making recommendations to the Virginia Drought Coordinator concerning drought declarations in the Commonwealth. These descriptions should not be viewed as absolute requirements for drought designation, but as a mechanism to be used by the DMTF to reach consensus on the appropriate drought recommendations.

Normal Conditions

No more than one indicator outside of the normal range:

- Precipitation exceeds the percent of normal precipitation for the time period in precipitation table
- Streamflows are above the 25th percentile
- Ground water levels are above the 25th percentile for all historic levels
- Water Supply Reservoirs exceed 120 days of useable storage or appropriate criteria for non-water supply reservoirs

Drought Watch
At least 2 indicators meet the following conditions:

- Precipitation levels are at or below the percent of normal precipitation for the time period in precipitation table
- Streamflows fall between the 10th and 25th percentile
- Ground water levels fall between the 10th and 25th percentile for all historic levels
- Water Supply Reservoirs contain between 90 and 120 days of useable storage or appropriate criteria for non-water supply reservoirs

Drought Warning
At least 2 indicators meet the following conditions:

- Precipitation levels are at or below the percent of normal precipitation for the time period in precipitation table
- Streamflows fall between the 5th and 10th percentile
- Measured ground water levels fall between the 5th and 10th percentile for all historic levels
- Reservoirs contain between 60 and 90 days of useable storage or appropriate criteria for non-water supply reservoirs

Drought Emergency
At least 2 indicators meet the following conditions:

- Precipitation levels are at or below the percent of normal precipitation for the time period in precipitation table
- Streamflows are at or below the 5th percentile
- Measured ground water levels fall are at or below the 5th percentile for all historic levels
- Reservoirs contain 60 days or less of useable storage or appropriate criteria for non-water supply reservoirs

Responses to Drought in Virginia

The impacts of drought on society are broad reaching and complex. In addition, the nature of a particular drought event is dependent on the time of year, the long-term duration of precipitation deficits, the immediate impacts of short-term precipitation deficits within a period of general precipitation deficits, and many other interrelated factors. In short, every significant drought has a particular signature and the impacts of no two droughts will be identical. Due to the complex nature of droughts, responses to individual drought events must be tailored to the impacts that are being propagated. The specific response activities that are delineated below for the three drought stages should be viewed as activities that will generally be initiated and not as required activities that are “written in stone”.

Drought watch responses are generally responses that are intended to increase awareness, in the public and private sector, to climatic conditions that are likely to precede the occurrence of a significant drought event. During this drought stage the primary activities that are suggested are to prepare for the onset of a drought event. It is unlikely that significant water use reductions will occur at this stage although it is possible that the increased public awareness of water conservation activities may reduce water use up to 5%.

Drought warning responses are generally responses that are required when the onset of a significant drought event is imminent. Water conservation and contingency plans that have been prepared during a drought watch stage would begin to be implemented. From the perspective of the Commonwealth, water conservation activities at this stage would generally be voluntary. Voluntary water conservation activities generally result in reductions in water use of 5-10%.

Drought emergency responses are generally responses that are required during the height of a significant drought event. During these times, it is likely that some water supplies will not supply the amount of water needed by all users and non-essential uses of water should be eliminated. Mandatory water conservation requirements contained in water conservation and contingency plans should be initiated at this stage. Mandatory water conservation activities generally result in water use reductions of 10-15%.

While actions on the State level are important for the purpose of alerting localities and citizens of the advance of drought impacts, actions by local governments, individual water suppliers, and individual citizens are much more important and effective in actually addressing the impacts of drought. Water sources used by public waterworks and self-supplied water users vary considerably across the Commonwealth. Water conservation requirements for water users whose only source of water supply is a free-flowing stream with no significant storage will likely be different than requirements for a water user who relies entirely on a reservoir system for water supply. The development of a drought water conservation and contingency plan that takes into account the nature of a particular water source and the nature of the end use of water withdrawn is necessary to assure that proper water conservation activities are instituted at the proper times. In general, water supplies that rely on sources with significant storage (reservoir and ground water based systems) will realize greater benefits of water conservation activities initiated early in a drought cycle when compared to supplies that rely solely on free-flowing streams. It is likely that individual private well users, especially those who rely on shallow water table wells, will receive the largest benefit from their early individual initiation of water conservation activities.

