

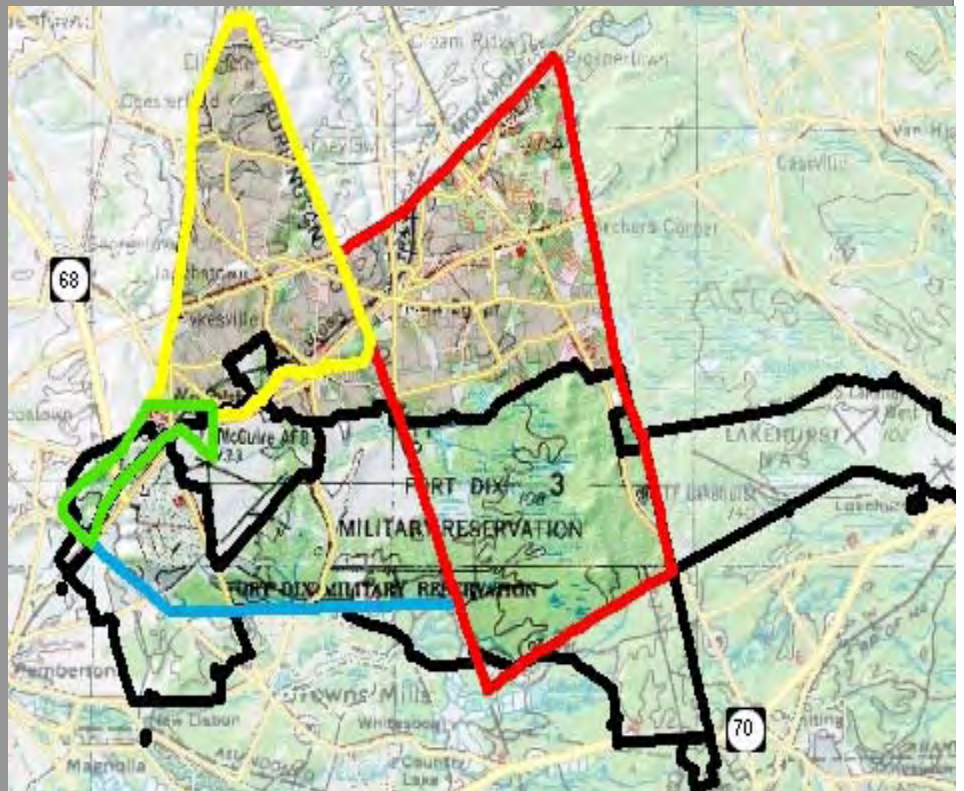
Joint Base Regional Wastewater and Growth Management Plan

Alternatives Analysis Report

Presented to:

Ocean & Burlington
Counties

Presented by:



September 2011

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INTRODUCTION

In 2008, the United States Department of Defense's Office of Economic Adjustment (DOD OEA) initiated the Joint Base Land Use Study (JLUS) to encourage cooperative land use planning between the military installations and adjacent communities. One of the recommendations provided in the JLUS was the creation of a regional wastewater and growth management plan to develop municipal growth management techniques to prevent and/or minimize encroachment from adjacent communities that may impair operations of military installations.

The Counties of Ocean and Burlington, in conjunction with the DOD OEA, provided funding for the initiation of the Joint Base Regional Wastewater and Growth Management Plan Study. The purpose of the study is to (1) promote smart growth planning and development within the civilian areas adjacent to the military installations; (2) address existing health and environmental concerns in the Upper Crosswicks Creek Watershed due to failing septic systems within the area; (3) stabilize and redevelop housing and economic development resources in the existing municipal centers and nodes; and (4) promote farmland and open space preservation.

The study consists of three (3) phases:

- Phase I is the creation of an alternatives analysis report. As part of this phase, the development of the service needs of the communities within the study area and conditions analysis of existing infrastructure for both the sanitary sewer and potable water services will be included. The final analysis report will outline alternatives proposed including economic cost and benefits, permitting, environmental concerns, and overall engineering feasibility of the presented alternatives.
- Phase II is the preparation of the preliminary and final feasibility study. This Phase will result in the selection of the most viable alternative for the provision of water and sewer utilities to the study members. Phase II will also include the drafting and submission of the Joint Base Regional Wastewater Management Plan to New Jersey Department of Environmental Protection (NJDEP) for review and approval.

- Phase III is the creation of the preliminary and final design documents for the proposed infrastructure selected during Phase I and Phase II of the study. Phase III will also include finalizing the Joint Base Regional Wastewater and Growth Management Plan for submittal to the DOD OEA.

In November of 2010, Ocean County authorized the team of T&M Associates and Gannet Fleming (the Team) to proceed with Phase I of the study. The Team met with representatives from the military, Ocean and Burlington Counties and the four (4) “host communities” to initiate the work associated with Phase I. As a result, this Alternative Analysis Report was developed to outline the various alternatives identified to service the wastewater and potable water needs of the study area and associated growth areas.

BACKGROUND

The area for this study consists of the Joint Base and four (4) “host communities” located along the northern border of the Joint Base. The Joint Base includes the Fort Dix Army Post, the Lakehurst Naval Air Engineering Station and McGuire Air Force Base. The host communities include Plumsted Township, which is located in Ocean County, and New Hanover Township, North Hanover Township, and Wrightstown Borough, which are all located within Burlington County. A Location Map of the Study Area is shown on Figure 1.

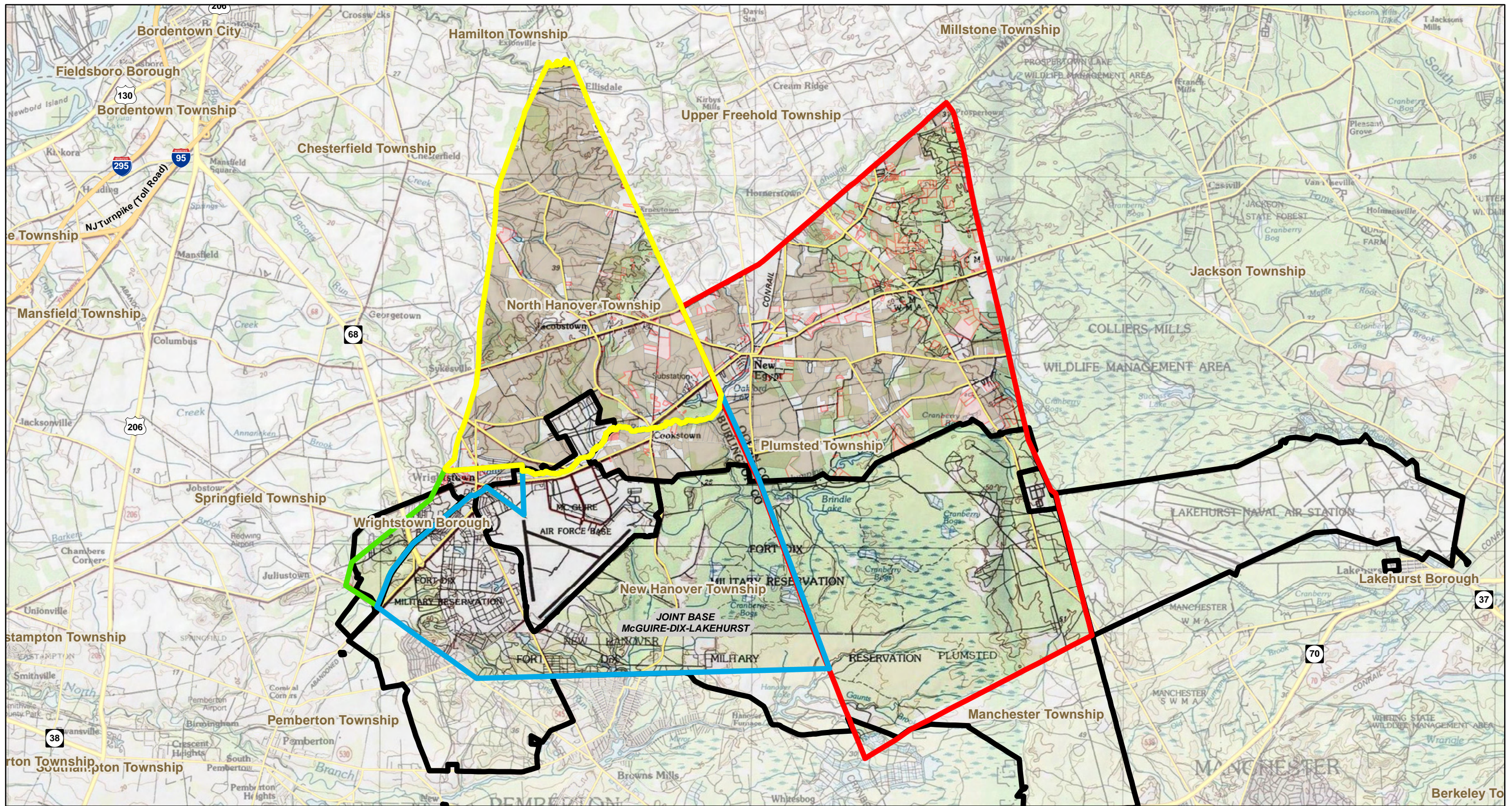
TOWNSHIP OF PLUMSTED, OCEAN COUNTY

The Township of Plumsted, the only host municipality in this study located in Ocean County, is bordered to the north by Upper Freehold Township, to the west by North Hanover and New Hanover Townships, the Joint Base and Manchester Township to the south, and Jackson Township to the east. The Township encompasses approximately 40 square miles, almost half of which is part of the Fort Dix section of the Joint Base. Plumsted is also considered to be the geographical center of New Jersey.

The Township, as it exists today, was incorporated in 1845, after seceding from Jackson Township. Historians note that the original tract of 2,700 acres known as “New Egypt” was granted to Clement Plumsted of London, U.K., in 1699, and the area is noted as “Plumsted” on the 1781 edition of the John Hill Map of Monmouth County. (Mainstreeusa.com) The civilian portion of the Township is rural, with agriculture as a dominate industry. According to the JLUS, Plumsted Township’s active preservation of farmland and right-to-farm regulations has created the largest area of preserved farmland in Ocean County. The Town Center is the New Egypt area of the Township located in the northwest area. Much of the area located near the Joint Base is also wetlands and forested. Oakford Lake transects the Main Street area of New Egypt, and is the major drainage feature in this area.

TOWNSHIP OF NEW HANOVER, BURLINGTON COUNTY

New Hanover Township was first formed by Royal Charter in 1723, and incorporated as one of



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Legend

- North Hanover Township
- New Hanover Township
- Wrightstown Borough
- Plumsted Township
- Joint Base
- Interstate or Toll Route
- US or State Route
- County Route
- Local Road
- Ramp

*Figure No. 1
Municipalities and Joint Base
Burlington/Ocean County, New Jersey*



NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

the original New Jersey townships under a 1798 Act of the State Legislature. The Township encompasses approximately 22 square miles, of which 90% is federally owned according to the 2007 Township Master Plan Land Use Element Update. New Hanover is bordered in Burlington County by North Hanover and Wrightstown Borough to the north, Springfield Township to the west, Pemberton Township to the south, and Plumsted Township, Ocean County, to the east.

According to the Master Plan, of the 2.09 square miles of civil portion, 80% is agricultural, wooded or vacant. New Hanover Township is predominately rural in character, with a residential center located in the Village of Cookstown. The main commercial corridor runs along Wrightstown-Cookstown Road (CR 616), offering commercial and retail services to the military personnel on the Joint Base and the civilian population.

The topography of the civilian section of New Hanover is fairly flat, with some rolling hills. The area is interlaced with several rivers, streams, freshwater wetlands, and cranberry bogs. The high point of the Township is Taylor's Mountain. Little Pine Lake and portions of Oakford Lake and Cookstown Pond lie within the boundary, and act as the lower elevation points. The civilian section of New Hanover drains toward the North Run of Crosswicks Creek and into Oakford Lake.

TOWNSHIP OF NORTH HANOVER, BURLINGTON COUNTY

North Hanover Township encompasses approximately 17 square miles and is bordered by McGuire Air Force Base, Wrightstown Borough, and New Hanover Township to the south. Springfield and Chesterfield Townships border to the west, and Hamilton Township, Mercer County borders the northern most section. To the east lies Upper Freehold Township and Plumsted Township. A small portion of the southern area of the Township is owned by the military.

North Hanover is predominantly an active farming community and the Township actively seeks to preserve its existing farmland and open space areas. Per the JLUS, there are over 2,000 acres of forest within Township borders. The Township's residential and commercial communities are predominantly clustered along its North Cookstown, North Wrightstown, Jacobstown and Sykesville areas.

North Hanover's topography consists of rolling hills and flat lands, interlaced with streams and

wetlands. Monmouth Road (CR 537) acts as a drainage divide, channeling the southern portion's run off to Crosswick's Creek and the northern portion to Blacks Creek.

BOROUGH OF WRIGHTSTOWN, BURLINGTON COUNTY

Wrightstown Borough encompasses approximately 2 square miles of Burlington County. The Borough is bordered by New Hanover Township and Pemberton Township to the south and east, Springfield Township to the west and North Hanover Township to the north. The Borough's civilian sections lie north of the Joint Base boundary, and lies entirely within the 2 mile Joint Base buffer zone.

The Borough is predominately built-out, with a mixture of residential and commercial land uses. There is little agriculture within the Borough.

The civilian portion of the Borough is fairly flat, and transected by North Run. Smaller tributaries also run through the Borough. Lower elevations are located along North Run and the Joint Base border.

JOINT BASE

Under the Base Realignment and Closure Commission (BRAC) recommendations of 2005, Fort Dix, McGuire Air Force Base, and the Naval Air Engineering Station Lakehurst formed a joint operation for base operations under Air Force lead. Stretching across Burlington and Ocean Counties, the 60-square miles of contiguous land was the first and only Air Force-Army-Navy installation with significant Marine Corps and Coast Guard assets. McGuire Air Force Base, Fort Dix and Naval Engineering Station Lakehurst, which together occupy 42,000 acres, are now known as Joint Base McGuire-Dix-Lakehurst (Joint Base). The tri-base complex is a blend of Active Duty, Reserve, and National Guard military personnel. The base presently serves the following functions: training and mobilization for the Army, logistics and transport for the Air Force, and designing and testing aircraft components for the Navy. The Joint Base contains the largest Federal corrections facility, as well as, another prison compound, which combined houses more than 5,300 inmates. The base also supports over 18,700 active duty military and civil service members.

SERVICES NEEDS

As part of the Alternatives Analysis, the Team confirmed municipal and military growth areas, reviewed build out analysis and developed existing and future needs of the study area members in terms of sanitary wastewater and potable water. Information was obtained from various sources including interviews with the four municipalities, and data provided by the JLUS, Ocean County, and Burlington County. Interviews were conducted in accordance with the municipal outreach portion of this phase, in order to verify build-out information provided, confirm current and projected growth areas, and to discuss individual municipal goals and objectives.

SANITARY SEWER FLOW PROJECTION METHODOLOGY

Existing and projected sanitary sewer flows were calculated for North Hanover and New Hanover based on current build-out data as provided by the County and/or municipality, tax map information, aerial photography, and other information provided by municipalities, Counties, and local municipal utilities authorities (MUAs). Flows from Plumsted and Wrightstown were obtained from previous studies and existing permits.

Sanitary sewer flows were calculated utilizing NJDEP's published theoretical daily flow values as outlined in N.J.A.C. 7:14A-23 for each different type of development within each municipality. See Table 1 – NJDEP Flow Factors for a list of flow factors utilized as part of this study.

For those properties which were identified as vacant or available for development or re-development flow was quantified based on potential development allowed under current zoning guidelines. In other words, the total area for each of those properties was quantified and any environmental constrained areas identified within the property lines were deducted from the total square footage of the given lot. Examples of such constraints include riparian buffers, wetlands, and threatened and endangered species areas. A Floor to Area Ratio (FAR) factor of 25% for New Hanover Township and 30% for North Hanover Township, as recommended by Burlington County, were then applied, as well as, any zoning restrictions (i.e. property front and side setbacks, building height restrictions, etc.) for that given area in order to determine the potential area of development allowed on a per lot basis.

For existing residential properties, the flow factor was applied to each lot depending on the type of residential home description. For small to mid-size commercial and other type properties, flows were either calculated based on square footage or on a per person/per room basis depending on the type of commercial use of the property.

Existing large commercial properties were maximized to the allowable limits per the current zoning requirements in the event that these properties could potentially be redeveloped in the future once sewage infrastructure was provided in the area. Flow calculations for these properties were conducted similar to that of vacant properties noted above.

