

Via Email Attachment

June 18, 2019

Mr. Jeff Shanks, P.G.
Waste Management
1000 New Ford Mill Road
Morrisville, PA 19067

**RE: DRPI Landfill: Proposed Vertical Expansion Permit Application
Artesian Water Company Public Hearing Comment Review**

Dear Mr. Shanks:

As a follow-up to your request, Taylor GeoServices has prepared this summary letter to address comments made by Artesian Water Company (Artesian) and their representatives at the recent public hearing held at the Minquadale Firehouse on May 29, 2019, related to the proposed vertical expansion permit application for the Delaware Recyclable Products, Inc. (DRPI) Landfill. The primary issue raised by Artesian was related to increased levels of contaminants identified in their water supply well fields located approximately 1.2 to 2.2 miles south of DRPI (refer to Figure 1, Artesian Water Supply Well Locations). Artesian stated that they do not know where all of the contaminants are coming from and questioned the relationship between the landfill and their water supply wells in the Columbia and Upper Potomac Aquifer.

In response to the public hearing comments presented by Artesian and their technical representatives, we present here a brief summary of relevant site-specific data which demonstrates that the subsurface conditions at DRPI have been carefully evaluated as part of numerous investigations related to landfill development and in accordance with solid waste permitting requirements. Data from these extensive investigations date back to the late 1980s and have been submitted to the Delaware Department of Natural Resources and Environmental Control (DNREC) for review, comment and final approval by qualified groundwater scientists including Mr. Mike Apgar, P.G. and Mr. Frank Gavas, P.G. Furthermore, using both site-specific data and regional geologic/hydrogeologic information gleaned from the Delaware Geological Survey, it is evident that DRPI is hydraulically isolated from the water supply well fields identified by Artesian during the public hearing. Accordingly, there is no reference or indication that DRPI has impacted the Artesian wells or the Aquifer(s) in which they are located.

DRPI Landfill Background

The DRPI landfill accepts only construction and demolition type wastes for disposal and is permitted DNREC and is monitored daily by a full-time, on-site DNREC Inspector. Prior to obtaining the current Solid Waste Operating Permit, the subsurface conditions at DRPI were required to be extensively investigated in accordance with the DNREC Solid Waste Regulations. As part of the permitting process, multiple subsurface investigations have been completed at DRPI over the past 35 years. These investigations have included the drilling of approximately 75 test borings for the purposes of characterizing the geology, hydrogeology and groundwater quality conditions at DRPI. DRPI has a DNREC-approved groundwater monitoring program that includes the routine sampling, analysis and reporting of groundwater quality conditions from the 14 groundwater monitoring wells in the Columbia and in both the Upper and Lower Potomac Hydrostratigraphic units.

Shallow Groundwater Flow Setting

Based on review of regional geologic information and groundwater elevation data, DRPI is not located within the source water supply recharge areas for the identified Artesian water supply fields (refer to Figure 2, Regional Groundwater Flow). DRPI is topographically separated from the Artesian well fields and is, therefore, in a separate watershed. As a result, surface water from the landfill area does not flow toward the areas where the Artesian well fields are located.

DRPI is located in a different shallow groundwater flow system that is separated from the Artesian well fields by a groundwater divide in the regional shallow groundwater flow system. This groundwater divide is depicted on Figure 2, which is derived from the Digital Water-Table Data for New Castle County Delaware (Digital Data Product No. 05-04¹). As presented on Figure 2, the divide is oriented generally northeast to southwest with the shallow flow zone on the north side of the groundwater divide flowing toward the Christina River, while the shallow flow zone on the south side of the groundwater divide flows toward the Delaware River. With the DRPI Landfill located to the north side of the shallow groundwater divide, and the Artesian well fields as identified by Artesian in the public hearing located to the south of the groundwater divide, they are clearly separated and represent different groundwater flow regimes.

In addition to the groundwater divide, and in accordance with permit requirements, DRPI operates a groundwater dewatering system to control head levels in the shallow groundwater flow system beneath the landfill. As depicted on the Groundwater Contour Map for the Shallow Groundwater Flow Zone at DRPI (October 2018) included as Attachment 1, this dewatering creates a depression in the shallow water table beneath the landfill and results in an inward gradient to the landfill. Put simply, shallow water in the immediate area of the landfill flows to the landfill, not away from it.

¹ Digital Water-Table Data for New Castle County Delaware (Digital Data Product No. 05-04, September 2005). <https://www.dgs.udel.edu/datasets/digital-water-table-data-new-castle-county-delaware-digital-data-product-no-05-04>

This inward gradient further imparts groundwater flow away from the Artesian water supply wells, in addition to the natural flow direction that results from the groundwater divide.