The following responses will generally be made upon declaration of individual drought stages.

Drought Watch

- The Virginia Drought Coordinator will declare a statewide or regional Drought Watch and will issue a press release indicating the reasons for the declaration.
- The Virginia Drought Coordinator will notify all local governments within the drought watch area of drought watch status.

- The Virginia Drought Coordinator will report the drought watch declaration to the Governor's Cabinet and request the assistance of all state agencies in the implementation of the drought response plan.
- The VDH will inform all public waterworks within the drought watch area of drought watch status.
- The Virginia Cooperative Extension Service will cooperate with all state agencies owning or controlling impoundments and/or river access to identify sources that may be used by livestock producers for emergency livestock watering during declared drought emergencies. VCE will inform livestock producers of these opportunities and will provide contact information necessary to access these sources.
- The DMTF will continue to monitor statewide moisture conditions and provide monthly reports of drought conditions to the Virginia Drought Coordinator who will update the Governor's Cabinet.
- The DMTF will make monthly reports of drought conditions available to media outlets within the drought watch area.
- The Virginia Drought Coordinator will encourage all public waterworks and self-supplied water users who withdraw more than 10,000 gallons per day to develop or review existing drought water conservation and contingency plans.
- All DMTF agencies will include water conservation information on their websites and will distribute water conservation information as broadly as possible.
- All executive branch agencies and institutions will review existing drought water conservation and contingency plans or develop new plans with the goal of reducing water usage by 15% during declared drought emergencies.
- VDH will continue monitoring problems incurred by public waterworks on a monthly basis.
- VDH will encourage all public waterworks to aggressively pursue leak detection and repair programs.
- Local governments and public waterworks may impose water use restrictions consistent with local water supply conditions at any time.

Drought Warning

- The Virginia Drought Coordinator will declare a statewide or regional Drought Warning and will issue a press release indicating the reasons for the declaration.
- The Virginia Drought Coordinator will notify all local governments within the drought warning area of drought warning status.
- The Virginia Drought Coordinator will advise the Governor and his Cabinet regarding the necessity of authorizing the Departments of State Police, Transportation and Motor Vehicles to grant temporary overweight/overwidth/registration/license exemptions to carriers transporting essential emergency relief supplies into and through the Commonwealth in order to support disaster response and recovery.
- The VDH will inform all public waterworks within the drought warning area of drought warning status.
- The Virginia Department of Agriculture and Consumer Services will cooperate with the Virginia Association of Counties, the Virginia Municipal League, Virginia Cooperative Extension, the Virginia Farm Bureau Federation and the Virginia Agribusiness Council in notifying agricultural communities, agriculture

interest groups and local governments within the drought warning area of the potential for federal agricultural drought disaster designation. VDACS will also work with VACO, VML, VCE, VFBF and VAC in communicating the appropriate procedure for local governments to use in applying to the Governor for federal disaster designation.

- The DMTF will continue to monitor statewide moisture conditions and provide monthly reports of drought conditions to the Virginia Drought Coordinator. Significant changes in drought conditions will be reported biweekly.
- The Virginia Drought Coordinator will update the Governor's Cabinet concerning drought conditions on a biweekly basis.
- The Governor's Press Office will encourage media outlets within the drought warning area to publicize updates of drought conditions by developing biweekly press releases.
- All local governments will be encouraged to review existing local ordinances requiring mandatory non-essential water use restrictions or adopt such ordinances consistent with the mandatory non-essential water use restrictions listed below.
- All public waterworks and self-supplied water users who withdraw more than 10,000 gallons per day will initiate voluntary water conservation requirements contained in drought water conservation and contingency plans.
- All public waterworks and self-supplied water users who withdraw more than 10,000 gallons per day that have not developed drought water conservation and contingency plans will be encouraged to voluntarily reduce or eliminate non-essential uses of water including the elimination of non-essential flushing of water lines.
- All persons who utilize any source of water for outdoor irrigation will assure that the minimum amount of water is utilized in the most efficient manner practical.
- All self-supplied users who withdraw less than 10,000 gallons per day, including private well users, will be encouraged to voluntarily reduce or eliminate non-essential uses of water.
- All executive branch agencies and institutions will initiate the reduction or elimination of non-essential uses of water with the goal of reducing total water usage by 5-10%.
- VDH will continue monitoring problems incurred by public waterworks on a monthly basis.
- Local governments and public waterworks may impose water use restrictions consistent with local water supply conditions at any time.