Table 1: NJDEP Flow Factors

Type of Unit	Flow Factor
Single Family Home	300 GPD
Mobile Home	200 GPD
1 Bedroom Apartment	150 GPD
2 Bedroom Apartment	225 GPD
Commercial	0.1 GPD/SF
Farmstead	787.5 GPD
Industrial	0.1 GPD/SF
Professional/Office	0.1 GPD/SF
Motels/Hotels	60 GPD/Room

POTENTIAL GROWTH AREAS AND SERVICE NEEDS

During the course of this phase of the study, the Team conducted meetings with representatives from each municipality within the study area to discuss and confirm existing development and potential development growth needs, as well as, needs for sanitary and potable water infrastructure. From these meetings growth areas and their infrastructure demands were identified for each of the four municipalities as follows:

PLUMSTED TOWNSHIP

Plumsted Township is primarily an agricultural community and approximately one-half of its land area is located within the Fort Dix section of the Joint Base. Based on discussions with Township representatives, Plumsted is primarily built out with the exception of various tracts of

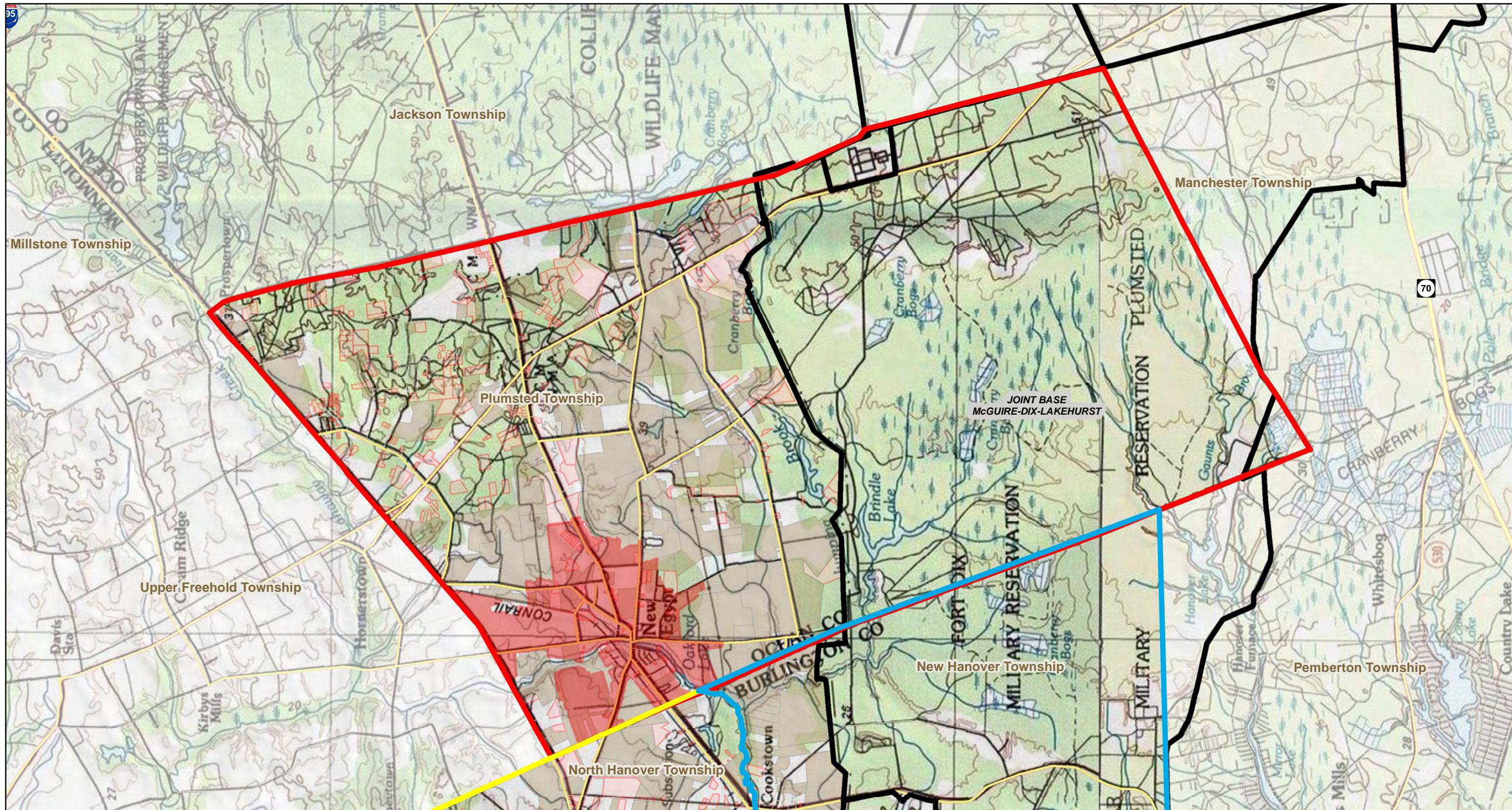
agricultural lands which they wish to preserve as farmland or forested properties. Its largest residential and commercial population area outside of the military boundary is their “New Egypt” area, which has been designated as a town center in the State Development and Redevelopment Plan. Given this designation and the Township’s plans for revitalization of this area, new growth is anticipated provided wastewater infrastructure is also secured.

During our subsequent meetings with Township representatives, Plumsted indicated that several studies had been previously conducted by other professionals over the years to determine projected sewer demands of their potential growth areas within the municipality. Discussions with regulatory agencies had also been pursued in order to establish potential options for servicing the sanitary sewer demands of the Township. As such, the potential growth areas and sewer demands had already been identified prior to our meeting.

The Township’s primary need is to provide service to its “core downtown” or “C-4” area. Refer to Figure 2 for a map outlining the Township’s proposed growth areas. The C-4 area is a small section of the main downtown area centered primarily along East Main and Main Streets. Flow projections based on build out estimates calculated by the Township for this small area are estimated at 175,000 gallons per day (GPD). Further discussions with Township representatives also revealed that to service the entire downtown area, which would include the C-4 area, would require approximately 450,000 GPD of sanitary sewer flow. Ultimate build out of the designated town center, including a large parcel slated for future development as either a hotel or adult only community would require 900,000 GPD of sanitary sewer flow. Ultimate build out is assuming that existing properties are redeveloped to its maximum allowable limit and flow calculations are based on estimates provided by the Township. The Plumsted Municipal Utilities Authority (PMUA) has indicated that this scenario is unlikely and their goal is to provide sanitary sewer service to their downtown area only. Therefore, for the purpose of this study it is assumed that the service need for Plumsted will not exceed 450,000 GPD.












NEW HANOVER TOWNSHIP

Within New Hanover Township, the small percentage of land (approximately 10%) not located within the McGuire and Fort Dix sections of the Joint Base, is primarily comprised of agricultural, wooded or vacant properties. Commercial and residential properties are centered along its West Cookstown area and Cookstown area, respectively. The Cookstown area has been designated a village center and is comprised of a mix of historic and modern single family



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|  | New Hanover Township |  | Joint Base |
|  | North Hanover Township |  | Interstate or Toll Route |
|  | Plumsted Township |  | US or State Route |
|  | Wrightstown Borough |  | County Route |
|  | Plumsted Growth Area |  | Local Road |
| | |  | Ramp |



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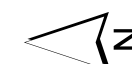


Figure No. 2
 Plumsted Growth Area
 Ocean County, New Jersey

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

homes. Based on discussions with Township and Burlington County personnel, the Township wishes to promote preservation of existing farmland and vacant land while promoting growth within the West Cookstown and Cookstown areas. Refer to Figure 3 for a map of these areas.

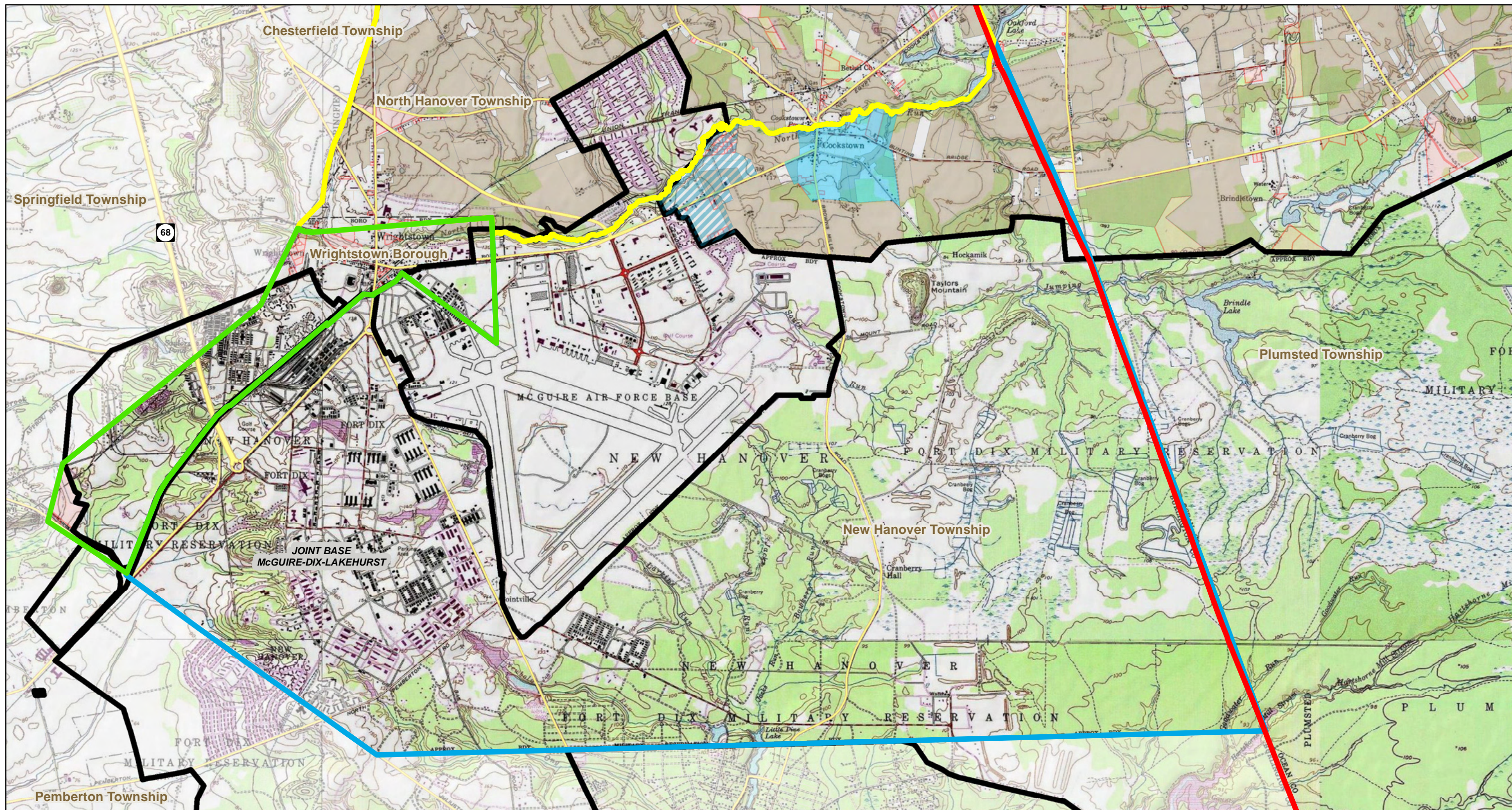
It is also important to note that the areas of Cookstown and West Cookstown are known to have areas of failing septic systems. According to Burlington County, between 1991 and 2009, ten failing septic system complaints were validated. This figure doesn't account for invalidated or non-reported incidents of failure. These failures provide additional incentive to construct public sewer infrastructure.

West Cookstown is located along the border of North Hanover and the Joint Base and contains most of the civilian portion's non-residential development, as well as, several small residential lots. An inventory of existing properties was conducted and existing development and future development properties were identified and flow projections quantified as noted earlier in this report. For commercial lots, the maximum allowable development areas were calculated to determine future build out projections. See Table 2: West Cookstown Area – Sewer Demand, for a summary of the flow projections for the area.

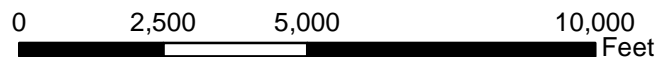
Table 2: West Cookstown Area – Sewer Demand

	Existing Development	Future Development	Total Future Development	Flow Factor	Future Sewer Demand (GPD)
Single Family	52	25	77	300 GPD	23,100
Industrial (SF)	46,000	-46,000	0	0.1 GPD/SF	0
Commercial/Civic (SF)	178,400	844,687	1,023,087	0.1 GPD/SF	102,309
Motels/Hotels (Room with restaurant)	100	0	100	75 GPD/Room	7,500
TOTAL GPD					132,909

The Cookstown area, which is located along the Township border with North Hanover, is predominately residential in terms of development. It is assumed, that, due to the size of the residential lots, there will be minimal, if any residential infill. Based on the property inventory conducted, flow projections were quantified and are shown in Table 3: Cookstown Area – Sewer Demand.



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| Wrightstown Borough | West Cookstown Growth Area | US or State Route |
| Plumsted Township | Cookstown Growth Area | County Route |
| North Hanover Township | Joint Base | Local Road |
| New Hanover Township | Interstate or Toll Route | Ramp |

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*Figure No. 3
 New Handover Growth Area
 Burlington County, New Jersey*

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

Table 3: Cookstown Area – Sewer Demand

	Existing Development	Future Development	Total Future Development	Flow Factor	Future Sewer Demand (GPD)
Single Family	148	21	169	300 GPD	50,700
Commercial/Civic (SF)	39,800	0	39,800	0.1 GPD/SF	3,980
TOTAL GPD					54,680

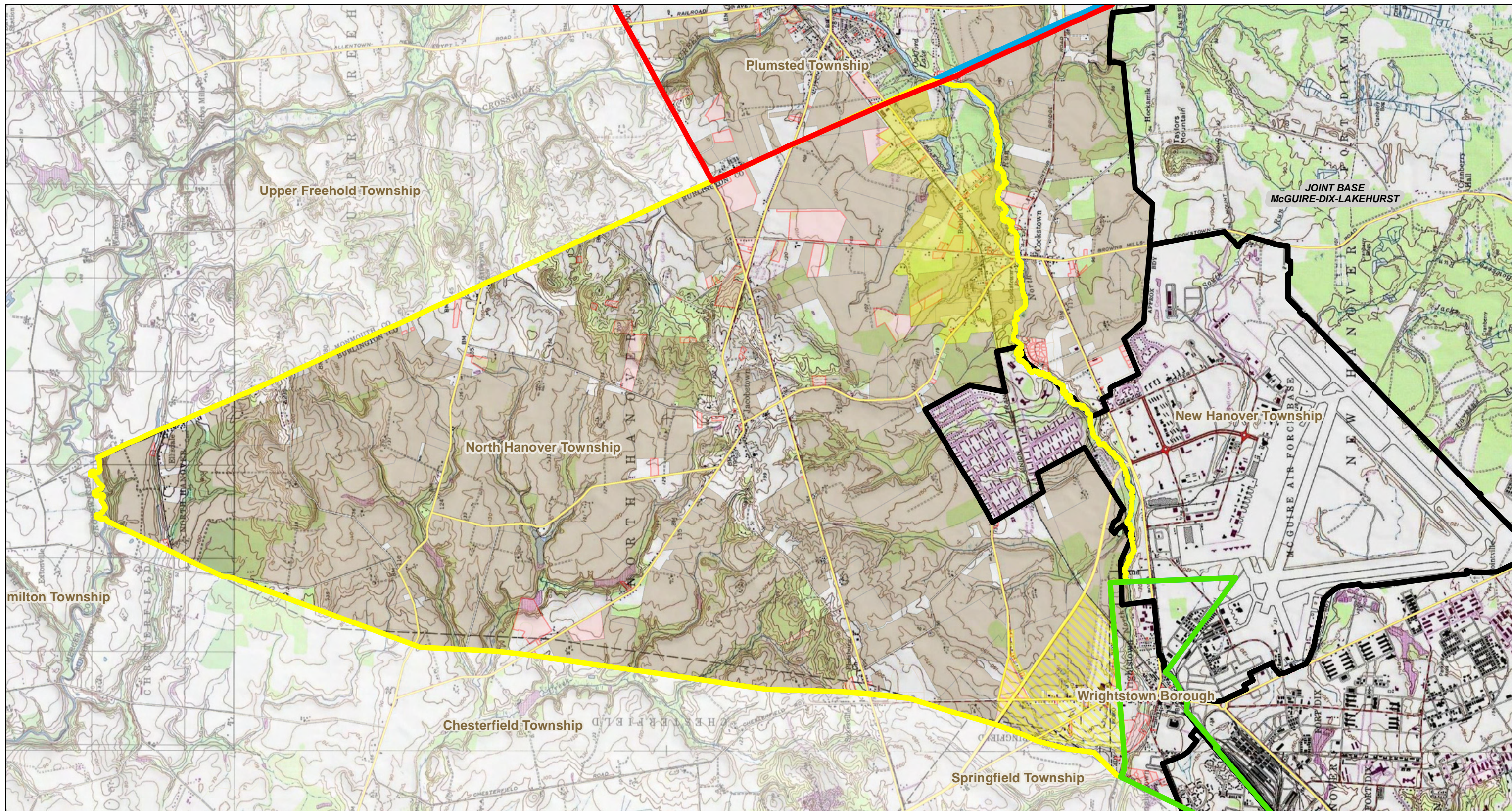
As noted in the tables above the total service need for New Hanover Township is 187,589 GPD. Of which approximately 49% or 92,420 GPD would be required to service existing development and the remaining 51% or 95,169 GPD would not be required until the near future when re-development of the existing properties and development of vacant lots took place.

NORTH HANOVER TOWNSHIP

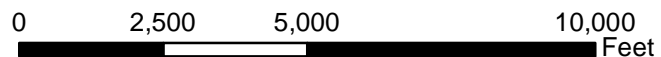
North Hanover Township is a rural community comprised mostly of farmland and agricultural lands. The Township has promoted farmland and open space preservation and to date has preserved over 3,000 acres. The Township’s residential and commercial properties are concentrated within existing town and village centers adjacent to major thru routes within the Township.

To continue promoting land preservation and growth within their existing town centers, the Township is in the process of developing two (2) Town Centers as receiving areas for proposed Transfer Development Rights (TDR) development. These receiving areas are more commonly known as the villages of North Wrightstown and North Cookstown. See Figure 4 for a map outlining these growth areas. Though Jacobstown, another village center located within the Township, houses the majority of Township’s single-family detached residential properties, it is nearly built out and is not being considered as a TDR receiving zone for the purpose of this study.

In discussions with Burlington County representatives, a build out analysis was prepared by their office with input from the Township to determine the number of existing and potential developed and developable properties located within the two receiving areas. Service need calculations were based on this information provided by the County. Refer to Tables 4 and 5 for



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| Wrightstown Borough | North Wrightstown Growth Area |
| Plumsted Township | Interstate or Toll Route |
| North Hanover Township | US or State Route |
| New Hanover Township | County Route |
| Joint Base | Local Road |
| North Cookstown Growth Area | Ramp |

Figure No. 4
 North Handover Growth Area
 Burlington County, New Jersey

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a summary of properties and the sewer service demands required.

In the North Wrightstown area, it is estimated that there are 279 existing residential properties and 422,500 square feet of commercial/industrial properties requiring 61,900 GPD and 42,730 GPD of sanitary sewer service, respectively. The commercial flow also includes demand from adjacent motel/hotel facilities. The Spartan Village mobile home community, which has its own NJPDES wastewater permit, accounts for 215 of the center’s 279 existing homes. The Township has designated the commercial portions of the center’s redevelopment areas. However, many of the abandoned and underutilized commercial properties cannot be fully occupied unless they are connected to a public sanitary sewage system.

At ultimate build out, using the County’s proposed TDR development factors, there are potentially 948 residential properties, 288,075 square feet of commercial properties, and 100 motel/hotel rooms including both existing and proposed in the future. This equates to a total of 284,208 GPD of sanitary sewer demand for the North Wrightstown area. See Table 4: North Wrightstown – Sewer Demand for a summary of the calculations. Please note a 10% safety factor was included on all future residential development to account for any changes in the TDR assumptions.