Artesian's comments at the public hearing also inferred concerns regarding emerging contaminants including PFAS. Attachment 2 is a DNREC Fact Sheet (Fact Sheet) related to detections of perfluorooctanoic sulfonate (PFOS) and perfluorooctanoic acid (PFOA). As reflected in that Fact Sheet, Artesian's public supply wells in the New Castle County Airport area contain concentrations of those substances above U.S. EPA's 2016 lifetime health advisory level of 0.07 parts per billion. It should be noted that the multiple Artesian public water supply well fields identified in Attachment 2, including the one closest to the New Castle County Airport, are located within an area of defined groundwater impact known as the New Castle Public Wells Groundwater Plume Site. DRPI is not associated in any way with the groundwater impacts in this area. Based on the delineated plume limits as reported by DNREC and as seen on the map in the Fact Sheet, the plume site is located to the south of, and does not encompass any portion of, DRPI. Therefore, there is no indication that DRPI has caused any of the identified PFAS impacts detected in the Artesian wells.

Shallow and Deep Groundwater Flow System Separation

Through extensive background subsurface characterization, and as presented in the DRPI permit application package, the central and northern portions of the DRPI disposal footprint are immediately underlain by clays of the Upper Potomac Formation. The southern disposal portion is underlain by a thin remnant of the Columbia Formation, which is underlain by clays of the Upper Potomac Formation. The first shallow groundwater zone occurring under water table conditions is present in the remnant Columbia Formation and sandy lenses in the clays of the Upper Potomac Formation. As stated above, groundwater flow in this shallow zone is to the north toward the Christina River and is also controlled by the dewatering system beneath disposal Cells 4 and 5 (causing groundwater to flow into the dewatering system), and groundwater flow in the broader area adjacent to the landfill is to the north toward the Christina River (away from the Artesian wells). Groundwater head elevations in this shallow unconfined zone range from 35 feet above mean sea level (MSL) in the southern portion of the site to approximately 5 feet MSL at the northern end of the site.

Deeper borings and wells drilled between 75 to 150 feet below the ground surface at DRPI encounter thick continuous clays (15 to 30 feet thick) of the Upper Potomac Formation beneath the shallow groundwater zone. Based on observed difference in groundwater head levels between the shallow and deep flow zones, these clays act as aquitards that separate the two groundwater flow systems. As indicated by Woodruff (Information Series 3, 1986), "The finer grained material (silt or clay) act as barriers to water movement, both vertically and horizontally, and are known as confining layers." In other words, these aquitards or confining units serve to isolate the deeper groundwater zones from the shallow groundwater zones. At depth and below the clays, two

discontinuous sand layers that make up the deeper flow zone are present and are monitored as part of the groundwater monitoring program at DRPI and do not exhibit water quality degradation.

As presented on Figure 3 (Geohydrology Conditions Map and Cross Section), the geologic cross-section (B – B') from Woodruff (1981) depicts a clay in the Upper Potomac between the base of Columbia Formation and the upper sand zone of the Upper Potomac Formation, which is consistent with the Conceptual Model developed for DRPI. Therefore, there is no direct communication with the Columbia Formation and the upper sand zone of the Upper Potomac Formation in the vicinity of DRPI.

Groundwater Quality

Groundwater monitoring is conducted in accordance with the DRPI Sampling and Analyses Plan approved by DNREC. Per this Plan, DRPI monitors and reports on an extensive list of chemical parameters (substances commonly found in leachate) for the samples collected from each groundwater monitoring well and the dewatering underdrain system. These chemical parameters are specified by DNREC and are analyzed by an independent laboratory certified to perform each required analysis. Monitoring is conducted in both the upper shallow flow zone and in the deeper confined flow zone.

Based on data dating back over 25 years, the groundwater monitoring well network demonstrates that the groundwater quality has remained consistent and that there is no landfill derived degradation of groundwater quality. This historic groundwater quality data, along with the defined hydrogeologic flow regime, demonstrate that DRPI is in a separate groundwater flow system from the Artesian public water supply well fields and that DRPI is not influencing water quality conditions in these well fields.

In addition to the ongoing routine groundwater monitoring, additional parameters including volatile organic compounds (VOCs) were analyzed and reported for select shallow and deep monitoring wells along the south side of the landfill as part of the permitting process for Cell 6. Based on this data, no VOCs were detected in the permanent perimeter monitoring wells in this area. This demonstrates that the historic wastes are not affecting groundwater. (refer to DRPI Landfill, Proposed Cell 6 Expansion, Hydrogeologic Assessment Summary, October 2004, Blazosky Assoc, Inc.).

Landfill Cap

Development of Disposal Cell 6 at DRPI has included the capping of approximately 15 acres of historic landfill areas that were operated by previous landowners (Petrillo Brothers Dry Waste Landfill). Additional portions of the adjacent Petrillo Landfill and former industrial areas, as well as Disposal Cells 1, 2 and 3 of the DRPI Landfill have also been lined over as part of the Disposal

Cell 6 development. These liner/cap systems (constructed with plastic liners) will cover all of the historic landfill areas and will prevent continued infiltration of rainwater/surface water into the historic waste. By preventing infiltration, the continued generation of leachate within the waste mass will be eliminated.