Drought Emergency

- The Governor will declare a statewide or regional Drought Emergency by executive order and will issue a press release indicating the reasons for the declaration.
- The Virginia Drought Coordinator will notify all local governments within the drought emergency area of drought emergency status.
- The VDH will inform all public waterworks within the drought emergency area of drought emergency status.
- The DMTF will continue to monitor statewide moisture conditions and provide monthly reports of drought conditions to the Virginia Drought Coordinator. Significant changes in drought conditions will be reported weekly.

- The Virginia Drought Coordinator will update the Governor's Cabinet concerning drought conditions on a weekly basis.
- The Governor's Press Office will encourage media outlets within the drought emergency area to publicize updates of drought conditions by developing weekly press releases.
- All public waterworks and self-supplied water users who withdraw more than 10,000 gallons per day will initiate mandatory water conservation requirements contained in drought water conservation and contingency plans that include the mandatory non-essential water use restrictions listed on page 16.
- All public waterworks and self-supplied water users who withdraw more than 10,000 gallons per day that have not developed drought water conservation and contingency plans initiate the mandatory non-essential water use restrictions listed below including the elimination of non-essential flushing of water lines.
- All self-supplied users, who withdraw less than 10,000 gallons per day, including private well users, will initiate the mandatory non-essential water use restrictions listed below.
- All executive branch agencies and institutions will implement drought water conservation and contingency plans with the goal of reducing water usage by 15% that include the mandatory non-essential water use restrictions listed on page 16.
- Local governments and public waterworks may impose water use restrictions more stringent than the mandatory non-essential water use restrictions listed below consistent with local water supply conditions at any time.
- For the duration of the declared drought emergency the Director of the Department of Environmental Quality shall be authorized to allocate ground water and surface water resources and to restrict any withdrawals based upon the adequacy of the resource to meet the necessary beneficial uses as set forth in §62.1-44.36 of the Code of Virginia. Such allocations may apply to any withdrawer and shall over-ride any existing authorizations to use or withdraw surface water or ground water.
- For the duration of the declared drought emergency the State Forester shall be authorized to declare open burning bans in wild fire susceptible areas of the Commonwealth.
- For the duration of the declared drought emergency the Departments of State Police, Transportation and Motor Vehicles shall be authorized to grant temporary overweight/overwidth/registration/license exemptions to carriers transporting essential emergency relief supplies into and through the Commonwealth in order to support the disaster response and recovery.
- Volume I, Virginia Emergency Operations Plan (COVEOP) Basic Plan, July 1997 as amended shall be implemented by agencies of the state and local government along with other appropriate state agency plans.
- The Virginia Emergency Operations Center (VEOC) and State Emergency Response Team (SERT) will be activated to coordinate state operations in support of affected localities and the Commonwealth, to include issuing mission assignments to agencies designated in the COVEOP and others that may be identified by the State Coordinator of Emergency Management, in consultation with the Secretary of Public Safety, which are needed to provide for the preservation of life, protection of property and implementation of recovery activities.

- Local governments of the Commonwealth will be authorized to adopt local ordinances to enforce the mandatory non-essential water use restrictions listed below and to establish, collect, and retain fines for violations of these restrictions. Nothing contained in this drought response plan should be construed to limit the powers of local government to adopt and enforce local emergency ordinances as necessary to protect the public welfare, safety and health.

Mandatory Non-essential Water Use Restrictions

The following non-essential water uses will be prohibited during periods of declared drought emergencies. Please note the exceptions that follow each prohibited use. These prohibitions and exceptions will apply to uses from all sources of water and will only be effective when the Governor of Virginia declares a Drought Emergency through the issuance of an executive order. Water use restrictions shall not apply to the agricultural production of food or fiber, the maintenance of livestock including poultry, nor the commercial production of plant materials so long as best management practices are applied to assure the minimum amount of water is utilized.