Table 4: North Wrightstown Area – Sewer Demand

	Existing Development	Future Development	Total Future Development	Flow Factor	Future Sewer Demand (GPD)
Single Family Home	60	421	481	300 GPD	144,300
Town Home	0	160	160	300 GPD	48,000
Mobile Home	215	0	215	200 GPD	43,000
1 Bedroom Apartment	0	88	88	150 GPD	13,200
2 Bedroom Apartment	4	0	4	225 GPD	900
Industrial (SF)	150,600	-150,600	0	0.1 GPD/SF	0
Commercial/Civic (SF)	271,900	16,175	288,075	0.1 GPD/SF	28,808
Motels/Hotels (Room)	48	52	100	60 GPD/RM	6,000
GRAND TOTAL					284,208

In the North Cookstown area, which is the second proposed Receiving Area, it is estimated that there are 426 existing residential properties and 86,000 square feet of industrial/commercial properties requiring 100,350 GPD and 8,600 GPD of sanitary sewer service, respectively.

At ultimate build-out there are projected to be 1,977 residential connections consisting of single and multi-family units for a projected sewer demand of 562,050 GPD. The projected industrial/commercial demand is expected to decrease to 6,400 GPD. See Table 5: North Cookstown – Sewer Demand for a summary of the flow calculations.

Total anticipated service need for the two growth areas equates to 846,258 GPD for all residential and industrial/commercial properties.

Table 5: North Cookstown Area – Sewer Demand

	Existing Development	Future Development	Total Future Development	Flow Factor	Future Sewer Demand (GPD)
Single Family Home	132	1231	1,363	300 GPD	408,900
Town Home	0	175	175	300 GPD	52,500
Mobile Home	213	-32	181	200 GPD	36,200
1 Bedroom Apartment	1	-1	0	150 GPD	0
2 Bedroom Apartment	80	178	258	225 GPD	58,050
Industrial (SF)	42,000	-10,000	32,000	0.1 GPD/SF	3,200
Commercial/Civic (SF)	44,000	-8,000	32,000	0.1 GPD/SF	3,200
GRAND TOTAL					562,050

WRIGHTSTOWN BOROUGH

Wrightstown Borough is predominately built out with the exception of two parcels of land totaling approximately 44 acres located along Saylor's Pond Road (across from Borough Hall) which are scheduled for non-residential re-development. These two parcels were previously owned by the Federal Government, and are located within the Pinelands region.

Wrightstown is comprised of a mixed bag of land uses though the majority of its existing residential and commercial properties lie in the northern section of the Borough. See Figure 5 for a map outlining the Borough's growth area.

In discussions with Borough personnel, Wrightstown is actively pursuing development of the two parcels of land noted above; however, final development of the site is as yet to be determined. A review of the build out analysis prepared by the Borough indicates that there is the potential for an additional 29 new residential homes and approximately 340,000 square feet of non-residential construction at full build out including the two parcels of land available for development based on current zoning. This would equate to a service need of approximately 43,000 GPD of sanitary sewer service. Presently, existing development generates 90,000 GPD of sanitary sewer flow. Therefore, total demand at build out would equal 133,000 GPD.

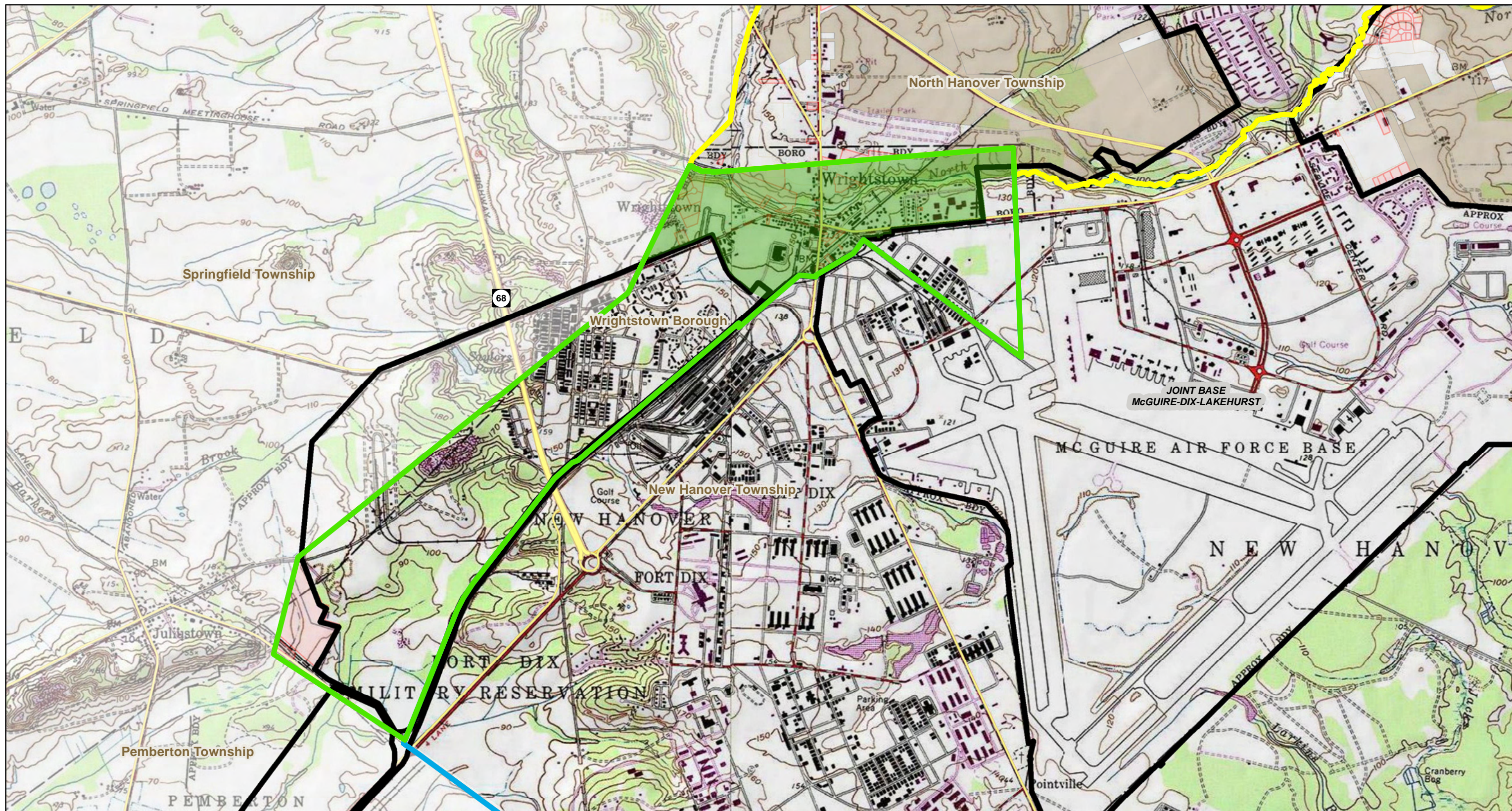
As stated above, the Redevelopment Parcels may impact the Wrightstown Municipal Utilities Authority’s (WMUA) wastewater treatment plant by increasing the future flow from Wrightstown. The final flow calculation will be dependent on the final use of these properties, and the final zoning overlay established. As part of this study, it is assumed that the WMUA plant can potentially double in size to accommodate additional flow demands. Any modifications to the Redevelopment Parcels should not affect the potential future capacity available after this expansion; however, any changes to the potential build out for these properties may alter the timetable for the proposed improvements.

SUMMARY

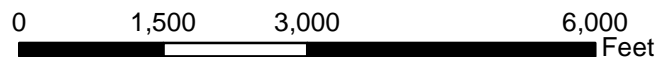
As outlined in this section of the report below is a summary of the sanitary sewer service needs for each of the four host (4) municipalities within the study area. In Plumsted, though ultimate build out for the given growth area can be calculated at 900,000 GPD, the Township and the PMUA are only interested in providing 450,000 GPD at this time.

Table 6: Existing Sewer Demand Summary

	Plumsted Township	New Hanover Township	North Hanover Township	Wrightstown Borough
Existing Sanitary Sewer Treatment Demand (GPD)	450,000	93,920	213,600	90,000
Build-Out Sanitary Sewer Treatment Demand (GPD)	450,000	187,589	846,258	133,000



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Legend

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|------------------------|--------------------------|-------------------------|
| Wrightstown Borough | Joint Base | Wrightstown Growth Area |
| Plumsted Township | Interstate or Toll Route | |
| North Hanover Township | US or State Route | |
| New Hanover Township | County Route | |
| | Local Road | |
| | Ramp | |

Figure No. 5
 Wrightstown Growth Area
 Burlington County, New Jersey

Prepared by: BAR, 8/10/2011
 Source: NJDOT, NJDEP, Ocean County GIS, Burlington County GIS
 File Path: H:\OCTY\00380\GIS\Projects\Fig 5- Wrightstown Growth.mxd



NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

CONDITIONS ANALYSIS

As part of this study, the Team also conducted an assessment of existing infrastructure within the four (4) study municipalities, as well as, the Joint Base in order to identify available infrastructure capacity and areas for potential expansion for both the sanitary sewer and potable water systems. Information was obtained from various sources including the four municipalities, and data provided or obtained from the JLUS, Ocean County, Burlington County and the NJDEP.

EXISTING INFRASTRUCTURE

Below is a discussion of the available sanitary sewer and potable water infrastructure, its conditions and capacities within the proposed study area.

PLUMSTED TOWNSHIP

There are no existing sanitary sewer infrastructure or individual small package treatment plants within Township boundaries. The Township relies primarily on individual septic systems for its current sanitary sewer service needs. According to Township personnel these individual septic systems are failing. In order to promote revitalization of its downtown areas a public sewer system to service the identified growth area will be required.

The Township also has an existing public water system which services 459 connections, which is owned and operated by New Jersey American Water Company - New Egypt (NJ American). According to the NJDEP Division of Water Supply (DWS), NJ American has a current firm capacity of 0.173 MGD, a daily peak of 0.152 MGD and an annual peak demand of 47.328 MGY.

Per Allan Sleeper of NJ American, the New Egypt system has a supply firm capacity surplus of approximately 0.021 MGD. This surplus equates to less than 10 new residential connections; however, Mr. Sleeper indicated that NJ American is actively pursuing a Major Modification to its Water Allocation permit to increase firm capacity to 0.425 MGD. This proposed increase would be achieved by proposed increases to their existing well capacity, as well as, construction of a new well. Within 3 to 5 years, NJ American proposes to use two 210 GPM wells and one 125

GPM well to supply potable water to the downtown area of Plumsted.

There are also fifteen (15) private water systems located within the Township boundary; however, most of these systems are too small to contribute to the surplus capacity calculations. It should be noted though that these fifteen (15) systems presently support 343 residential or mobile home water connections, and 34 commercial or industrial connections and it is anticipated that they will continue to provide water service to these units at ultimate build out.

NEW HANOVER TOWNSHIP

New Hanover has no public sanitary sewer infrastructure within the civilian portion of the Township boundaries. The Township relies primarily on individual septic systems to provide its sewer service needs. However, soils within the Township, while highly suitable for agriculture, are generally wet with high groundwater tables and poorly suited for septic systems. Therefore, many of the existing septic systems are failing due to these conditions. Since there is no public infrastructure, residential growth has been limited.

There are also two small package plants not associated with the Joint Base located in the West Cookstown area of New Hanover Township. These plants discharge to ground water, and have been issued separate New Jersey Discharge Pollutant Elimination System (NJPDES) permits indicating flow is greater than 2,000 GPD. It is anticipated that these individual small plants are intended to service their respective property and any expansion is not feasible to the scale required.

New Hanover also does not have an existing public water system. Individual lots are serviced by private wells. There are also nine (9) transient, non-community water systems located within the Township boundary. However, these systems are only intended to service the six commercial properties, 2 restaurants, and 1 hotel that it currently services and expansion would be limited.

NORTH HANOVER TOWNSHIP

North Hanover also has no public sanitary sewer infrastructure in its civilian sections. The Township relies solely on individual septic systems to provide sanitary sewer service to its existing residents and businesses. However, in order to redevelop their designated growth

areas, a public system will be required. It should be noted that The Falcon Courts, a military housing complex between North Wrightstown and North Cookstown, is presently sewered.

There are also twelve (12) permitted small package treatment plants located throughout the Township with a capacity totaling approximately 405,400 GPD according to the *Northern Burlington/Route 206 Farmbelt Build-Out and Infrastructure Analysis Existing Zoning Scenario* and the NJDEP's permitting database. Of these plants, the California Village Mobile Home Park, Spartan Village Mobile Home Park and Cedar Grove Apartments plants are located within the Growth Areas included as part of this study. These three plants have the combined capacity to treat 82,100 GPD of sewage. However, since these facilities service a single large user, no expansion of the treatment facilities is expected at these locations.

North Hanover has no public water infrastructure and relies on private wells to service the needs of its residents. Based on NJDEP records, there are also eleven (11) community systems that provide water service to 767 residential and mobile homes located throughout the Township. While DWS does not have much data on these systems, Aqua NJ: California Village has a Firm Capacity of 0.04 MGD, an annual peak demand of 8.806 MGY, and a surplus of 3000 GPD. The water system for the Wagon Wheel Estates has a firm capacity of 0.036 MGD, but demand and surplus data is unavailable. There are also 10 non-community water systems which provide water for 66 commercial services connections, as well as 1 school and 1 hotel.

WRIGHTSTOWN BOROUGH

The Borough owns and operates a 337,000 GPD wastewater treatment plant and sanitary sewer collection system to service its residents and businesses. The treatment plant is located at the Borough's Public Works Facility off of Martha Avenue. Based on mapping provided by the WMUA, the sanitary sewerage system is a mix of gravity and pressure piping. Small 3" force mains convey sewage from low lying areas into the existing gravity system located west of Saylor's Pond Road. The gravity system is comprised of 8" PVC and ACP mains, 10" RCP main, and 12" PVC trunk lines along Fort Dix Street. The gravity system appears to be built at minimum slope.

The wastewater treatment plant provides some tertiary treatment using sequencing batch reactors (SBRs) and ultraviolet (UV) disinfection before discharging through its outfall to Crosswicks Creek. The current flow from its 235 connections is approximately 90,000 GPD.

According to the WMUA, the discharge stream has an unconfirmed carrying capacity of 750,000 GPD of treated effluent, which would allow the WMUA to double its current permitted discharge limit of 337,000 GPD; however, appropriate NJDEP studies and approvals will be required prior to any expansion.

There are no privately owned sewage treatment plants within the Borough on record with NJDEP or Burlington County.

The Borough also owns and operates its own drinking water treatment plant and distribution system, with groundwater sourced from two wells. The Borough's wells have been allocated 500 GPM and 60 MGY withdrawals. The Borough operates an ion exchange water treatment plant with booster pumping and some storage capacity. The system has a water supply firm capacity of 0.504 MGD, a current peak daily usage of 0.113 MGD, and a yearly peak demand of 47.702 MGY. The system has a surplus firm capacity of 0.289 MGD.

The water distribution system is comprised of 8" and 12" mains, many of which terminate at dead ends. It is feasible to convert the dead end connections to potential interconnections along Saylor's Pond Road, Lewis J. Court, Meeting House Road, Fort Dix Street, Platt Street and East Main Street. There is also an emergency 6" interconnection on Fort Dix Street with the Joint Base. The water treatment plant is also located at the Borough Public Works Facility.

According to DWS, the Maplewood Apartments is the only other water system in the Borough. This community system provides water for 40 residential services. Though information regarding firm capacity surplus/deficit is not available from the DWS, it is not anticipated that this system can be expanded to service other connections.

JOINT BASE

The Joint Base has an existing Wastewater Treatment Plant located on Fort Dix and collection system to service the sewer demands within the military base boundary. The plant was built in 1998 and considered to be in very good condition. The wastewater plant provides tertiary treatment through primary settling, a "Bardenpho" treatment process, secondary settling and filtration. Effluent is discharged to percolation/evaporation lagoons on Fort Dix and through beneficial reuse at the Joint Base golf course. According to Joint Base personnel, the treatment plant has a capacity of 4.6 MGD and an excess capacity of 1.5 MGD at buildout.

In 1994 the McGuire wastewater treatment plant was replaced by a pump station to convey untreated sewage to the new Fort Dix Wastewater Treatment Plant. The pump station is located at the original Wastewater Treatment Plant site near the intersection of Mount Road and Browns Mill – Cookstown Road. The pump station is a three story wet well/dry well facility. It contains three (3) pumps rated at 1,500 GPM. One of the pumps is able to meet the pump station needs. The facility discharges to a 16 inch diameter force main. Based on information provided, it appears that the facility and associated force main have at least 2 MGD of available capacity.

Based on mapping provided by the Joint Base, the sanitary sewerage collection system is a mix of gravity and pressure piping. Small force mains convey sewage out of the isolated sections of the system to the main gravity system. The gravity system appears to be built at minimum slope. The wastewater collection system at Fort Dix is comprised of 276,031 linear feet of sewer mains, is 45 years old and has 8 lift stations throughout the base. Sewage is sent to a treatment plant on Fort Dix. The system has infiltration issues that need to be addressed as well as settling issues with its mains. The sewer collection system has been built over many years beginning in the 1940s, with continuous upgrades and additions. Some of the sewer lines require lining, and the military installation has a continuing program to rehabilitate the main sewer trunk lines. The piping system is old and needs to be upgraded. There are several projects identified to help raise the current assessment rating from Degraded to Adequate. The wastewater collection system at the Joint Base is comprised of a total 571,818 linear feet of sewer mains, is 48 years old and has 36 lift stations. Sewage from Naval Air Engineering Station Lakehurst is discharged to Ocean County Utility Authority (OCUA) for treatment. Sewage from McGuire Air Force Base is sent to Fort Dix's Sewage Treatment Plant.

For its water service needs, the Joint Base has a public water system on all three bases. There are also some industrial systems and non-community systems. According to DWS, the Fort Dix public water system has a firm capacity of 8.323 MGD and a total peak demand of only 2.708 MGD. DWS estimates the surplus at Fort Dix to be 5.615 MGD. In addition, the DWS indicates that McGuire Air Force Base has a firm capacity of 2.880 MGD, a total peak demand of 1.772 MGD and a surplus of 1.108 MGD.

CAPACITY SURPLUS/DEFICIT SUMMARY

A summary of the analyses of existing and proposed facilities for each study area is presented in

Table 7. It is noted that both Wrightstown and the Joint Base have current sanitary sewer capacity surpluses totaling approximately 1.747 MGD. Based on existing development, Plumsted, New Hanover and North Hanover have current sanitary sewer deficits totaling approximately 757,520 GPD. At ultimate build out, the available surplus capacity will total approximately 1.704 MGD and the needed demand from the deficit communities will total approximately 1.484 MGD. See Table 7: Sewer Treatment Capacity and Demand.

These calculations assume that the existing sanitary sewer capacity at both New Hanover and North Hanover, currently being provided by private package plants, will be abandoned and properties being serviced by those facilities will connect into the new sanitary sewer infrastructure.