Summary

Extensive subsurface characterization work has been conducted at the DRPI Landfill as part of original landfill permitting and for lateral expansions. These data and the resultant Site Conceptual Model have been extensively reviewed, commented on, and approved by DNREC. Due to the nature of this proposed new expansion (vertical, not lateral), the previously compiled subsurface investigation data is directly relevant and remains applicable in the form presented. The subsurface investigations conducted at DRPI provide an accurate depiction of the geology and hydrogeology and show that DRPI is hydraulically isolated from Artesian's well fields located to the south.

If you have any questions regarding this summary please feel free to contact me.

Sincerely,

Taylor GeoServices

A handwritten signature in black ink, appearing to read "A. Sokol".

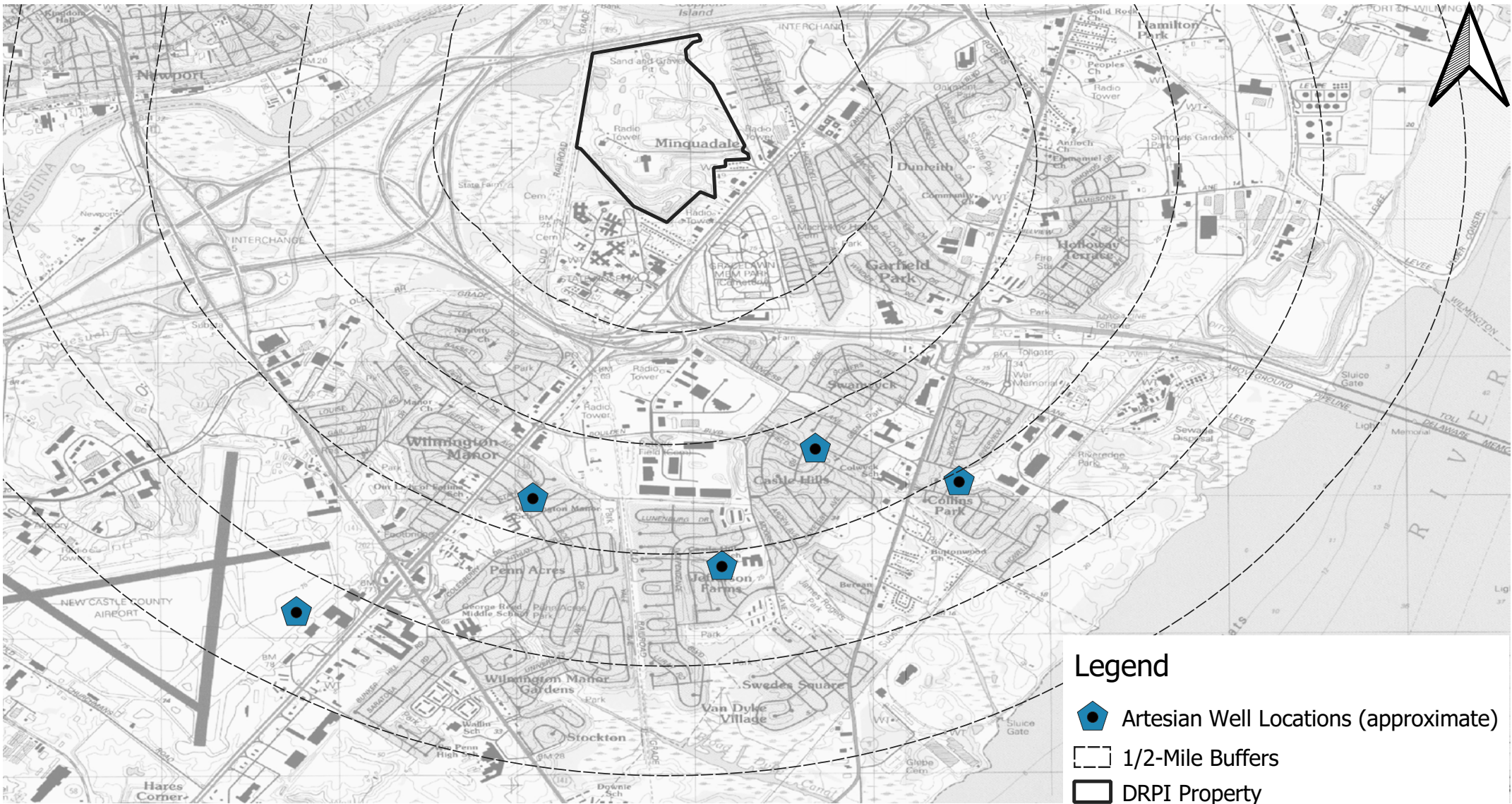
Andrew J. Sokol, P.G.
Vice President/Senior Geologist