Unrestricted irrigation of lawns is prohibited.

- Newly sodded and seeded areas may be irrigated to establish cover on bare ground at the minimum rate necessary for no more than a period of 60 days. . Irrigation rates may not exceed one inch of applied water in any 7 day period.
- Gardens, bedding plants, trees, shrubs and other landscape materials may be watered with hand held containers, hand held hoses equipped with an automatic shutoff device, sprinklers or other automated watering devices at the minimum rate necessary but in no case more frequently than twice per week. Irrigation should not occur during the heat of the day.
- All allowed lawn irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Irrigation systems may be tested after installation, routine maintenance or repair for no more than ten minutes per zone.

Unrestricted irrigation of golf courses is prohibited.

- Tees and greens may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.
- Localized dry areas may be irrigated with a hand held container or hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Greens may be cooled by syringing or by the application of water with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Fairways may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary not to exceed one inch of applied water in any ten-day period.
- Fairways, tees and greens may be irrigated during necessary overseeding or resodding operations in September and October at the minimum rate necessary. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period.

- Newly constructed fairways, tees and greens and areas that are re-established by sprigging or sodding may be irrigated at the minimum rate necessary not to exceed one inch of applied water in any seven-day period for a total period that does not exceed 60 days.
- Fairways, tees and greens may be irrigated without regard to the restrictions listed above so long as:
    - The only water sources utilized are water features whose primary purpose is stormwater management,
    - Any water features utilized do not impound permanent streams,
    - During declared Drought Emergencies these water features receive no recharge from other water sources such as ground water wells, surface water intakes, or sources of public water supply, and,
    - All irrigation occurs between 9:00 p.m. and 10:00 a.m.
- All allowed golf course irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Rough areas may not be irrigated.

Unrestricted irrigation of athletic fields is prohibited.

- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at a rate not to exceed one inch per application or more than a total of one inch in multiple applications during any ten-day period. All irrigation water must fall on playing surfaces with no outlying areas receiving irrigation water directly from irrigation heads.
- Localized dry areas that show signs of drought stress and wilt (curled leaves, foot-printing, purpling) may be syringed by the application of water for a cumulative time not to exceed fifteen minutes during any twenty four hour period. Syringing may be accomplished with an automated irrigation system or with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. during necessary overseeding, sprigging or resodding operations at the minimum rate necessary for a period that does not exceed 60 days. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period. Syringing is permitted during signs of drought stress and wilt (curled leaves, foot-printing, purpling).
- All allowed athletic field irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Irrigation is prohibited on athletic fields that are not scheduled for use within the next 120-day period.
- Water may be used for the daily maintenance of pitching mounds, home plate areas and base areas with the use of hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary.
- Skinned infield areas may utilize water to control dust and improve playing surface conditions utilizing hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary no earlier than two hours prior to official game time.

Washing paved surfaces such as streets, roads, sidewalks, driveways, garages, parking areas, tennis courts, and patios is prohibited.

- Driveways and roadways may be pre-washed in preparation for recoating and sealing.
- Tennis courts composed of clay or similar materials may be wetted by means of a hand-held hose equipped with an automatic shutoff device at the minimum rate necessary for maintenance. Automatic wetting systems may be used between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.
- Public eating and drinking areas may be washed using the minimum amount of water required to assure sanitation and public health.
- Water may be used at the minimum rate necessary to maintain effective dust control during the construction of highways and roads.

Use of water for washing or cleaning of mobile equipment including automobiles, trucks, trailers and boats is prohibited.

- Mobile equipment may be washed using hand held containers or hand held hoses equipped with automatic shutoff devices provided that no mobile equipment is washed more than once per calendar month and the minimum amount of water is utilized.
- Construction, emergency or public transportation vehicles may be washed as necessary to preserve the proper functioning and safe operation of the vehicle.
- Mobile equipment may be washed at car washes that utilize reclaimed water as part of the wash process or reduce water consumption by at least 10% when compared to a similar period when water use restrictions were not in effect.
- Automobile dealers may wash cars that are in inventory no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
- Automobile rental agencies may wash cars no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
- Marine engines may be flushed with water for a period that does not exceed 5 minutes after each use.