The Team also evaluated the option of eliminating the WMUA facility and converting it into a transfer station; however, the potential capacity available at the Joint Base is not sufficient to handle all flow from the four member municipalities. While existing flow may be feasible to direct into the Joint Base for treatment, the limited capacity potentially available would prohibit growth in the member communities. Therefore, for the purpose of this study it is assumed that the WMUA facility and available capacity will be included as a potential surplus for the study area.

Table 7: Sewer Treatment Capacity & Demand

	Plumsted Township	New Hanover Township		North Hanover Township		Wrightstown Borough	Joint Base
Growth Region	New Egypt	West Cookstown	Cookstown	North Cookstown	North Wrightstown	Wrightstown	Joint Base
Current Treatment Capacity (GPD)	0	4,000*	0	82,100*		337,000	4,600,000
Existing Treatment Demand (GPD)	450,000	45,540	48,380	108,800	104,800	90,000	3,100,000
Current Surplus/Deficit (GPD)	-450,000	-45,540	-48,380	-108,800	-104,800	+247,000	+1,500,000
Build Out Treatment Demand (GPD)	450,000	132,909	54,680	562,050	284,208	133,000	3,100,000
Expected Surplus/Deficit (GPD)	-450,000	-132,909	-54,680	-562,050	-284,208	+204,000	+1,500,000

*It is expected that these small systems will be decommissioned as a result of TDR development, and are therefore not considered to be available treatment capacity.

For water service, there is approximately 7.033 MGD of excess surplus within the Joint Base, Wrightstown and Plumsted. New Hanover and North Hanover have deficits totaling approximately 1.242 MGD. It should be noted that though there appears to be excess capacity the majority of the surplus is generated from the Joint Base and no information has been provided at this time regarding future demands for military operations. See Table 8: Water Supply and Demand for a summary of capacity available.

Table 8: Water Supply & Demand

	Plumsted Township	New Hanover Township	North Hanover Township	Wrightstown Borough	Joint Base
Firm Capacity (GPD)	173,000*	Minimal	76,000	504,000	11,203,000
Demand (GPD)	152,000*	361,300	956,272	113,000	4,480,000
Surplus/ Deficit (GPD)	+21,000*	-361,300	-880,272	+289,000	+6,723,000

*Per NJ American, additional surplus may be available once upgrade of the existing system is complete.

ALTERNATIVE ANALYSIS

While each of the four host communities in this study and the Joint Base have individual needs, they all share several similarities that combine to make the wastewater management planning process unique to this area. This alternatives analysis will outline various options available for the treatment and conveyance of the existing and proposed sanitary sewer flow within the study region, as well as, the treatment and distribution of potable water.

WASTEWATER TREATMENT ALTERNATIVES

The wastewater issue is divided into two major components: treatment and collection. Both of these components must be addressed in order to construct a complete system for the treatment of the proposed sanitary sewage.

The main component is treatment and disposal of wastewater. Wastewater treatment plants use a variety of physical, chemical, and biological treatment processes to remove contaminants, solids, and pathogens from the wastewater. The treated water (known as effluent) is then generally discharged from the plant either into a nearby stream system, known as a surface water discharge, or by land application process. Since the treated effluent eventually works its way through the soil to the groundwater table, this later disposal option is more commonly known as discharge to groundwater.

Outlined in this section are alternatives investigated for providing treatment of sanitary wastewater from the described Growth Areas of the four host municipalities included in this study. Alternatives include the construction of a centralized wastewater treatment plant, construction of localized wastewater treatment plants, expansion of existing public treatment facilities, use and expansion of existing military treatment facilities, and construction of pump stations to transport the wastewater to neighboring municipalities with existing wastewater treatment plants (WWTPs) for treatment. A summary of the alternatives investigated is provided in Table 14 – Sanitary Sewer Alternatives Analysis Summary.

Common to all alternatives investigated is the option of directing sanitary sewer flow from the North Wrightstown growth area to the Wrightstown treatment facility given its close proximity.

For the purpose of this report rather than repeating this option for all alternatives we have isolated the discussion of the benefits and challenges of this option as follows:

WRIGHTSTOWN MUA ALTERNATIVE

Given the surplus available at the WMUA and the limited sewer service needs of the North Wrightstown Growth Area of North Hanover, a viable option would be to direct the proposed sewer flow demand to the WMUA treatment facility located off of Martha Street. This option would require expansion of the existing WMUA facility to service the future development demand; however, it currently has capacity to service the existing development flow demand.

Aside from the internal collection system that would be required, two pumping stations would be required to pump the sewer flows from some of the outer most sections of the growth area to interconnection points within Wrightstown, which are fairly shallow. The 12" interconnection main located on Fort Dix Street is sufficiently sized to handle flow from both Wrightstown and North Wrightstown though this will be verified as part of Phase II of this study.

The WMUA's existing treatment plant has a design capacity of 337,000 GPD; however, in order to comply with NJDEP's Capacity Assurance requirements (N.J.A.C. 7:14A-22), the plant is presently limited to 80% of its capacity or 269,000 GPD. The existing WMUA capacity as described previously, is adequate to handle the existing Wrightstown demand (90,000 GPD) and the estimated existing demand from North Wrightstown (107,303 GPD).

For future flow demands, the treatment plant would require an expansion of approximately 218,000 gallons of additional tankage. This increase can be handled via the installation of two new treatment trains equal in size to those already in operation. This construction would ultimately double treatment capacity at the plant, and reach the estimated maximum carrying capacity of the stream. However, further discussion with NJDEP and execution of a new stream study will be required to confirm this estimated carrying capacity and will be evaluated further during Phase II of this study. In light of this, there is the possibility of phasing the proposed expansion to meet flow demands as growth occurs rather than all at once.

ALTERNATIVE NO. 1: CENTRAL PLANT OPTION

A centralized plant located in North Hanover, New Hanover or Plumsted with a maximum daily treatment capacity of 3.0 MGD would provide enough treatment capacity for the sanitary flows from the Growth Areas of North Cookstown, West Cookstown, Cookstown and Plumsted. Per NJDEP requirements, this 3.0 MGD capacity equates to 2.5 times the needed 1.2 MGD future demand outlined in Table 7. It is important to note that this plant and those mentioned in the following alternatives, is sized for the ultimate build-out of the area it serves, and no additional growth is expected to occur after construction.

The 250% of additional capacity buffer is a requirement from NJDEP to allow for adequate capacity to handle peak flows, surges, or unexpected additional flow such as long term infiltration or inflow (I/I) or excessive stormwater from large storm events. This capacity buffer also allows for adequate plant sizing for future growth.

In this alternative, flow from each Growth Area would be collected and pumped to a centrally located treatment plant. Depending on the final selected location of the central plant, a portion of the flow may be conveyed through gravity interceptors.

Topography of the area flows towards North Run, with higher elevations to the north, and the lowest elevations near where these three Township borders meet. There is a partially encumbered, developable parcel in Cookstown between Bunting Bridge Road and the border of North Cookstown, which lies along the North Run. The portion of this property not encumbered by environmental constraints may provide a suitable location for a central plant. North Run is a FW2-NT stream, and a stream study will be needed to determine its carrying capacity and required treatment levels. If this alternative is selected, this will be further evaluated as part of Phase II of this study. Based on general topography, it may also be possible to convey the sanitary sewage from Cookstown and a portion of North Cookstown through a network of gravity sewers to this location.

Another potential location for a central treatment plant is in Plumsted Township at the intersection of Rt. 616 and Brown Road. The central plant could then discharge a portion of the treated effluent into the artificial Oakford Lake through a long outfall constructed in the right of way (ROW) of Lakeview Drive; however, this may be limited because of the recreational usage of the lake.

As previously stated, this option would require the construction of a Central Plant, about one half the size of the existing plant on the Joint Base. This would also require the acquisition of a large tract of land and disposal of such large quantities of flow may require the use of both surface and ground water discharge. In addition, given the large size of the proposed construction project, design, permitting and construction periods will be lengthy due to both its size and complexity.

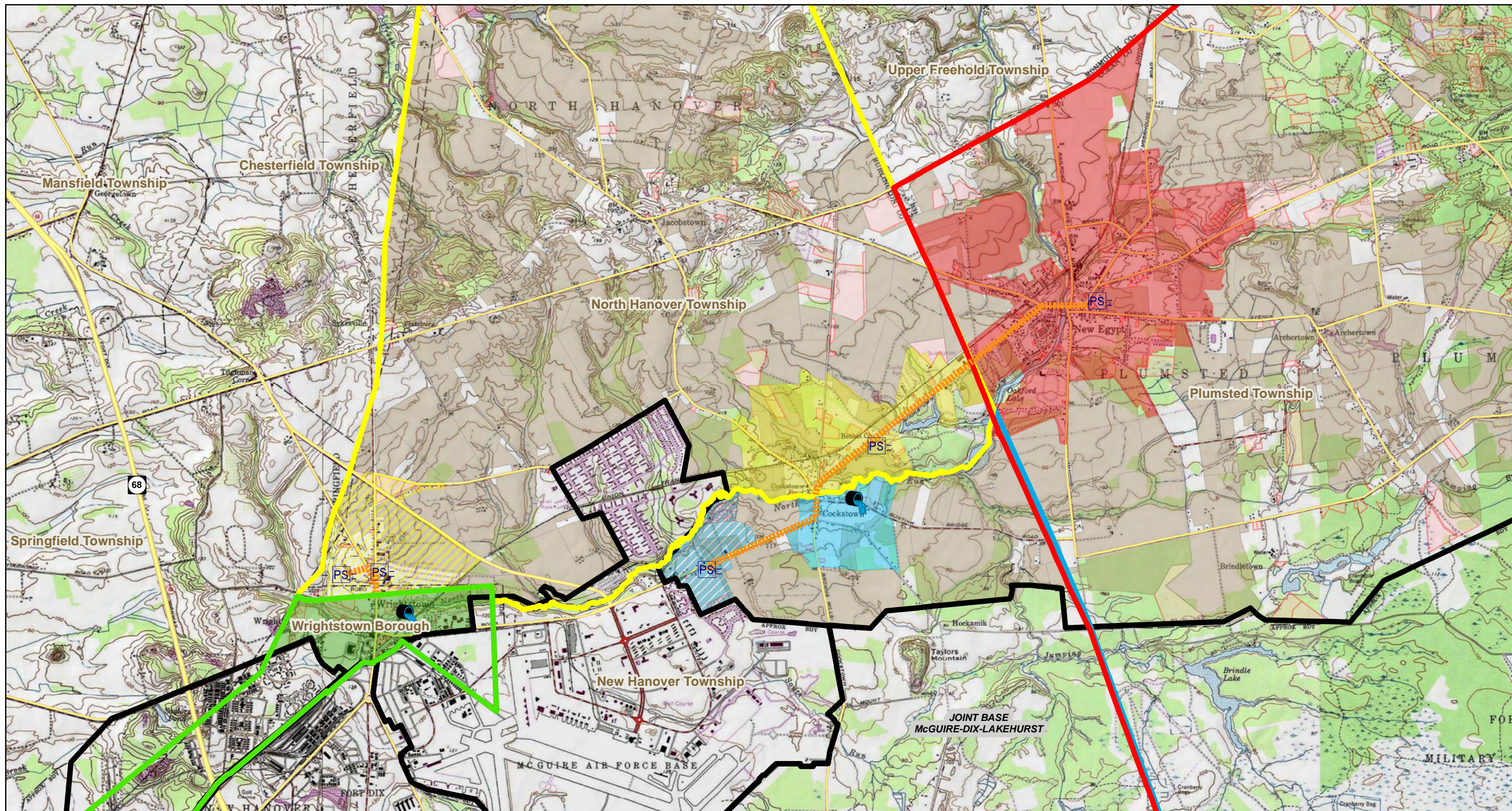
As discussed further in this report, this option is the least expensive option that does not include the use of the existing facilities at the Joint Base. This lower cost is due to the relatively short force mains, and smaller pump stations required to convey the sewage to the new central treatment facility. Also, since this option does not require assistance from the Joint Base, it may have fewer coordination and special circumstance issues associated, which may increase the pool of contractors willing and qualified to bid on the project.

Refer to Figure 6 for a map outlining the proposed infrastructure.

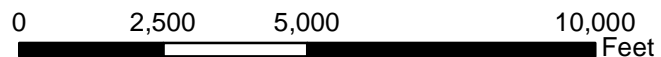
INFRASTRUCTURE REQUIRED

The level of treatment of the wastewater is dependent on the effluent discharge location and NJDEP permitting requirements. Based on neighboring plants, it is likely that advance tertiary treatment including biological nutrient removal may be required. Regardless of location, a central plant would also likely require land and/or easement acquisition, the extent of such acquisitions would be dependent on the final selected location.

The flow from West Cookstown could be conveyed by gravity through an interceptor, or a force main less than 2 miles in length. A gravity interceptor or force main along Rt. 616 would provide conveyance for the flow from Plumsted Township. It would be recommended to install metering chambers on the interceptors and flow meters at the pump stations to allow for the accurate tracking of flow from each Growth Area sewage basin.



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 Source: NJDOT, NJDEP, Ocean County GIS, Burlington County GIS
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Legend

- | | | |
|--------------|-------------------------------|-----------------------------|
| Pump Station | Wrightstown Borough | Plumsted Growth Area |
| WWTP | Plumsted Township | Wrightstown Growth Area |
| Force Main | North Hanover Township | West Cookstown Growth Area |
| Joint Base | New Hanover Township | Cookstown Growth Area |
| | North Wrightstown Growth Area | North Cookstown Growth Area |
| | | Interstate or Toll Route |
| | | US or State Route |
| | | County Route |
| | | Local Road |
| | | Ramp |



*Figure No. 6
 Alternative No. 1 - Central Plant
 Burlington/Ocean County, New Jersey*

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

ALTERNATIVE NO. 2: PLUMSTED FLOW TO BASE, COOKSTOWN REGION TO CENTRAL PLANT

Alternative No. 2 outlines the option of sending the flow from the Plumsted Growth Area to the Joint Base's existing wastewater treatment plant. Based on available information, the Joint Base has adequate excess capacity within their existing treatment plant to handle the proposed flow from Plumsted. This option would propose that the estimated 450,000 GPD sewer service demand from the Plumsted Growth Area be collected and pumped to the Joint Base plant for treatment through the Mount Road Pump Station located on McGuire Air Force Base. From there flow would be conveyed to the plant using existing infrastructure. Flow from North Cookstown, West Cookstown and Cookstown (Cookstown Region) would be treated in a proposed centralized wastewater treatment plant to be located in the Cookstown area noted in the Alternative No. 1 option or in the West Cookstown area.

This alternative has the advantage of allowing Plumsted to advance its sewerage project independently of New Hanover and North Hanover. Since Plumsted will not be required to construct a plant under this alternative, only a large pump station and force main, it is possible this alternative may progress more rapidly for Plumsted. Alternative No. 2 does require a Central Plant to be designed, permitted, and constructed, but since the plant is smaller than that proposed under Alternative No.1, smaller tracts of land will be required. This will reduce the environmental impacts caused by a large plant. In addition, a smaller plant will have smaller staffing and operational needs thus reducing overall costs. Since the Cookstown Region Central Plant will be located centrally to the Growth Areas served, pump station sizes will be reduced, and it is possible that a greater portion of the flow may be conveyed by gravity.

However, the force main required to convey the Plumsted sewage flow to the Joint Base treatment plant would be lengthy. Long force mains result in two distinct issues. First, longer force mains result in greater pressure losses due to friction loss along the route. In order to counter these greater losses, greater pressures must be used as the pump station, which results in higher energy requirements. Pipe diameters must be increased, to a point, in order to reduce flow velocity to greater than 2 feet per second and losses due to pressure. Secondly, longer force mains are directly equivalent to longer transmission times from the points where the sewage is exposed to air. Without oxygen the flow is likely to become septic, as it begins to degrade anaerobically. The anaerobic degradation is the perfect situation to produce odors such as hydrogen sulfide. In addition to the unpleasant rotten eggs odor, hydrogen sulfide is the precursor to sulfuric acid, a chemical which causes concrete decay.

INFRASTRUCTURE REQUIRED

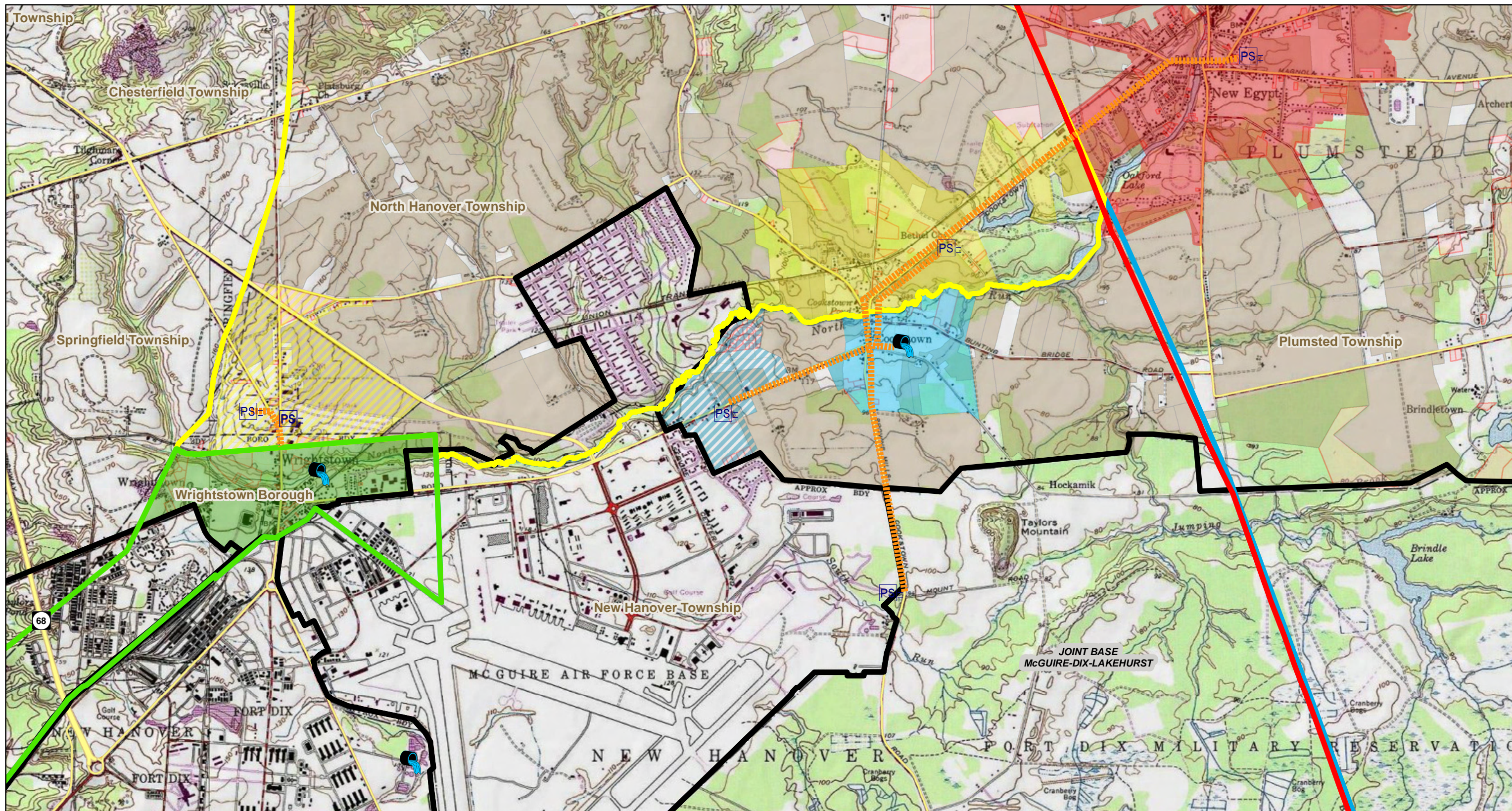
As described earlier in Alternative No. 1, a smaller centralized plant built in Cookstown could provide treatment for flow from North Cookstown, West Cookstown, and Cookstown. This smaller plant would also be designed to handle 2.5 times the expected future average daily flow (0.75 MGD), in accordance with NJDEP requirements, or approximately 1.9 MGD. Alternative No. 2 would also allow the opportunity to phase construction of the proposed facility. For example, to handle current demand, a 1.07 MGD plant could be initially constructed and then upgraded to 1.9 MGD to handle future flow demand. Phasing the construction will allow for construction costs to be spread over a greater time period, and for the full impacts on the proposed TDR type development to be analyzed and determined. As with the proposed Plumsted treatment plant, it is likely the plant will be designed for advanced tertiary treatment of the wastewater. In addition, based on NJDEP's requirements, a combination of surface and groundwater discharges may be considered upon further study.