Enclosures




Figure 1, Artesian Water Supply Well Locations
Figure 2, Regional Groundwater Flow Map
Figure 3, Geohydrology Conditions Map and Cross Section

Attachment 1, October 2018 Groundwater Contour Map, DRPI Shallow Groundwater Flow Zone
Attachment 2, New Castle Public Wells Groundwater Plume Site Fact Sheet

Figure 1
Artesian Water Supply Well Locations



Legend

-  Artesian Well Locations (approximate)
-  1/2-Mile Buffers
-  DRPI Property

Artesian Water Supply Well Locations

**DRPI
Waste Management
New Castle County, Delaware**

FIGURE 1

Drawn by: MN

Date: 05/31/2019

0 0.25 0.5 mi



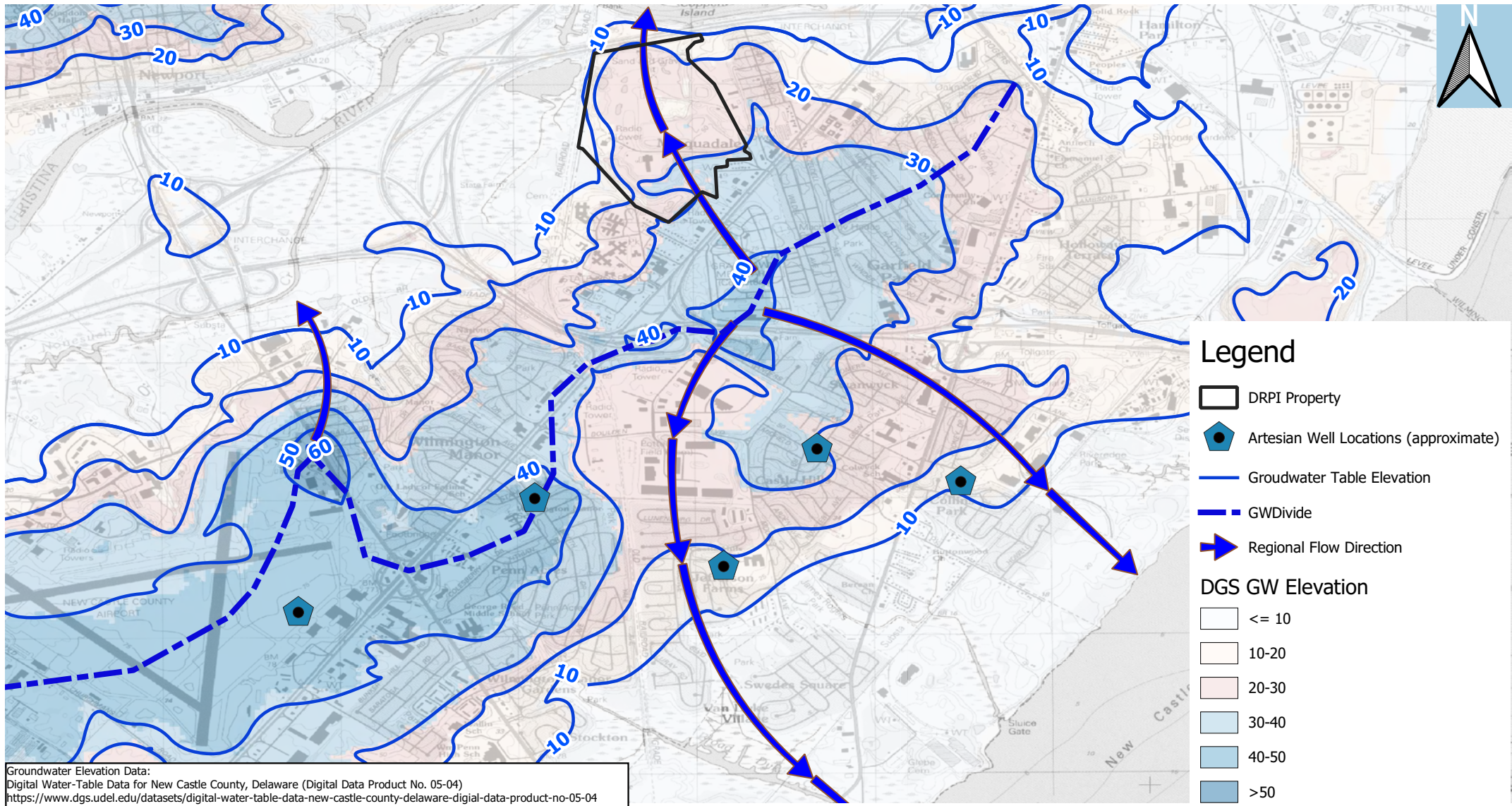
Checked by: AS

Source: Artesian Well Locations from Public Meeting map image



38 Bishop Hollow Road, Newtown Square, PA 19073
www.taylorgeoservices.com

Figure 2
Regional Groundwater Flow Map



Legend

- DRPI Property
- Artesian Well Locations (approximate)
- Groudwater Table Elevation
- GWDivide
- Regional Flow Direction