Use of water for the operation of ornamental fountains, artificial waterfalls, misting machines, and reflecting pools is prohibited.

- Fountains and other means of aeration necessary to support aquatic life are permitted.

Use of water to fill and top off outdoor swimming pools is prohibited.

- Newly built or repaired pools may be filled to protect their structural integrity.
- Outdoor pools operated by commercial ventures, community associations, recreation associations, and similar institutions open to the public may be refilled as long as:
  - Levels are maintained at mid-skimmer depth or lower,
  - Any visible leaks are immediately repaired,
  - Backwashing occurs only when necessary to assure proper filter operation,

    - Deck areas are washed no more than once per calendar month (except where chemical spills or other health hazards occur),
    - All water features (other than slides) that increase losses due to evaporation are eliminated, and
    - Slides are turned off when the pool is not in operation.
- Swimming pools operated by health care facilities used in relation to patient care and rehabilitation may be filled or topped off.
- Indoor pools may be filled or topped off.
- Residential swimming pools may be filled only to protect structural integrity, public welfare, safety and health and may not be filled to allow the continued operation of such pools.

Water may be served in restaurants, clubs, or eating-places only at the request of customers.

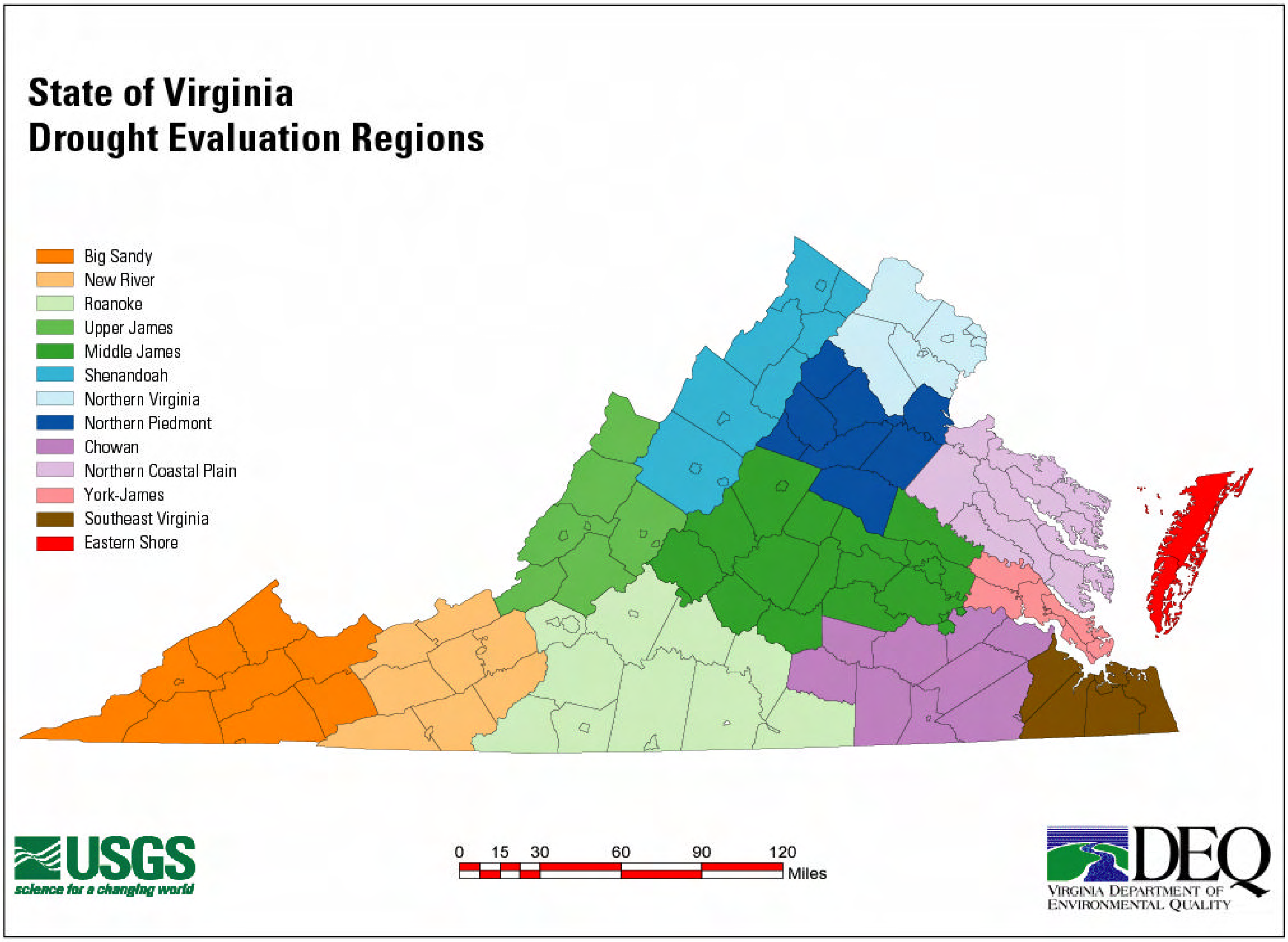
All residential, business and industrial water users; whether supplied by public water supplies, self-supplied sources, or private water wells; who do not normally utilize water for any of the listed prohibited uses are requested to voluntarily reduce water consumption by at least 10%. This reduction may be the result of elimination of other non-essential water uses, application of water conservation practices, or reduction in essential water uses.