Plumsted's flow would be directed to a centralized pump station. This station would then pump the flow through a 10 inch diameter force main to the Joint Base treatment plant located on Sunrise Avenue. The proposed 7.25 mile long force main would likely follow the path shown in Figure 7. Using existing ROW's and previously disturbed lands will ease the permitting requirements, and reduce land acquisition and/or easements required.

The Mount Road Pump Station will require upgrades to handle the proposed flow. The existing electrical system is dated and the extended shaft pumps should be replaced with submersible pumps. The new pumps will be similarly sized to handle the flow, but are considered safer and easier to operate, reducing operation and maintenance costs.

Refer to Figure 7: Plumsted to Base and Cookstown to Central Plant for a map outlining the proposed infrastructure.

A derivation of this option would be to decrease the size of the centralized plant even further and direct either the entire flow or a portion of the flow from the Cookstown and West Cookstown areas into the Plumsted force main, which would travel through these areas on its way to the Joint Base. This may also eliminate the need for individual pump stations in these areas; however, this will require additional evaluation which should be undertaken under Phase II of this study if this alternative is selected.



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Legend

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|---------------------|--------------|-------------------------------|-----------------------------|--------------------------|
| PS | Pump Station | Joint Base | Plumsted Growth Area | Interstate or Toll Route |
| WWTP | WWTP | Wrightstown Growth Area | West Cookstown Growth Area | US or State Route |
| Force Main | | Cookstown Growth Area | North Cookstown Growth Area | County Route |
| Wrightstown Borough | | North Wrightstown Growth Area | North Hanover Township | Local Road |
| Plumsted Township | | | New Hanover Township | Ramp |

0 1,875 3,750 7,500 Feet

Prepared by: BAR, 8/10/2011
 Source: NJDOT, NJDEP, Ocean County GIS, Burlington County GIS
 File Path: H:\OCTY\00380\GIS\Projects\Fig 7- Alternative 2.mxd

*Figure No. 7
 Alternative No. 2 - Plumsted to Base and Cookstown to Central Plant
 Burlington/Ocean County, New Jersey*



NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

ALTERNATIVE 3: COOKSTOWN REGION TO JOINT BASE PLANT, LOCALIZED PLUMSTED PLANT

Another alternative illustrated in Figure 8 is to send the anticipated future average daily flow of 0.75 MGD from the Cookstown Region's Growth Areas to the Joint Base's existing wastewater treatment plant. Again, according to military personnel, the Joint Base WWTP has available capacity of 1.5 MGD within their existing plant. The flow from the Cookstown Region will be pumped to the Mount Road Pump Station, and then be conveyed through existing infrastructure to the plant. This option would also include collection and treatment of the expected 450,000 GPD flow from the Plumsted Growth Area to a local WWTP within the Township border.

This alternative has the advantage of allowing Plumsted to advance its treatment project independently of New Hanover and North Hanover. Based on all previously gathered data, Plumsted has begun the work of locating a plant, as well as started some preliminary engineering. This alternative allows the Plumsted MUA to continue as a separate entity, and move forward with the design and construction of the plant. In addition, a smaller plant would require smaller staffing and operational needs thus further reducing costs. Alternative No. 3 does not require a Central Plant to be designed, permitted, and constructed in the Cookstown Region, which will decrease the overall schedule for work within the Cookstown Region. This will also reduce the likelihood a large plant is constructed within the 2 mile buffer of the Joint Base border.

There is one notable negative aspect to this alternative. Since Plumsted will be designing, constructing and permitting its own plant, the PMUA must locate enough available land to construct the plant as well as handle both the liquid and solid end discharges from the plant. Based on previous PMUA studies, the lack of available land for this project is one of the greatest challenges.

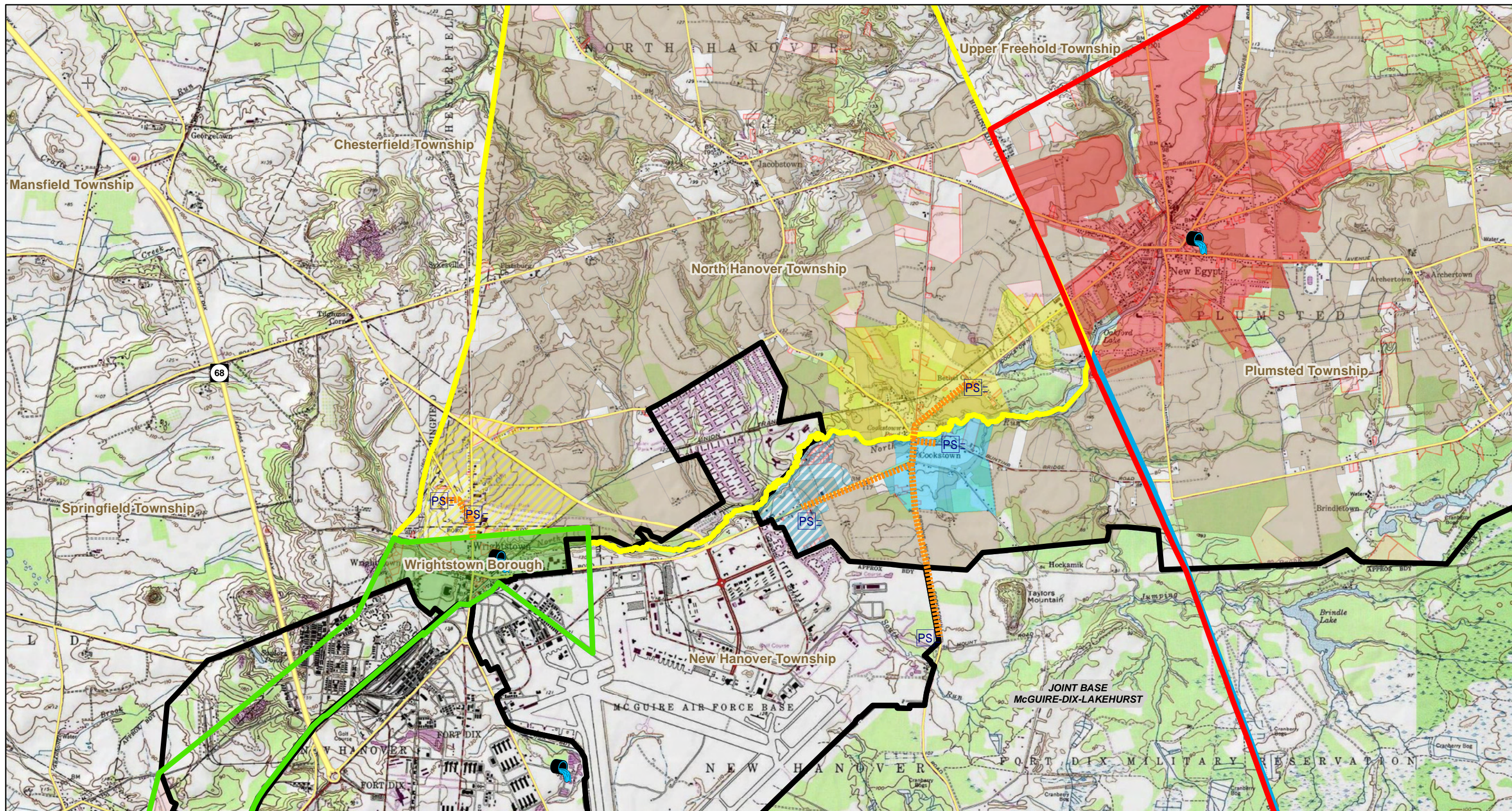
INFRASTRUCTURE REQUIRED

A pump station and force main would be constructed to convey flow from North Cookstown and Cookstown areas to the Joint Base. An additional pump station constructed in West Cookstown would also pump into the force main and convey the West Cookstown flow to the Joint Base. This option requires a 12 inch diameter force main to the Joint Base Plant located on Sunrise Avenue. The proposed 5 mile long force main would likely follow the path shown in

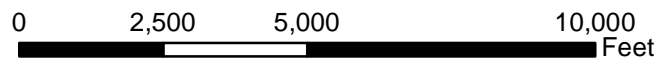
Figure 8. Using existing ROWs and previously disturbed lands will ease the permitting requirements, and reduce land acquisition and/or easements required.

The Mount Road Pump Station at the Joint Base will also require upgrades to handle the proposed flow. The existing electrical system is dated and the extended shaft pumps should be replaced with submersible pumps. The new submersible pumps will be similarly sized to handle the flow, but are considered safer and easier to operate, reducing operation and maintenance costs.

Flow from Plumsted would be treated in a proposed wastewater treatment plant and be under the jurisdiction of the PMUA. The treatment plant would be designed to handle 450,000 GPD and could potentially be located on a parcel on RT. 537, near Evergreen Road. It is likely that Plumsted's collection system will need intermediate pump stations, in order to convey flow to the new treatment plant. The new treatment plant will require surface water discharge, or a combination of surface and ground water discharges. Based on available data, there is presently not enough available land to support land application of the entire flow. If this alternative is selected, this will be further evaluated as part of Phase II of this study.



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Legend

- | | | |
|------------------------|-------------------------------|--------------------------|
| Pump Station | Joint Base | Interstate or Toll Route |
| WWTP | Plumsted Growth Area | US or State Route |
| Force Main | Wrightstown Growth Area | County Route |
| Wrightstown Borough | West Cookstown Growth Area | Local Road |
| Plumsted Township | Cookstown Growth Area | Ramp |
| North Hanover Township | North Cookstown Growth Area | |
| New Hanover Township | North Wrightstown Growth Area | |

*Figure No. 8
 Alternative No. 3 - Cookstowns to Base and Plumsted to Own Plant
 Burlington/Ocean County, New Jersey*

Prepared by: BAR, 8/10/2011
 Source: NJDOT, NJDEP, Ocean County GIS, Burlington County GIS
 File Path: H:\OCTY\00380\GIS\Projects\Fig 8- Alternative 3.mxd



NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

ALTERNATIVE 4: COOKSTOWN REGION AND PLUMSTED TO JOINT BASE PLANT

In this alternative, all flows from the Cookstown Region and Plumsted would be pumped to the Joint Base WWTP through an interconnection at the Mount Road Pump Station for treatment and disposal.

This alternative is, as described in later sections, by far the least costly of all the alternatives. Since there are no new treatment plants to construct, the project schedule and scope is greatly reduced. In addition, this alternative allows for pump stations to be linked together in series. The use of pump stations in series has the advantage of shorter force mains resulting in reduced pressures felt at the pump discharge head. In addition, by using a joint force main, there is less redundant piping to install.

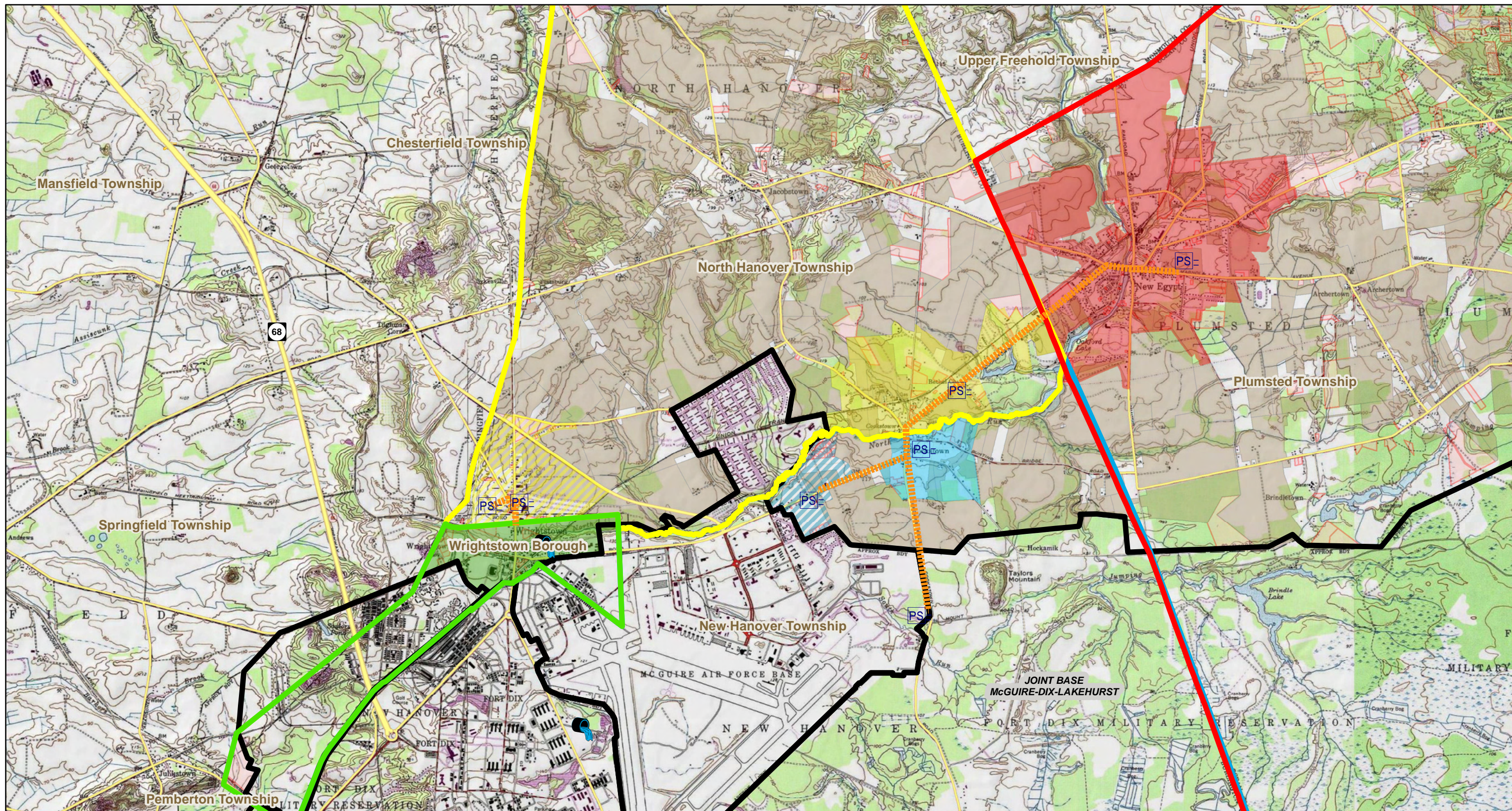
This alternative will push the limits of capacity of the Joint Base plant. Should the final TDR scenarios cause increased flow from North Hanover, or should Plumsted opt to increase its treatment demand by providing sewer to a greater region, a plant upgrade may be required. In addition, given the increase in flow which is expected, the Joint Base may need to advance their Infiltration/Inflow (I/I) investigations and rehabilitation of their existing infrastructure to maintain flow within NJDEP Capacity Assurance requirements in the future.

INFRASTRUCTURE REQUIRED

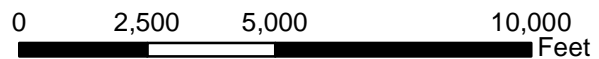
As described above, each Growth Area will need a collection system, and a total of three main pump stations would be required. The Plumsted Pump Station would pump the flow from Plumsted to the Cookstown Transfer Pump Station. From the Cookstown Station, flow would be pumped to the Joint Base through the force main described above. By pumping in series, the Plumsted Pump Station will utilize smaller pumps, and may decrease the diameter of this portion of the force main. The Cookstown Station will also allow an entry point into the force main for odor control. A third, smaller station, would pump the flow from West Cookstown into the Joint Base Force Main as described in Alternative 2 above. This alternative and the proposed path of the force main are illustrated on Figure 9.

As previously noted, the Mount Road Pump Station will also require upgrades to handle the proposed flow. Presently, the existing electrical system is dated and the extended shaft pumps should be replaced with submersible pumps. Submersible pumps will be sized to handle the

flow, and are considered safer and easier to operate, thus reducing operation and maintenance costs.