DGS GW Elevation

- <= 10
- 10-20
- 20-30
- 30-40
- 40-50
- >50

Groundwater Elevation Data:
 Digital Water-Table Data for New Castle County, Delaware (Digital Data Product No. 05-04)
<https://www.dgs.udel.edu/datasets/digital-water-table-data-new-castle-county-delaware-digital-data-product-no-05-04>

Regional Groundwater Flow

**DRPI
 Waste Management
 New Castle County, Delaware**

FIGURE 2

Drawn by: MN

Date: 06/11/2019

0 0.25 0.5 mi



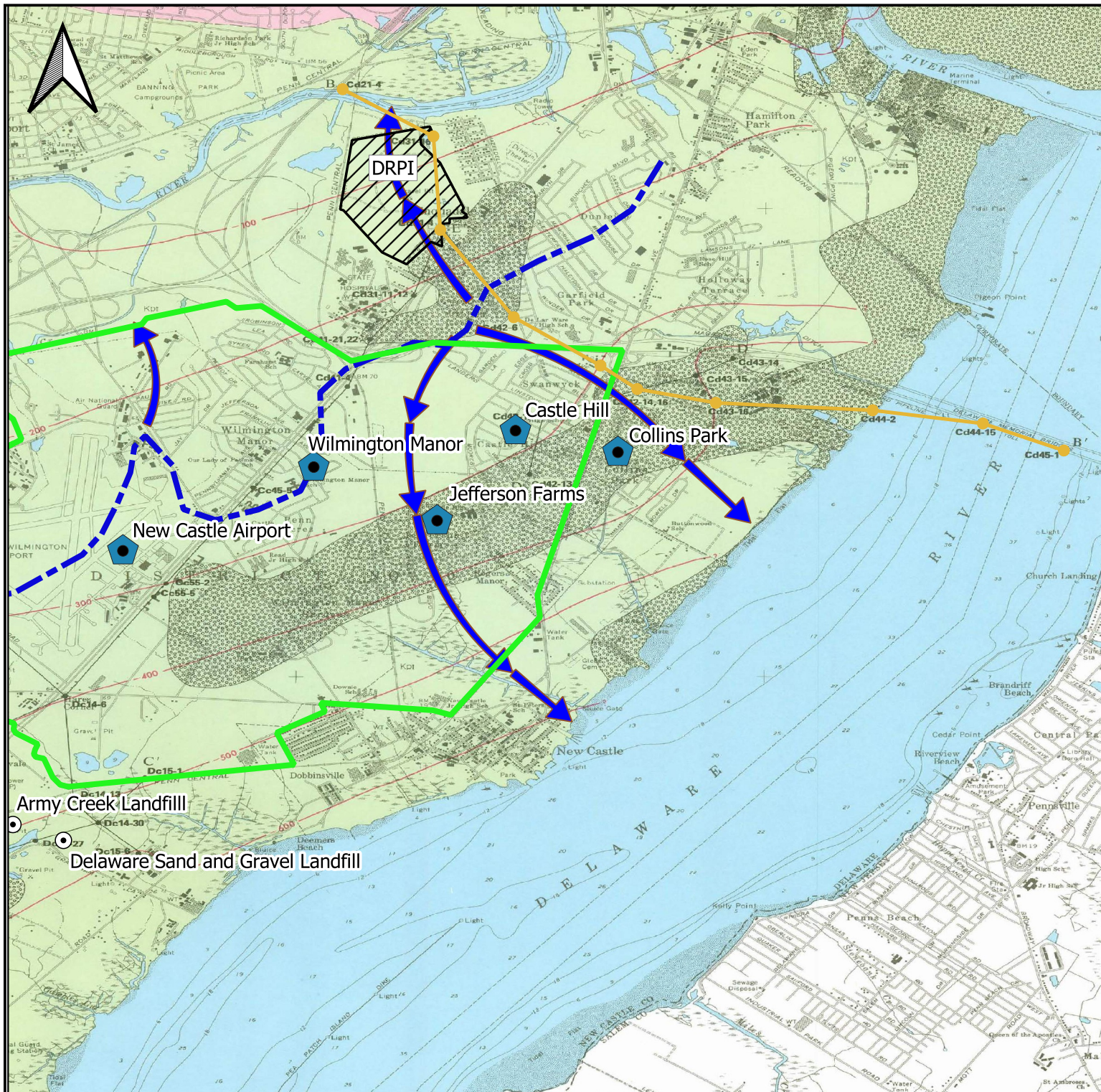
Checked by: AS

Source: Artesian Well Locations from
 Public Meeting map image



38 Bishop Hollow Road, Newtown Square, PA 19073
www.taylorgeoservices.com

Figure 3
Geohydrology Conditions Map and Cross Section

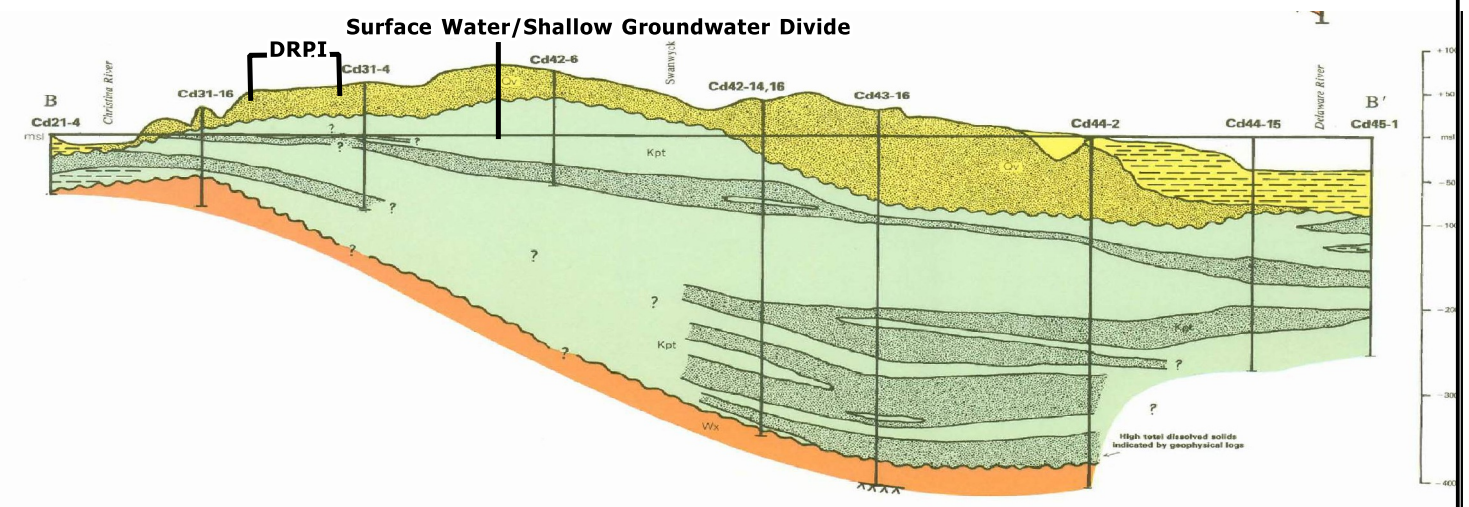


Altitude in feet of weathered basement beneath Coastal Plain sediments (sea level datum). The top of weathered basement usually defines the maximum depth of drilling for ground-water exploration in the Coastal Plain. Locally, little ground-water has been found in the basement (crystalline) rocks beneath the Coastal Plain sediments.

Fracture traces or lineaments postulated from study of conventional air photos, topographic maps, and satellite photos. Such traces often indicate zones of fractured rock where ground-water yields may be higher than average.