Water Rationing

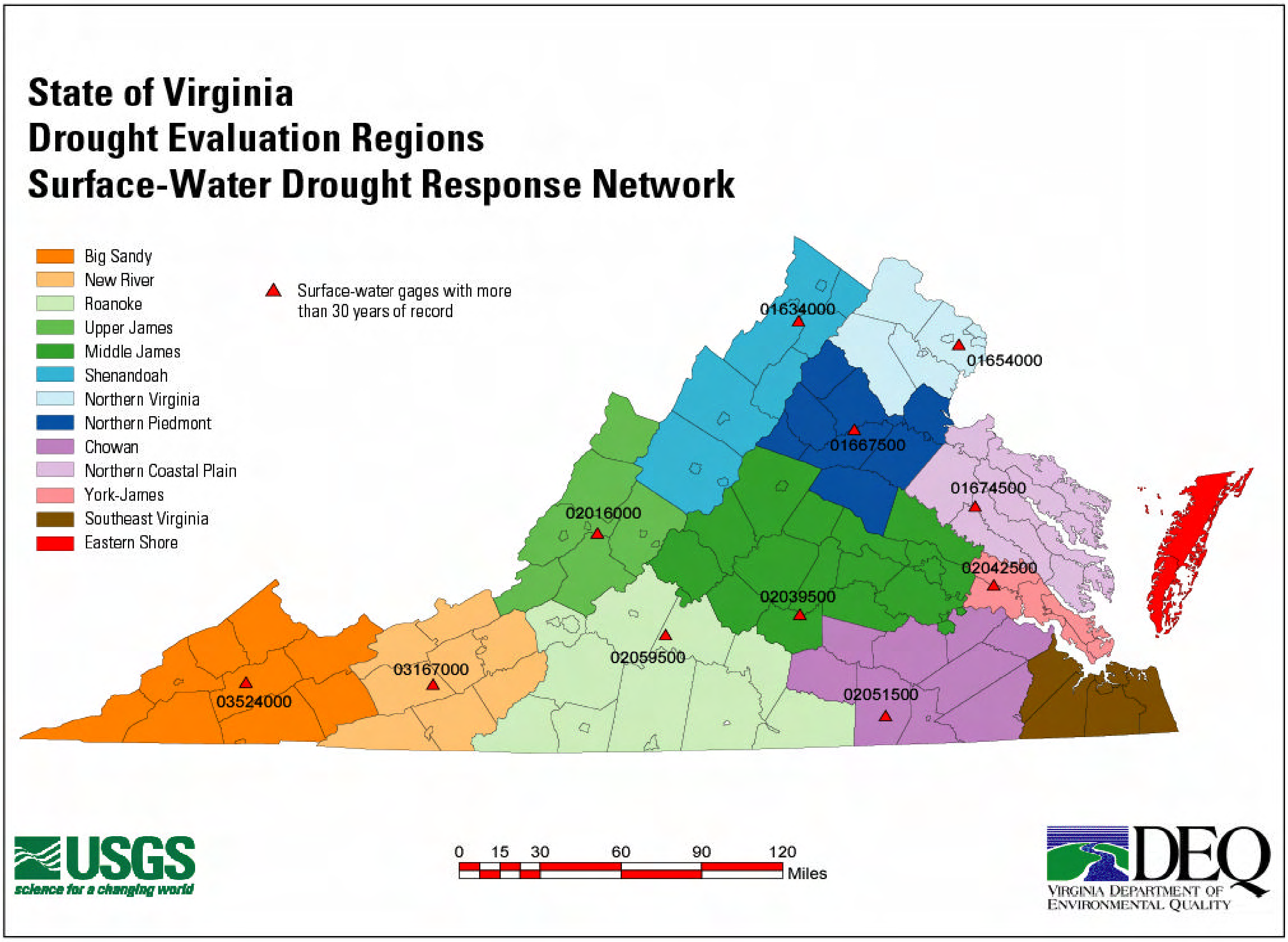
In some cases, the mandatory non-essential water use restrictions may not be sufficient to protect the supplies of an individual public waterworks. When an individual waterworks' sources are so depleted as to threaten public health and safety, it may become necessary to ration water within that system in order to assure that water is available to support essential uses. Rationing water is a more severe measure than merely banning nonessential uses of water. Under rationing, each customer is allotted a given amount of water, based on a method of allotment developed by the waterworks or local government. Generally it will be based on a percentage of previous usage or on a specific daily quantity per household. Rationing is more likely to have some effect on welfare than mandatory non-essential use restrictions, because industrial and commercial water uses may be curtailed or eliminated to assure an adequate supply is available for human consumptive uses.