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Legend

- WWTP
- PS= Pump Station
- Force Main
- Wrightstown Borough
- Plumsted Township
- North Hanover Township
- New Hanover Township
- Joint Base
- Plumsted Growth Area
- Wrightstown Growth Area
- West Cookstown Growth Area
- North Cookstown Growth Area
- North Wrightstown Growth Area
- Interstate or Toll Route
- US or State Route
- County Route
- Local Road
- Ramp

Prepared by: BAR, 8/10/2011
 Source: NJDOT, NJDEP, Ocean County GIS, Burlington County GIS
 File Path: H:\OCTY\00380\GIS\Projects\Fig 9- Alternative 4.mxd

*Figure No. 9
 Alternative No. 4 - All to Base
 Burlington/Ocean County, New Jersey*



NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

ALTERNATIVE 5: FLOW TO MOUNT HOLLY MUA

Mt. Holly Municipal Utilities Authority (MHMUA) owns and operates a WWTP located on Rancocas Road in Mt. Holly, New Jersey. This plant has a permitted flow of 7.675 MGD and treats flow using both suspended and fixed film biological treatment. Using the Capacity Assurance threshold of 80% of design flow available for use, this plant has excess capacity of approximately 2.45 to 2.75 MGD. The range of available capacity is based on the peak average annual plant flows from 1994 through 2009 and the flow for average annual flow for 2009. This means MHMUA has available capacity to treat the total future flow expected to be generated by all four host municipalities' Growth Areas, including the Borough of Wrightstown.

This option has the advantage of not requiring the construction of additional treatment plant capacity. However, given the distance between the Joint Base Region and Mt. Holly, the station pumps would have large horsepower motors. Also, odor control along the force main and at each pump station will likely be required to prevent the flow from becoming septic. In addition, this option requires the transfer of flow from the Crosswicks Creek and Blacks Creek watersheds into the Rancocas Creek Watershed, which will require coordination and approval from the governing agencies. This option, as discussed below, is the most costly to construct.

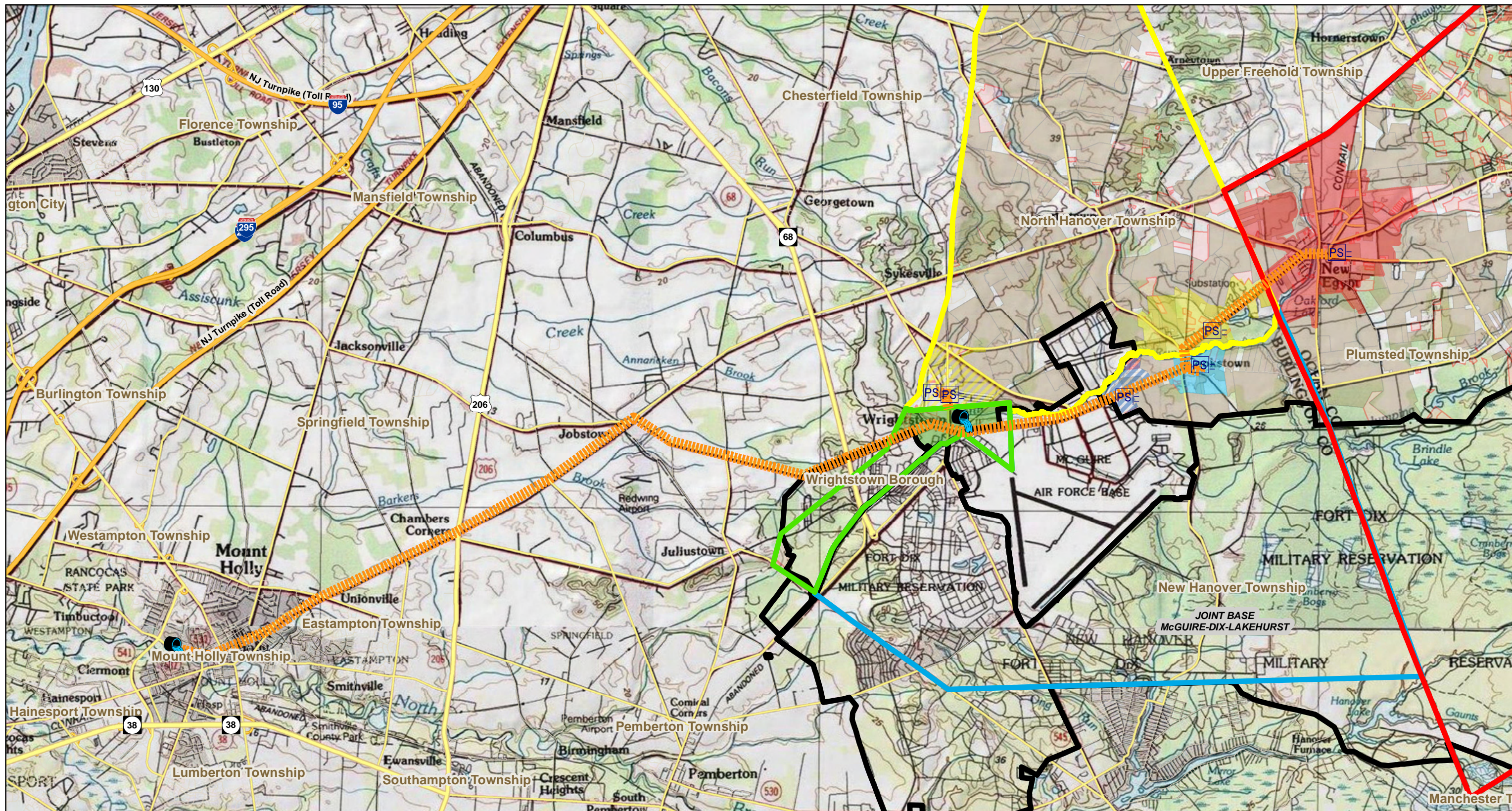
INFRASTRUCTURE REQUIRED

This option would require each municipality to pump its sanitary sewer flow to a common force main that would connect to the MHMUA system. As shown on Figure 10, a force main from Wrightstown-Sykesville Road on the border between Wrightstown and North Wrightstown would be over 11 miles long, if it followed the major roadways in the area. A joint force main would be 13 miles long from the plant to the western border of West Cookstown, 14 miles to the intersection of Cookstown-Wrightstown Road and Cookstown-Browns Mills Road in Cookstown, and more than 16.5 miles to the center of downtown Plumsted. The joint force main would also need to be sized between 12 and 16 inches in diameter by the time it leaves the western borders of Wrightstown.

The most efficient path for this force main will take the flow past the WMUA Martha Avenue plant. Given the proximity of the proposed force main, it is possible to decommission the WMUA plant, and convert the plant into a pump station. However, this would require that both the force main and pumping equipment be increased in sized to handle the additional flow

from Wrightstown and North Wrightstown. Aside from the additional material and equipment costs, costs for decommissioning of the plant and new pump station conversion would further increase overall costs for this alternative.

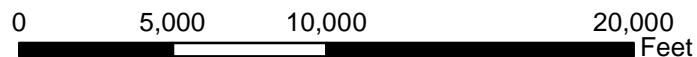
Lastly, for the purpose of this study, the final discharge location was not selected and costs were based on the selection of a conservative path and connection point into the Mt. Holly system for cost estimating purposes. If this alternative is selected, additional investigation into possible alternative discharge locations within the Mt. Holly collection system will be evaluated to determine the most cost effective connection point. However, it is not anticipated that any modifications made to the discharge location will have a significant impact to the overall costs given the length of force main required.



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Legend

- Pump Station
- WWTP
- Force Main
- Wrightstown Borough
- Plumsted Township
- North Hanover Township
- New Hanover Township
- Joint Base
- Plumsted Growth Area
- Wrightstown Growth Area
- West Cookstown Growth Area
- Cookstown Growth Area
- North Cookstown Growth Area
- North Wrightstown Growth Area
- Interstate or Toll Route
- US or State Route
- County Route
- Local Road
- Ramp



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 File Path: H:\OCTY\00380\GIS\Projects\Fig 10- Alternative 5.mxd

Figure No. 10
 Alternative No. 5 - Cookstowns and Plumsted to Mount Holly
 Burlington/Ocean County, New Jersey



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ALTERNATIVE 6: FLOW TO PEMBERTON MUA

Pemberton Township MUA owns and operated the Francis S. Doyle, Jr. Treatment Facility, a 2.5 MGD activated sludge wastewater treatment plant located on Birmingham Road. The MUA also owns and operates 259 acres of fields used for biosolids land application. Since 1994, the peak flow to this plant was 2.05 MGD; however this flow has consistently decreased to about 1.7 MGD in 2009. Again, without exceeding 80% of the plant's existing flow rating, the plant has a maximum of 450,000 GPD of excess capacity. The annual average flow to the Francis S. Doyle, Jr. Treatment Facility has slowly decreased from the peak in 2004.

Based on this available capacity of 0.3 MGD, the Francis S. Doyle, Jr. Treatment Facility may be able to handle the expected flow demand from North Wrightstown, West Cookstown or Cookstown.

However, this alternative has several disadvantages, one of which would require the construction of additional treatment plant capacity at the Francis S. Doyle Treatment Facility and installation of an extremely long force main, which would require odor control throughout the new system to prevent the flow from becoming septic. In addition to the lengthy force main, in order to travel the distance from the Joint Base to Pemberton the pumps would most likely have large horsepower motors increasing equipment and maintenance costs. The force main would also travel through the Joint Base in order to reach the treatment facility at Pemberton, which may not be feasible upon further evaluation. Additionally, discharge from the Joint Base to Pemberton will require an inter-basin transfer into the Rancocas Creek watershed. Therefore, though there is the potential of a partial connection into Pemberton the disadvantages far outweigh the advantages particularly given the limited available capacity. This option, as discussed below, is also one of the most costly to construct for the reasons noted above.

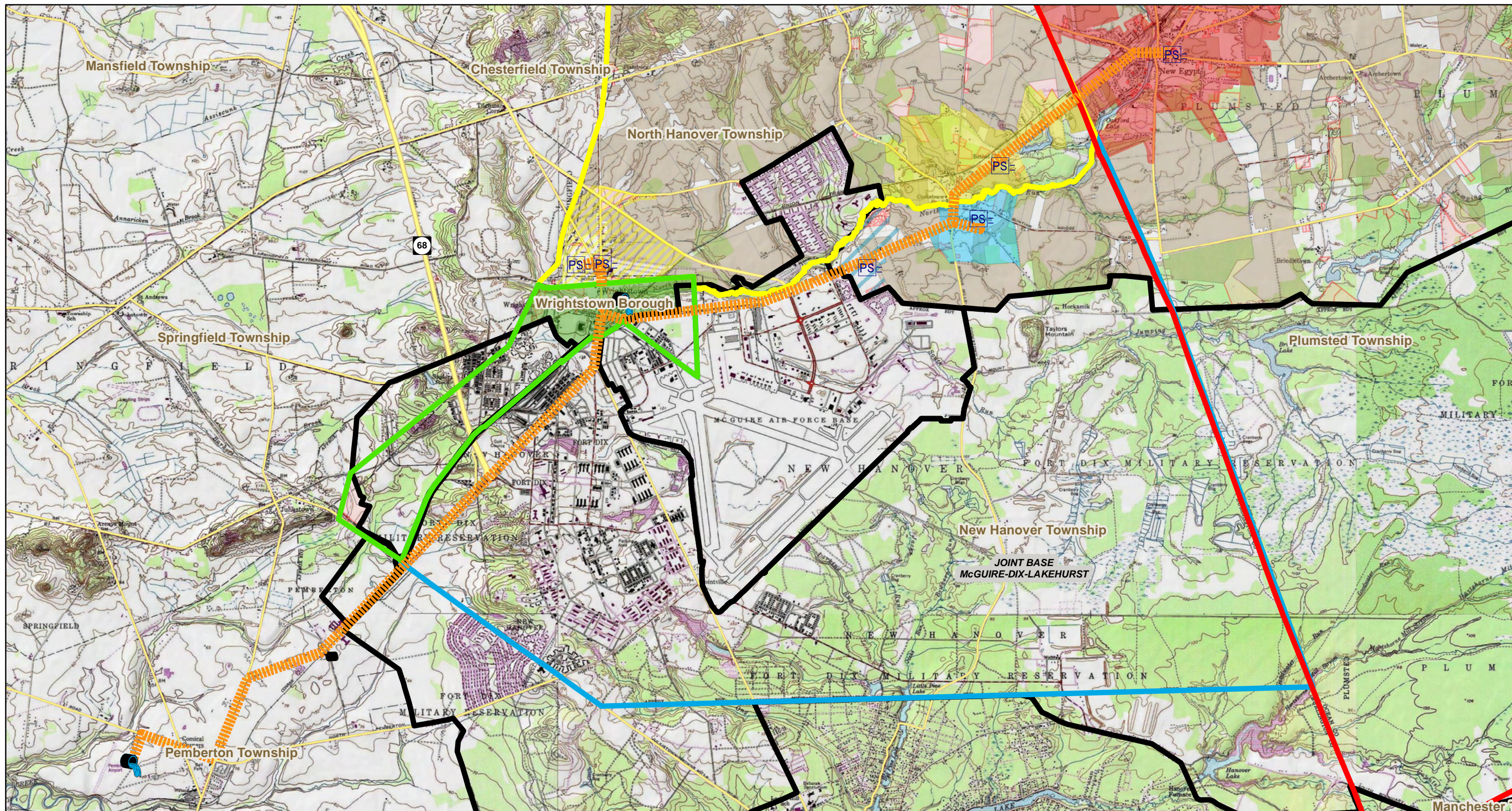
INFRASTRUCTURE REQUIRED

Similar to the MHMUA option, wastewater flow would need to be pumped to the plant for treatment. Figure 11 illustrates the proposed path of such a force main. Any force main to Pemberton would likely cross the Joint Base along Pemberton–Wrightstown Road, Fort Dix St. and Wrightstown–Cookstown Road. Utilizing main roads, a force main to the MUA would be approximately 13.8 miles in length stretching from its upstream point in Plumsted to the

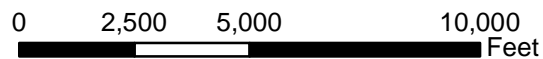
discharge at Pemberton.

In addition, plant expansion would be required to treat the expected future flow from North Cookstown, or any combination of these four Growth Areas. As with Alternative No. 5, the project route of the force main will pass by the WMUA plant. However, for the reasons noted in Alternative No. 5 the option to connect the flow from Wrightstown and North Wrightstown, though feasible, will increase overall costs even further particularly given the limited capacity available.

The existing and future flows from Plumsted could be pumped to the plant for treatment, but a plant expansion would be required to treat the flow expected at build out. For the purposes of this report, however, cost estimates are based on building a central plant instead of upgrading Pemberton's facilities.



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 File Path: H:\OCTY\00380\GIS\Projects\Fig 11- Alternative 6.mxd

Legend

- WWTP
- Pump Station
- Force Main
- Joint Base
- Wrightstown Borough
- Plumsted Township
- North Hanover Township
- New Hanover Township
- Joint Base
- Plumsted Growth Area
- Wrightstown Growth Area
- West Cookstown Growth Area
- Cookstown Growth Area
- North Cookstown Growth Area
- North Wrightstown Growth Area
- Interstate or Toll Route
- US or State Route
- County Route
- Local Road
- Ramp

Figure No. 11
 Alternative No. 6 - Cookstowns and Plumsted to Pemberton
 Burlington/Ocean County, New Jersey



NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

ALTERNATIVE NO. 7: LOCALIZED WWTPS

In this alternative, flow from the four municipalities could be split amongst three localized wastewater treatment plants. Flow from North Wrightstown would still be directed to the WMUA as noted earlier in the report. Sanitary flow from the Cookstown Region would be directed to a new treatment plant located in the Cookstown location described in earlier alternatives, or in the northern most section of West Cookstown. Flow from Plumsted would be treated in a new treatment plant also located within its growth area.

INFRASTRUCTURE REQUIRED

As described in Alternative No. 2, a smaller centralized plant built in Cookstown could provide treatment for flow from North Cookstown, West Cookstown, and Cookstown. This plant would be designed for 1.9 MGD in order to treat the minimum capacity as required by NJDEP standards. Flow from the Plumsted town center would be treated at a proposed plant operated by the PMUA. The PMUA has actively studied this option and determined a plant and associated collection system can be constructed to treat their downtown area service needs, including the C-4 town center area. The PMUA is looking towards talks with NJDEP with regards to a surface water discharge permit. Based on the previous work of the PMUA, Plumsted is closer to its goal than the other municipalities. Localized WWTPs will allow for greater flexibility in the schedule, so each Growth Area could be addressed based on needs.

Localized WWTPs would reduce the need for long interceptors or force mains, and allow the communities in greatest need to act with a little more independence. In addition, smaller sized plants may have less difficulty during the discharge permitting process. However, it is important to note, this option requires the design, permitting, and construction of three new treatment plants. Each plant would be smaller, reducing the typical savings seen by large scale projects, and each plant will likely require the acquisition of appropriate property and/or easements to accommodate the new infrastructure. Refer to Figure 12: Localized WWTPs for a map outlining the proposed infrastructure.

The discharge type and location for each plant would require intense study. The localized plants could utilize any combination of surface water discharges and/or groundwater discharges. Surface water discharges, as described previously, require stream studies to confirm nutrient and flow carrying capacity of the streams. These stream studies also

determine the level of treatment the plants are required to achieve. Surface water discharges are frequently considered to have more “risk associated with unknowns” until the stream studies are complete than that of groundwater discharges. However, surface water outfalls generally do not require any mechanical maintenance to operate. Groundwater discharge locations require land with suitable soils to handle the discharge. The pre-permit investigation for such discharges is limited to geotechnical and hydro-geological testing, on pre-screened sites. The difficulty with such discharges in this region is the lack of available suitable land. In addition, groundwater discharges also require mechanical equipment which must be maintained. Further discussion of suitable soil types is noted in the Permitting and Environmental Constraints section of this report. If this alternative is selected, evaluation of the available discharge options will be conducted in Phase II of this study.