Quaternary age sediments of the Coastal Plain greater than 40 feet thick. Immediately adjacent to the Delaware River and in areas such as Cherry Island and Pigeon Point these sediments include the Columbia Formation of Pleistocene age, overlying sediments of Recent age deposited by the Delaware River, and possibly hydraulic fill. In other areas only the Columbia Formation is present.

- Legend**
- Artesian Well Locations (approximate)
 - DRPI Landfill Property
 - Regional Flow Direction
 - Groundwater Divide
 - Approximate Outline of New Castle Public Wells GW Plume Site
 - Cross Section B to B'



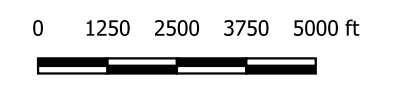
- INTERPRETIVE CROSS-SECTIONS**
- CROSS-SECTION KEY**
- | | | | | |
|-------|---|---------------------|-------------------------|--|
| Cv | Columbia Formation and Holocene Sediments (indicated on cross-section only) | QUATERNARY | marsh | Transmissivity, ft ² /day × 10 ⁴ |
| Kpt | Potomac Formation | CRETACEOUS | aquifers or sandy zones | unconformity |
| Wx | weathered crystalline basement | PRE-CAMBRIAN | silt | correlation uncertain |
| A A A | Top of unweathered crystalline basement (dashed where inferred) | | clay | |