The decision to ration water will typically be made by the local government or waterworks operator. The Virginia Drought Coordinator will work closely with any entity where water rationing is required to assure that all available State resources are effectively used to support these highly stressed water supply systems. The Virginia Department of Emergency Management (VDEM) is the first point of contact for waterworks or local governments who decide to ration water. VDEM will coordinate the Commonwealth's response and assistance to such entities.

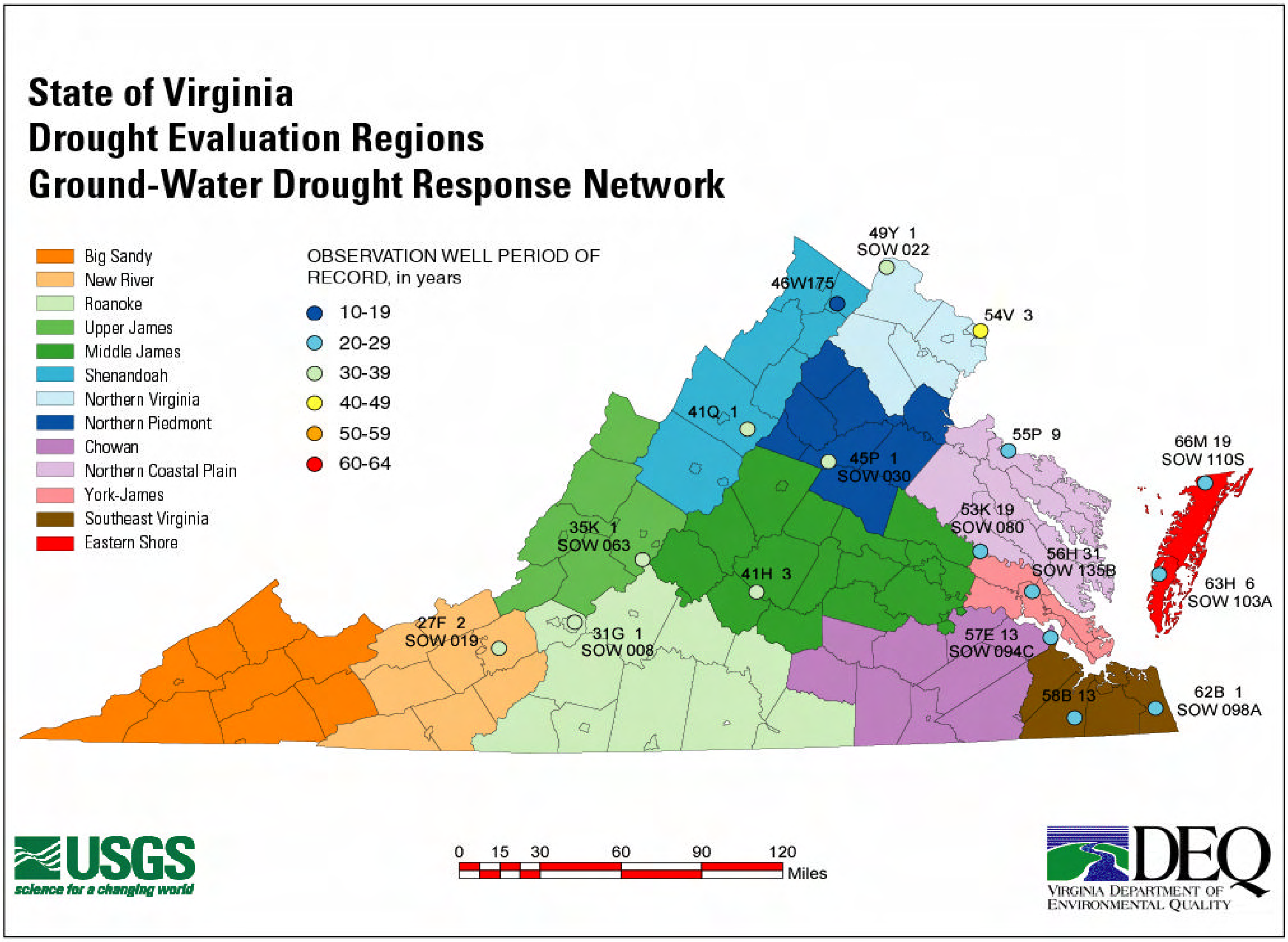
Appendix A


State of Virginia
Drought Evaluation Regions
Big Sandy
New River
Roanoke
Upper James
Middle James
Shenandoah
Northern Virginia
Northern Piedmont
Chowan
Northern Coastal Plain
York-James
Southeast Virginia
Eastern Shore
USGS
science for a changing world
0 15 30 60 90 120
Miles
DEQ
Virginia Department of
Environmental Quality

Appendix B


State of Virginia
Drought Evaluation Regions
Surface-Water Drought Response Network
Big Sandy
New River
Roanoke