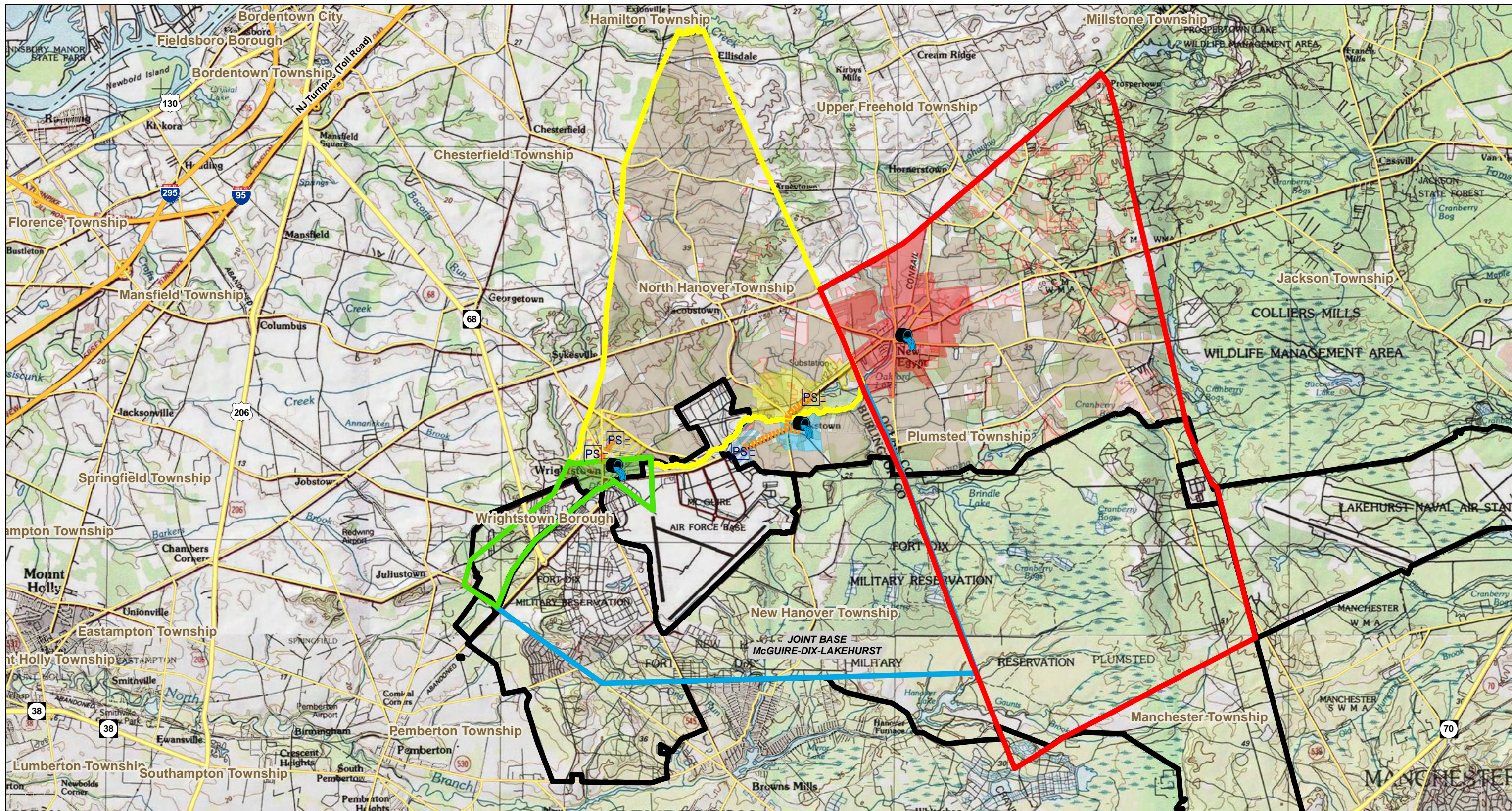
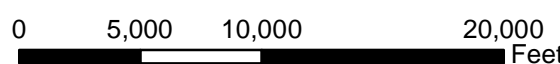


Figure No. 12
 Alternative No. 7 - Localized Plants
 Burlington/Ocean County, New Jersey

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 File Path: H:\OCTY\00380\GIS\Projects\Fig 12- Alternative 7.mxd

- Legend**
- [PS] Pump Station
 - [Green Outline] Wrightstown Borough
 - [Red Outline] Plumsted Growth Area
 - [Orange Line] Interstate or Toll Route
 - [Blue Circle] WWTP
 - [Red Outline] Plumsted Township
 - [Green Outline] Wrightstown Growth Area
 - [Yellow Line] US or State Route
 - [Orange Line] Pipe
 - [Yellow Outline] North Hanover Township
 - [Blue Outline] West Cookstown Growth Area
 - [Yellow Line] County Route
 - [Blue Outline] New Hanover Township
 - [Blue Outline] Cookstown Growth Area
 - [Grey Line] Local Road
 - [Black Outline] Joint Base
 - [Yellow Outline] North Cookstown Growth Area
 - [Yellow Outline] North Wrightstown Growth Area
 - [Yellow Line] Ramp



NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

ALTERNATIVE NO. 8: PLUMSTED FLOW TO JACKSON MUA AND COOKSTOWN REGION TO CENTRAL PLANT

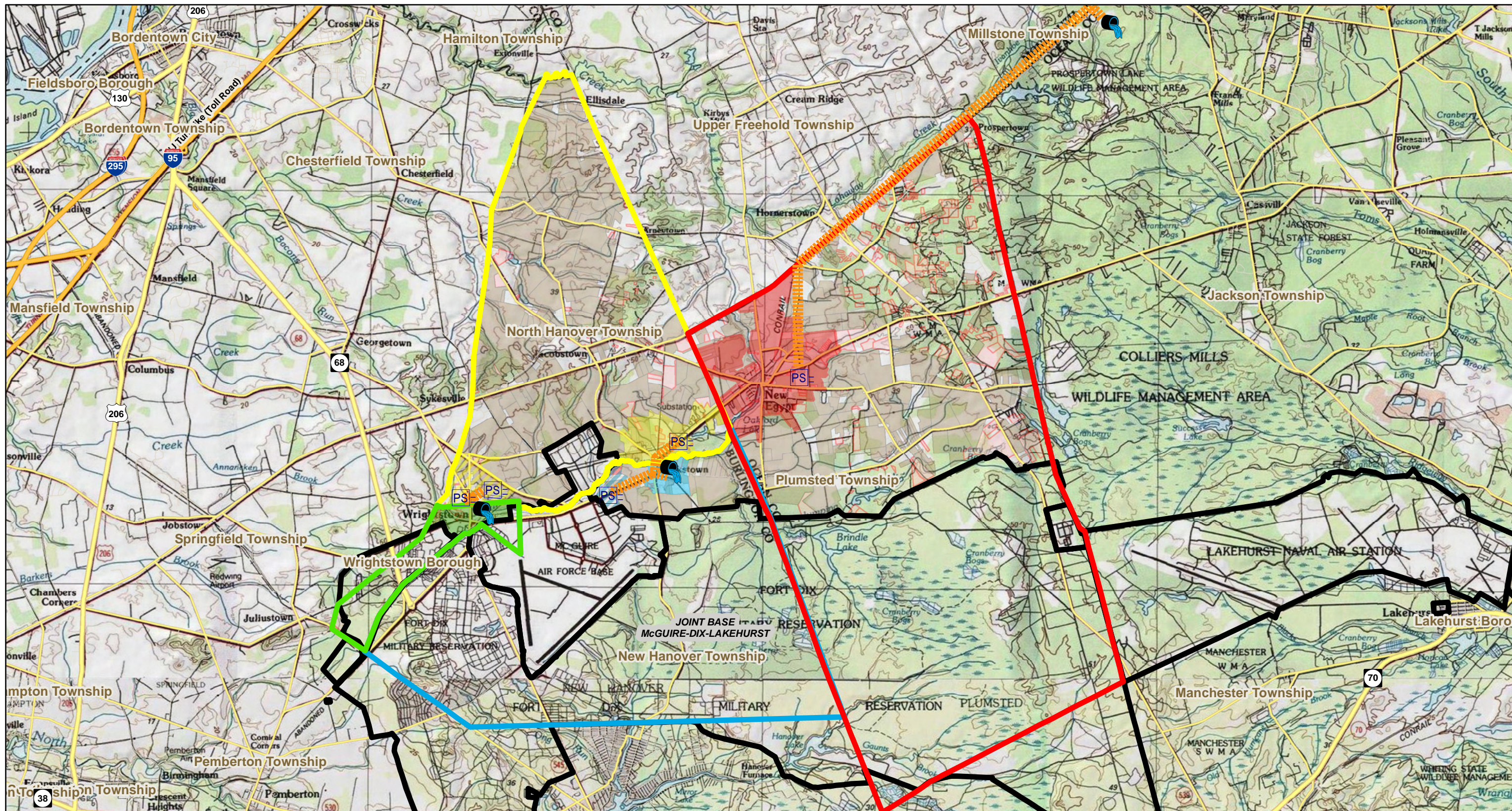
The Jackson Township Municipal Utilities Authority (Jackson MUA) owns and operates the collection system in Jackson Township. Included in this system is a pump station located at the Six Flags Great Adventure and Wild Safari theme park. Flow from this station is pumped through an associated 16" force main to the Metedeconk Interceptor. The 30" Metedeconk Interceptor discharges into the Ocean County Utilities Authority (OCUA) North Pump Station No. 6 for eventual treatment at the OCUA Northern Water Pollution Control Facility in Brick Township, New Jersey. The flow from this plant is then discharged 1 mile offshore in the Atlantic Ocean. In this alternative, flow from Plumsted Township would be collected at a central pump station, and then pumped to the Great Adventure Pump station. The flow from the Cookstown Region would be collected and treated in the new central plant proposed as part of Alternative No. 2.

Refer to Figure 13 : Plumsted Flow to Jackson MUA and Cookstown Region to Central Plant for a map outlining the proposed infrastructure.

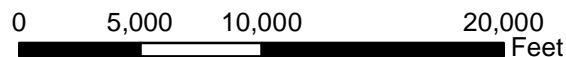
INFRASTRUCTURE REQUIRED

This alternative requires similar infrastructure to that of Alternative No. 2. The Cookstown Region would require a 1.9 MGD treatment plant, and Plumsted would require construction of a large central pump station. The force main in this case would need an estimated 8.1 mile of pipe to reach the Great Adventure Pump Station.

It is important to note that construction of this pump station has been reviewed and rejected previously by the PMUA. The cost of the force main, the inter-basin transfer requirements, and Delaware River Basin Commission's review and application fees, and expected fees from Jackson Township MUA and OCUA were considered not to be cost effective. According to the PMUA, the cost to construct a 450,000 GPD pump station including interconnection fees is estimated to be \$10,000,000. This alternative is quite costly, in addition, given the unknown requirements of the inter-basin transfer, it has a large amount of risk associated with the preliminary design.



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 File Path: H:\OCTY\00380\GIS\Projects\Fig 13- Alternative 8.mxd

Legend

- WWTP
- Pump Station
- Force Main
- Wrightstown Borough
- Plumsted Township
- North Hanover Township
- New Hanover Township
- Joint Base
- Plumsted Growth Area
- Wrightstown Growth Area
- West Cookstown Growth Area
- Cookstown Growth Area
- North Cookstown Growth Area
- North Wrightstown Growth Area
- Interstate or Toll Route
- US or State Route
- County Route
- Local Road
- Ramp



Figure No. 13
 Alternative No. 8 - Jackson Township MUA
 Burlington/Ocean County, New Jersey

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

Table 9: Sanitary Sewer Alternatives Analysis Summary

Alternative	1	2	3	4	5	6	7	8
	Central Plant	Plumsted to Joint Base, Cookstown Region Plant	Cookstown Region to Joint Base, Plumsted Plant	Plumsted & Cookstown Region to Joint Base	Mt. Holly MUA	Plumsted to Pemberton MUA, Cookstown Region Central Plant	Localized MUAs	Plumsted to Jackson MUA, Cookstown Region Plant
Cost	\$33,744,200	\$32,498,900	\$28,582,000	\$23,576,500	\$45,936,000	\$37,941,000	\$39,423,000	\$38,970,000
Advantages	<ul style="list-style-type: none"> No non-member town or Joint Base participation Good soil conditions for GW discharge in Cookstown Region 	<ul style="list-style-type: none"> Existing WWTP Municipalities can move forward alone Good soil conditions for GW discharge 	<ul style="list-style-type: none"> Existing WWTP Municipalities can move forward alone 	<ul style="list-style-type: none"> Least expensive Existing WWTP Municipalities can move forward alone Reduced Construction 	<ul style="list-style-type: none"> Existing WWTP Municipalities can move forward alone Reduced Construction 	<ul style="list-style-type: none"> Existing WWTP Municipalities can move forward alone Good soil conditions in Cookstown Region for GW discharge 	<ul style="list-style-type: none"> Municipalities can move forward alone Smaller plants required 	<ul style="list-style-type: none"> Phase project to suit Good soil conditions in Cookstown Region for GW discharge
Dis-Advantages	<ul style="list-style-type: none"> Large new plant Additional studies required Land required 	<ul style="list-style-type: none"> New plant TDR to be finalized to confirm sizing Additional Studies required Land required Joint Base approval 	<ul style="list-style-type: none"> New plant Additional studies required Bad soil conditions for GW discharge Joint Base approval 	<ul style="list-style-type: none"> Joint Base approval 	<ul style="list-style-type: none"> Most expensive Large pump stations Odor Control Inter-basin transfers Involves Non-member towns 	<ul style="list-style-type: none"> Large pump stations Odor Control New plant Additional studies required Inter-basin transfers MUA capacity 	<ul style="list-style-type: none"> New plants Additional Studies required Permitting Not all municipalities have good soil conditions for GW discharge 	<ul style="list-style-type: none"> Large pump stations Odor Control Inter-basin transfer New plant Permitting

COLLECTION SYSTEM ALTERNATIVES

The second component of the wastewater issue is the collection of wastewater, which is accomplished through the construction of a tree like network of underground piping, wherein sanitary sewage is collected from homes through lateral pipe connections into sanitary sewer mains located in streets or ROWs. Sewer mains are constructed at pitch in order direct sewage to flow through the system via gravity. Sanitary sewer manholes are constructed at intervals along the pipeline, at major turning points and at intersections. As the volume of sewage flow increases, the mains gradually increase in diameter to maintain capacity. Occasionally, the topography of an area does not allow for flow to be practically conveyed via gravity. At this point, pump stations are constructed to move sewage via pressure, through force mains, which then discharge the wastewater either at treatment plants, or downstream in the gravity system, where there is once again capacity to convey the flow. As part of this analysis it is assumed that each municipality will be responsible for the construction of the collection system in its respective growth areas as needed.

In order to provide sanitary sewer service to each growth area within the study, the municipalities will be required to construct new gravity collection systems. Regardless of which alternative is selected, the construction of gravity or pressure collection systems will be similar for all options depending on the desired area of service. Below is a general description of the proposed collection systems sized to service all current property lots within each growth area. Costs for the collection system are outlined in the Estimated Construction Cost section of this report.

PLUMSTED TOWNSHIP

In order to service the downtown area of Plumsted, which includes its C-4 area, a new collection system will include 47,500 linear feet (LF) of 8" PVC gravity sewer, according to the Plumsted MUA's current conceptual design. Additionally, the collection system will require over 160 four-foot diameter precast manholes. The system overall will range in depth from four to twenty feet at its deepest point. Design and construction of the system may be phased to accommodate the C-4 area first in order to reduce overall costs.

In addition, depending on the alternative selected, Plumsted will also require the construction of an intermediate pump station. As described in the alternatives, the size and location of this

station will depend on the final treatment plant location. A flow meter chamber should be installed on any gravity interceptors or pump stations which interconnect into other municipalities or the Joint Base for accurate billing and record keeping purposes.

NEW HANOVER TOWNSHIP

New Hanover will be required to construct two (2) gravity collection systems, one in West Cookstown and one in Cookstown. The Cookstown collection system would include 11,900 LF of 8" PVC gravity sewer and 2,800 LF of 10" PVC gravity Sewer. This collection system will require approximately fifty-five 4' diameter precast manholes.

The West Cookstown collection system would include 10,525 LF of 8" PVC gravity sewer and 3,500 LF of 10" PVC gravity Sewer. The length of the interceptor needed will depend on the final alternative selected. This collection system will require approximately fifty 4' diameter precast manholes.

It is expected that pump stations will be required to convey the collected flow from New Hanover Township to the treatment destination. The exact number of stations is depended on the selected alternative. Since all of the alternatives require New Hanover to join with at least one other municipality, flow meters should be installed at each pump station or in chambers upstream of the interceptors to allow for accurate tabulation of the flow entering the joint treatment plant for billing and permitting purposes.

NORTH HANOVER TOWNSHIP

North Hanover will also require construction of two (2) gravity collection systems, one in North Wrightstown and one in North Cookstown. North Wrightstown's collection system would be comprised of mostly 8" gravity sewer and measure approximately 9,500 LF of new main installed along Rt. 545, Carlyle Dr., Barclay Ct., Crosshaw Rd., and Charles Street. This collection system would require at minimum of 40 sanitary manholes. Flow from the 8" lines would join into a 4,250 LF, 10" interceptor along Rt. 666.

Due to the size of the collection system, the downstream most portions are expected to be quite deep. It is important to note, that the interconnection between North Wrightstown and Wrightstown is shallow and will require lift/pump stations. A smaller station, located on Carlyle

Drive is needed to convey flow from this small residential neighborhood to the main pump station. This smaller station would require an 850 LF two inch diameter force main to connect this area into the Wrightstown collection system on Fort Dix Road. The larger or main pump station located on or near Fort Dix Avenue would be required to lift the flow from North Wrightstown several feet into the 12" diameter Wrightstown gravity located near the border on Fort Dix Avenue. Flow meters should be installed at each pump station to allow for accurate tabulation of the flow entering the Wrightstown system for billing and permitting purposes.

The North Cookstown collection system would include 1,430 LF of 8" PVC gravity sewer and 9,700 LF of 10" PVC gravity Sewer. The length of the interceptor needed will depend on the final alternative selected. This collection system will require approximately thirty 4' diameter precast manholes.

As stated above, it is expected that pump stations will be required to convey the collected flow from North Hanover Township to the treatment destination. The exact number of stations is dependent on the selected alternative. Since all of the alternatives require North Hanover to join with Wrightstown and at least one other municipality, flow meters should be installed at each pump station or in chambers upstream of gravity interceptors to allow for accurate tabulation of the flow entering the joint treatment plant for billing and permitting purposes.

WRIGHTSTOWN BOROUGH

The Borough of Wrightstown already has sewer infrastructure in place, and will not need to build additional collection systems. An extension of the existing system on Meeting House Road, would allow for a short force main for the southwestern section of North Wrightstown, and allow additional growth in this area. In addition, the Phase 1 and 2 Redevelopment will require additional branch connections, once the final development plan and design are complete.

JOINT BASE

As previously stated, the Joint Base has an existing sanitary sewer system. The system, particularly on Fort Dix has slowly been expanded since the initial construction in the 1940s. Some of the sewer lines require lining, and the installation has a continuing program to rehabilitate the main sewer trunk lines.

The piping system is old and needs to be upgraded. There are several projects identified to help raise the current assessment rating from Degraded to Adequate. Most of the existing sanitary collection system is vitrified clay pipe which is prone to failure and leakage. In addition, there are connections from the stormwater system into the sanitary sewer collection system. The Joint Base is determining the extent of infiltration and inflow and will be developing a plan to address this issue. It may be possible that if these issues are addressed that additional capacity may be available; however, at this time there is no timetable as to when these issues may be resolved.