Geohydrology Conditions Map and Cross Section

**DRPI
Waste Management
New Castle County, Delaware**

Drawn by: MI

Date: 06/18/2019



Checked by: AS

Sources: Artesian Well Locations from Public Meeting map image
Geohydrology of Wilmington Area, Delaware by Kenneth D. Woodruff (1981)
DNREC Community Fact Sheet Map

FIGURE 3

**Taylor
GEOSERVICES**
38 Bishop Hollow Road, Newtown Square, PA 19073
www.taylorgeoservices.com

Attachment 1
October 2018 Groundwater Contour Map, DRPI Shallow Groundwater Flow Zone



DNREC —Site Investigation and
Restoration Section
391 Lukens Drive
New Castle, Delaware 19720
Phone: 302-395-2600
Fax: 302-395-2601

Delaware Department of Natural Resources and Environmental Control

New Castle County Airport Area Community Fact Sheet PFOS/PFOA Detected in Ground Water from New Castle Public Wells

Artesian Water Company and the City of New Castle Municipal Services Commission detected perfluorooctanoic sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in public water supply wells in the New Castle County Airport area that are above the U.S. EPA's 2016 lifetime health advisory level of 0.07 parts per billion. The public drinking water is treated to remove the contaminants.

What is DNREC doing?

DNREC is continuing to investigate the source of the ground water contamination in the public wells. In 2017 DNREC will be working with U.S. EPA to install monitoring wells and sample ground water to help determine the extent of the contamination.

Can I continue to drink the public water?

Yes. Artesian and the City of New Castle Municipal Services Commission have been treating the public drinking water to remove PFOS and PFOA so the water does not exceed the health advisory level. The drinking water supplied by Artesian and the City of New Castle continues to meet Federal and State Safe Drinking Water Act standards.

What are PFOS and PFOA?

PFOS and PFOA are part of a group of chemicals known as per- and polyfluoroalkyl substances (PFAS). They are man-made chemicals that have been used in manufacturing and industrial operations, most prevalently in the 1950s-1970s. PFAS were first developed by companies like DuPont and 3M in manufacturing adhesives and non-stick Teflon™. They have been used in firefighting foams and other products with stain, water, oil and grease repellent properties such as clothing, food-wrappers and carpet. Over time, PFOS and PFOA have become widely distributed in the environment and have been detected in the blood of humans, wildlife, and fish.

What adverse health effects may be associated with exposure to PFOS and PFOA?

In laboratory studies of animals given large doses of PFOS and PFOA, results indicate that the substances can cause developmental, reproductive, and other adverse health effects including increased liver weight in laboratory animals. In humans, more research is ongoing, but the most consistent findings from epidemiology studies are elevated blood serum total cholesterol levels among exposed populations, and limited findings related to low infant birth weights.

Where is the site located?

The contaminated area, known as the New Castle Public Wells Ground Water Plume Site, is approximately seven square miles. The Site is bound by Interstate 295 to the north, the Delaware River to the east, Route 273 to the south, and Route 13 and New Castle County Airport to the west. DNREC's previous investigations in the area refer to the site as the Zero (0) East Basin Road Site (DE-0363).

Delaware Department of Natural Resources and Environmental Control

New Castle County Airport Area Community Fact Sheet PFOS/PFOA Detected in Ground Water from New Castle Public Wells *Continued...*



Outline of New Castle Public Wells Ground Water Plume Site.