Upper James
Middle James
Shenandoah
Northern Virginia
Northern Piedmont
Chowan
Northern Coastal Plain
York-James
Southeast Virginia
Eastern Shore
Surface-water gages with more than 30 years of record
01634000
01654000
01667500
01674500
02016000
02042500
02039500
02059500
03167000
03524000
02051500
0
15
30
60
90
120
Miles
USGS
science for a changing world
DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Appendix C


State of Virginia
Drought Evaluation Regions
Ground-Water Drought Response Network
Big Sandy
New River
Roanoke
Upper James
Middle James
Shenandoah
Northern Virginia
Northern Piedmont
Chowan
Northern Coastal Plain
York-James
Southeast Virginia
Eastern Shore
OBSERVATION WELL PERIOD OF RECORD, in years
10-19
20-29
30-39
40-49
50-59
60-64
49Y 1
SOW 022
46W175
54V 3
41Q 1
55P 9
45P 1
SOW 030
66M 19
SOW 110S
53K 19
SOW 080
35K 1
SOW 063
56H 31
SOW 135B
63H 6
SOW 103A
41H 3
27F 2
SOW 019
31G 1
SOW 008
57E 13
SOW 094C
58B 13
62B 1
SOW 098A
0 15 30 60 90 120
Miles
USGS
science for a changing world
DEQ
Virginia Department of Environmental Quality