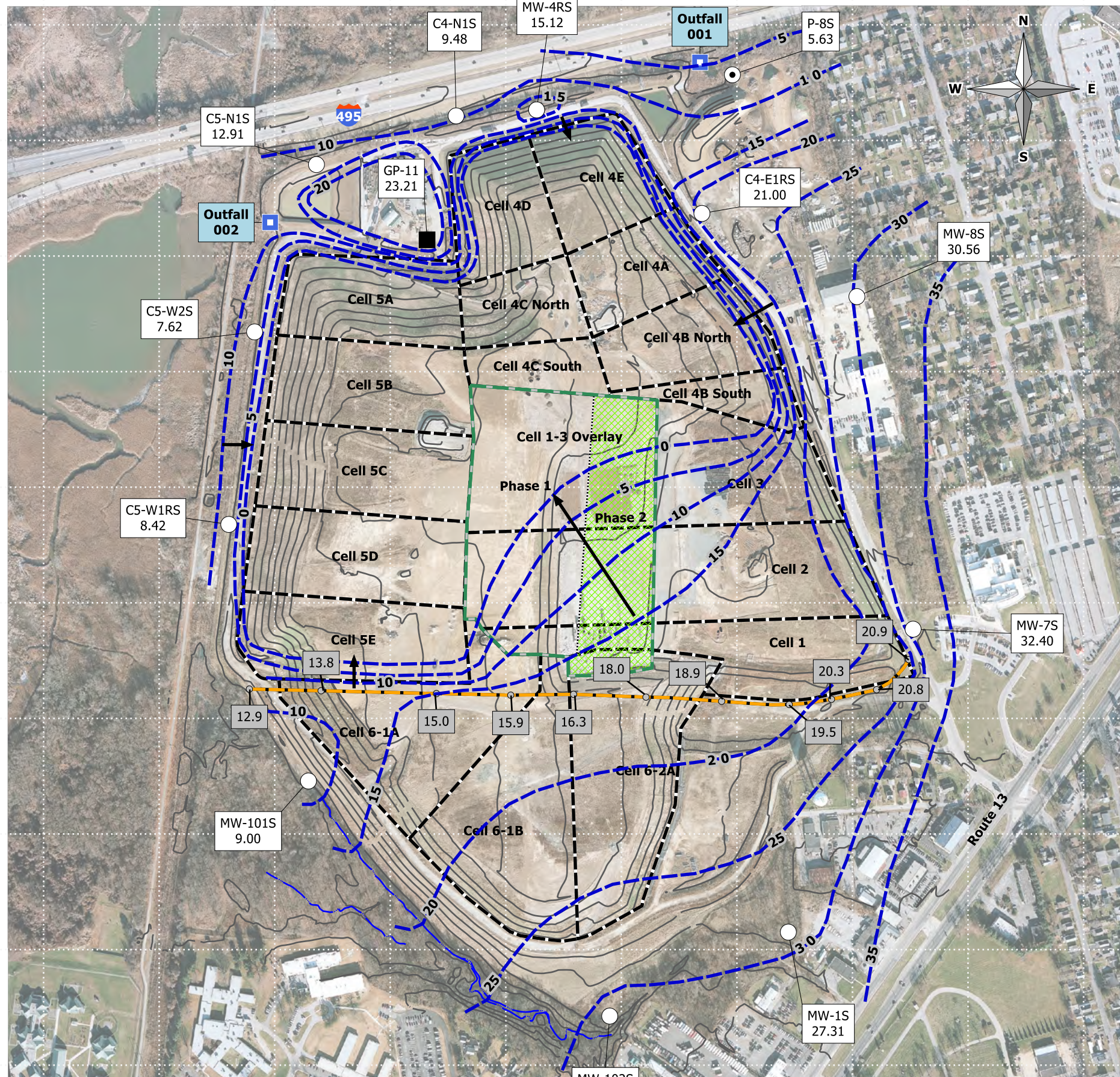
FOR ADDITIONAL PFAS INFORMATION — SEE EPA AND ATSDR WEBSITES:

- <https://www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas>
- <https://www.atsdr.cdc.gov/pfc/>

FOR ADDITIONAL QUESTIONS:

- **Site-related:** Please contact DNREC staff at 302-395-2600, or by email: Todd Keyser at Todd.Keyser@state.de.us or Stephanie Gordon at Stephanie.Gordon@state.de.us.
- **Public Drinking Water:** Please contact the Division of Public Health, Office of Drinking Water at 302-741-8630.
- **City of New Castle Municipal Services Commission:** Please contact Pamela Patone at 302-323-2330.
- **Artesian's Water Quality Department:** Please contact 302-453-6900.

Attachment 2
New Castle Public Wells Groundwater Plume Site Fact Sheet



NOTES

1. Base Aerial from Quantum Spatial flown 12/27/2017
2. Horizontal Grid is Delaware State Plane NAD 27
3. Vertical Datum is NGVD 1929
4. Water elevation data collected on October 2, 2018

LEGEND

- Shallow Zone Monitoring Well
- ⊙ Piezometer
- Gas Monitoring Probe
- Groundwater Contour (C.I. = 5')
- Stormwater Monitoring Points (Outfall 001 and 002)
- As-Built Invert Elevation (Cell 6 GWCD)
- Cell 6 Groundwater Control Drain (GWCD)
- - - Disposal Cell Limit
- - - Cell 1-3 Overlay Limit
- ▨ Active Disposal Areas
- ▭ Limit of Landfill
- - - Property Boundary
- Groundwater Flow Direction
- ⋯ State Plane Grid Line
- Stream
- Topographic Contour (C.I. = 10')

Hydraulic Gradient Calculation

(MW-7S to C4-N1S)
 L= 3,000 ft
 H1= 32.40 ft
 H2= 9.48 ft
 $I = ((H1-H2)/L) \times 100$
 I = 0.76%



11/19/2018

Drawn by: MI

Checked by: AJS

**DELAWARE RECYCLABLE PRODUCTS, INC.
 DRPI INDUSTRIAL WASTE LANDFILL**

Shallow Zone Groundwater Contour Map
 October 2, 2018

Minquadales Borough

New Castle County

Delaware

38 Bishop Hollow Road, Suite 200, Newtown Square, PA 19073 Phone: (610) 325-5570
 www.taylorgeoservices.com



Figure 1