POTABLE WATER ALTERNATIVES

In evaluating the alternatives available for the member communities, it was noted that Plumsted and Wrightstown are currently being supplied water via existing potable water systems and are projected to continue to be serviced under future demand requirements. Therefore, New Hanover and North Hanover are the only target areas for additional water system improvements. Presently, New Hanover and North Hanover are being serviced by private wells; however, as development occurs within their Growth Areas (Cookstown, West Cookstown, North Wrightstown and Wrightstown), remaining on private wells will not be feasible.

One alternative evaluated was to allow New Hanover and North Hanover to remain on private wells for the time being. This alternative would require no new infrastructure. Though this would address the Townships current needs, the lack of additional infrastructure would ultimately prohibit growth of any future commercial or large residential properties. Additionally, though there are an abundance of small water purveyors within the Growth Areas, they are small in size in comparison to the need required and will not be able to contribute to any future demands required. Therefore, though this option would provide the Townships additional time to develop an overall plan, new infrastructure will be required to promote growth within the identified growth areas.

A second alternative evaluated was the potential expansion of adjacent water treatment facilities/infrastructure. The WMUA is adjacent to the North Wrightstown Growth Area, has spare capacity, and an interconnection may be possible; however, the WMUA does not have enough capacity to service the entire North Wrightstown area. Also, the physical location of the WMUA is inhibitive to expansion. The very compact plant off Martha Avenue does not have any spare space within its existing treatment plant buildings. With the expected expansion of the sewage treatment plant, it is unlikely that additional satellite buildings, wells and/or other infrastructure will also fit within the limited space available at the Martha Avenue facility. There is the potential for adjacent open space areas; however, these areas will need to be further evaluated in Phase II of the study to determine their feasibility. If an available area were to be identified and selected, this alternative would require not only the acquisition of the potential land area, but also construction of a new well, connection into the existing treatment/distribution system, and expansion of the existing WMUA facility.

It also appears that the Joint Base has excess potable water capacity. The Joint Base is evaluating the available capacity and determining future needs. If the Joint Base determines it has available capacity the surrounding towns could consider approaching the Joint Base about the potential use of that available capacity. Due to lack of information and need for future in depth study by the military, this capacity is not considered available and will not be included as an alternative for potable water sources at this time. This option will be further evaluated in Phase II of the study to determine its feasibility. If capacity were made available for member communities, this alternative would require construction of an overall distribution system from the Joint Base to the Cookstown Region. Upgrades to the pumping capabilities at the Joint Base will most likely be required, in addition, to offsite storage capability.

As part of this alternative, expansion of private water entities such as New Jersey American Water Company were also considered. It is feasible; however, this option would need detailed analysis and investigation by the private entities to determine the financial viability of developing new water sources and treatment facilities in the growth areas noted. Any infrastructure required to provide water service could potentially be borne by the private entity and the Cookstown Region may only have to provide internal distribution systems for each growth area.

The last alternative evaluated was the construction of a centralized water treatment plant which would treat, and distribute water to the North Hanover and New Hanover growth areas. Location of this new regional plant would need to be carefully considered. Based on a review of the Cookstown Region, there appears to be limited space available in the highly built out Cookstown area and West Cookstown may not have enough available land, due to the concentration of industrial and commercial zones within this area. North Cookstown initially appears to have more area available for additional consideration; however, this will need to be evaluated further depending on the final outcome of the proposed TDR plan being prepared by Burlington County. Elevated storage will be required, and the location of such elevated tanks may be subject to FAA and military flight path regulations, depending on the location. Further evaluation of the best area to locate such facilities will need to be conducted during Phase II of this study.

If expansion of the WMUA water treatment facility is not feasible, one derivation of this alternative would be to construct a second smaller water treatment plant to service only the North Wrightstown growth area. Given the distance from North Wrightstown to the other

Cookstown Region growth areas this would reduce the size and reach of the overall distribution system.

INFRASTRUCTURE REQUIRED – CENTRAL WATER TREATMENT PLANT

A centralized regional plant would require the construction of several large capacity drinking water wells, treatment unit trains, distribution network, and appropriate storage. The distribution system, including a looped network of an average of 8” ductile iron pressure mains, fire hydrants, valves, and house connections using curb boxes and corporation stops, would be required for each Growth Area. Given the expansive area to be included, elevated water storage would be highly recommended. Elevated tanks will provide system head pressure to reduce the need for booster pumping.

If the North Wrightstown growth area would also need to be serviced separately a smaller scale treatment plant and associated wells, tanks, process units, distribution system would be required to service that area as well.

ESTIMATED CONSTRUCTION COSTS

Below is a summary of the proposed construction cost estimates for the infrastructure required for each of the alternatives. It should be noted that the Wrightstown MUA connection and Proposed Capital Improvements estimates provided have been included with a 30% contingency for unanticipated construction costs. It is estimated that the Mount Road Pump Station will require approximately \$1,000,000 in upgrades. This cost has been added to the appropriate Alternatives.

The collection system improvements estimates include the costs for construction of all collection systems within the New Hanover, North Hanover and Plumsted growth areas. A breakdown of these costs on a per municipality basis can be found in Table 10: Collection System Construction Cost Estimates. Please note these estimates also include a 30% contingency in the cost of the work. This contingency is considered prudent at this stage in planning since the final layout, design, and system alternative selected may have a substantial impact on the final cost.

The construction cost for the Wrightstown MUA connection option, which is common to all alternatives investigated, includes the construction of the necessary pump stations to convey flow from low lying areas in North Wrightstown into the Wrightstown interconnection points. The cost also includes upgrade of the existing WMUA treatment plant to accommodate the additional flow.

Table 10: Wastewater Infrastructure Construction Cost Estimates

	Collection System Improvements	Wrightstown MUA Connection	Proposed Capital Improvements	Grand Total
Alternative No. 1	\$8,415,000	\$5,574,000	\$19,755,200	\$33,744,200
Alternative No. 2	\$8,415,000	\$5,574,000	\$18,509,900	\$32,498,900
Alternative No. 3	\$8,415,000	\$5,574,000	\$14,593,000	\$28,582,000
Alternative No. 4	\$8,415,000	\$5,574,000	\$9,587,500	\$23,576,500
Alternative No. 5	\$8,415,000	\$5,574,000	\$31,947,000	\$45,936,000
Alternative No. 6	\$8,415,000	\$5,574,000	\$23,952,000	\$37,941,000
Alternative No. 7	\$8,415,000	\$5,574,000	\$25,434,000	\$39,423,000
Alternative No. 8	\$8,415,000	\$5,574,000	\$24,981,000	\$38,970,000

Table 11: Collection System Construction Cost Estimates

	New Hanover	North Hanover	Plumsted
Collection System Improvements	\$3,229,000	\$3,213,000	\$1,973,000*

*Based on data provided by the PMUA website regarding sewer system recommendations www.pmua.net/wwrecommendations.htm

ESTIMATED OPERATION AND MAINTENANCE COSTS

Operational and maintenance cost vary depending on plant and collection system size and complexity; however, given the similar size of the systems discussed an average value on a per gallon basis was used. Based on industry standards and experience, a value of \$2.00/gal was assigned to the operation and maintenance cost of the treatment facilities. The overall cost for the operation and maintenance of the collection system is generally accepted to be 20% of the cost of the entire system or \$0.50/gal. The overall operation and maintenance cost therefore is estimated using \$2.50 per gallon of flow. A summary of these costs are described below on an annual basis.

Operation and maintenance costs were excluded for Alternatives No. 5 and 8 since flow is sent outside of the study area; however, a service fee from the receiving treatment facilities will be assessed to each individual municipality.

Table 12: Annual Wastewater Infrastructure Operation and Maintenance Cost Estimates

	Collection System	Additional Wrightstown MUA WWTP	Proposed Plant O&M	Grand Total
Alternatives No. 1-4, 6 and 7	\$741,924	\$674,000	\$2,399,278	\$3,815,652
Alternatives No. 5 and 8	\$741,924	\$674,000	NA	\$1,416,374

Table 13: Annual Collection System O&M Cost Estimates

	New Hanover	North Hanover	Plumsted
Collection System Improvements	\$93,795	\$423,129	\$225,000

POTABLE WATER CONSTRUCTION COST ESTIMATES

Construction of a new water distribution system will be required for any of the options considered to provide potable water service to the study area, with the exception of the no construction alternative. The estimated costs for new potable water distribution system range from \$1,800,000 to \$2,400,000. Refer to Table 13 for a summary of the costs on a growth area basis.

Table 14: Potable Water Collection System Construction Cost Estimates

	North Hanover		New Hanover	
Potable Water Collection System Improvements	North Wrightstown	North Cookstown	West Cookstown	Cookstown
	\$2,186,600	\$1,775,000	\$2,245,000	\$2,355,000

As noted in the second alternative discussed, the estimated cost for expansion of the existing WMUA water treatment facility would be in the range of \$1,500,000 to \$2,500,000. This would vary depending on the proximity of the additional land area to be acquired, depth of the well and land acquisition costs.

The cost of the third alternative is difficult to determine at this time without further discussion with the private entities as some or all of the potential construction costs may be borne by these companies. The cost for construction of an overall distribution main from the Joint Base to the Cookstown Region would be in the range of \$5,000,000 to \$7,000,000 and would vary depending on the extent of the pumping and storage capacity improvements.

For the last alternative discussed and based on US EPA cost modeling, it is expected that the cost of a new direct filtration ground water treatment plant with chlorine contact tank for disinfection would cost approximately \$3.79 per gallon of water treated. As a result it will cost approximately \$4,927,000 to construct a new water plant to treat 1.3 MGD. Elevated storage costs approximately \$2.00 per gallon of water stored. Providing enough elevated storage for one average day (1.3 MGD) is estimated at \$2,600,000. Costs for construction of wells will vary depending on the capacity, location, depth and allocation granted; however, construction costs generally can range from \$500,000 to \$1,000,000 per well.

To provide the second smaller treatment plant in North Wrightstown, the overall construction cost would increase approximately 25 to 35% to account for the additional mobilization and labor associated with the additional construction site.

PERMITTING AND ENVIRONMENTAL CONSTRAINTS

For each alternative investigated the Team conducted an evaluation of permitting requirements associated with each option and associated environmental considerations.

The sections below have been prepared using NJDEP Digital Geographic Information System (GIS) data including streams, surface water quality standards, Category 1 water bodies, floodplains, wetlands, threatened and endangered species, Pinelands regions, acid producing soils, watersheds, and historic/archaeological resources. The following information summarizes the results of this review for the eight alternatives of the proposed project.

PINELANDS

All of the proposed alternatives, with the exception of Alternative No. 7, are located within the Pinelands Management Area. As such each option will require approval of a Public Development Application from the Pinelands Commission. No such approval will be required for Alternative No. 7. As with all regulated activities, project purpose and need must be demonstrated to the Pinelands Commission. Considering the benefits associated with correcting malfunctioning septic systems in the Pinelands, the selected alternative will be considered a permitted use.

During this phase of the study a preliminary meeting was held with a representative from the Pinelands Commission to discuss the potential alternatives proposed. Based on the meeting, additional coordination and review with the Pinelands Commission will be required in Phase II of this study once the selected alternatives are evaluated further. However, at this time the Pinelands Commission had no initial objections based on what was presented.

FLOOD HAZARD AREA

- The infrastructure associated with each of the alternatives will require crossing a number of streams including Crosswicks Creek (FW2-NT), North Run (FW2-NT), South Run (PL), and waters associated with Oakford Lake. For Alternative No. 6, connection to the Pemberton MUA, additional crossings across waters associated with Dogwood Lake (FW2-NT), Indian Run (FW2-NT/PL), and an unnamed tributary Pinelands Waters (PL) will also be required.

For Alternative No. 7, local WWTP's, it should be noted that the proposed improvements will only require crossing North Run (FW2-NT) since location of said improvements are intended to remain locally within each municipality as opposed to other alternatives investigated. For Alternative No. 8, connection to the Jackson MUA, the proposed improvements will only cross Lahaway Creek (FW2-NT), Prospertown Brook (FW2-NT) and Stonyford Brook (FW2-NT). It is important to note that none of the streams referenced above are designated as Category 1 Water bodies. It should further be noted that none of the streams are located within the same HUC14 sub-watershed as a Category 1 Water body.

- There are also regulated floodplains associated with the streams that would be crossed by the proposed infrastructure.
- The riparian buffers would vary from 50 feet to 150 feet wide. A portion of Crosswicks and Lahaway Creeks flows through the Lower Member of the Kirkwood Formation. This formation is on the list of geologic formations that contain acid producing soil. Acid Producing soil would increase the size of the riparian buffer from 50 to 150 feet wide.
- Any impacts to the streams, riparian buffers or floodplains would require a NJDEP Flood Hazard Area Permit.
- Riparian buffer mitigation at a 2:1 ratio will be required. The extent of mitigation will be determined as a function of the overall riparian buffer impact. Associated costs of any required mitigation can be estimated once impact areas are established. Riparian buffer mitigation has to be performed in the same sub-watershed as the impact unless circumstances prevent it.

WETLANDS

There are mapped wetlands located within each proposed alternative. The wetlands appear to be associated with the various streams that would be crossed by the pipes servicing the proposed infrastructure. The wetlands must be delineated and illustrated on appropriate base mapping. Any disturbance to these wetlands, wetland buffers and/or State open waters will require a freshwater wetland permit. If the pipes are jacked or directionally drilled underground so that there is no surface disturbance to freshwater wetlands, transition areas, or state open waters, no NJDEP approval is required under the Wetland rules. If there is above

ground disturbance, one the following two permits would be required:

- **Freshwater Wetlands General Permit No. 2** (underground utility line installation). Permanent above ground disturbance to freshwater wetlands, transition areas, and State open waters cannot be greater than 0.5 acres. The permanent maintained clearing over the utility line cannot be great than 20 feet wide. Mitigation shall be performed for all permanent impacts equal to or greater than 0.1 acres of less. If the 0.5 Acre wetland impact limit is exceeded, an Individual Permit will be required (see next section).
- **Individual Freshwater Wetlands Permit** (IP) An IP is required when the limit of disturbance for an activity exceeds the limit of disturbance requirement for a General Permit. Mitigation is almost always required for projects that need an IP. Once impacts associated with the selected alternative are established, freshwater wetland permitting requirements can be finalized.

THREATENED AND ENDANGERED SPECIES

As per the NJDEP's Landscape data (Version 2.1), there is bald eagle foraging habitat within the proposed project areas in all of the alternatives. Additionally, for those options that include the Joint Base, McGuire Air Force Base is listed as containing threatened and endangered species habitat. Specifically, the grassland areas on the base contain upland sandpiper habitat which is State endangered. The emergent wetlands on the base contain savannah sparrow habitat which is State threatened and there is also bald eagle foraging habitat in the open waters and forested/emergent wetlands on the base. Additionally, for Alternative No. 6, it was noted that barred owl and bobolink habitat, both State threatened species, is also located within the proposed project limits for that option.

For Alternative No. 7 it was noted that only wood thrush in the forested habitat is located within the project limits.

For Alternative No. 8, the forested habitat adjacent to the proposed project area contains numerous threatened and endangered species. Specifically, the forested and forested wetlands are listed as containing bald eagle, barred owl (State T), Coopers hawk (State T), northern pine snake (T), pine barrens treefrog (T), red-headed woodpecker (T) and red-shouldered hawk (T). In addition, there is wood turtle habitat within 1 mile of the proposed project area.

Proposed improvements in all of the alternatives presented have the potential to impact the habitat areas noted. Accordingly, habitat surveys may be required to determine the presence/absence of threatened and endangered species. The NJDEP's Division of Fish and Wildlife's Endangered and Nongame Species program as well as the US Fish and Wildlife Service provide guidance on when and if surveys are to be performed. Should habitat surveys be required, it must be noted that they must be performed on a species specific basis. Depending on the species targeted, surveys must be done at specific times of the calendar year when species are most active. Again, consultation with the NJDEP's Endangered and Nongame Species program and/or US Fish and Wildlife Service must be initiated to determine when and if surveys will be required. It is strongly recommended that this consultation period be initiated before designs are finalized and permit applications are submitted because any required survey has the potential to significantly delay the project schedule.

HISTORIC/ARCHAEOLOGICAL RESOURCES

As per the NJDEP's GIS data pertaining to historic/archaeological resources, no such resources exist within project limits of any of the alternatives proposed. It is important to note however, that due to the extent of sub-surface disturbance required to install the necessary piping system to service the designated growth areas, an archaeological investigation may be required by the NJDEP's Historic Preservation Office (HPO). This is especially the case in undisturbed wetlands. Consultation with the HPO should be initiated before designs are finalized and permit applications are submitted because any required investigation has the potential to delay the project schedule.

KNOWN CONTAMINATED SITES

In addition to environmental constraints, all potential issues pertaining to contamination were inventoried using GIS information obtained from the NJDEP. All proposed alignments as well as adjacent properties were checked for the presence of Known Contaminated Sites (KCSL), Classification Exception Areas (CEA) and/or Currently Known Extents (CKE). A few examples of KCSL include landfills, gas stations, dry cleaners, auto body shops, and sites with underground storage tanks (USTs). Based on the available information, all eight (8) proposed pipe alignments contain one or more KCSL. These sites vary from gasoline stations to private residences to military properties. The status of these sites is either "active with onsite contamination" or "closed with restricted use". Additionally, all eight (8) alternatives contain

one or more mapped Classification Exception Areas. The Classification Exception Area denotes areas with known groundwater contamination that are now restricted in terms of placing potable wells. It is important to note that most of the sites mentioned above are located adjacent to the proposed pipe alignments.

For Alternative No. 8, there are also four KCSLS within the project area. Three of the four are within the onsite construction and one is closed with restricted use. The three KCSLS are in North Hanover and the one closed is in Wrightstown Borough. There is one Classification Exception Area in Fort Dix and Charles Streets near the project area. When the selected alternative goes to construction, coordination with the appropriate State, County, and local agencies will most likely be required to minimize disturbance/exposure of any contaminated sites. The appropriate construction practices and health and safety measures must also be included in construction documents to minimize and/or eliminate hazards during construction.

TWAS AND NJPDES PERMITS FOR SANITARY SEWERAGE

The gravity collection systems, and pump stations will require Treatment Works Approvals (TWA) from the NJDEP, regardless of the alternative selected. The TWAs for the collection system and pump stations are relatively straight forward, and are estimated on a sliding scale based on overall construction costs. The Wrightstown MUA WWTP will also require a TWA for its plant upgrades. Since the discharge is increasing, a stream study and plant re-rating study maybe required, if they have not recently been completed. The results of these studies will impact both schedule and final feasibility of the selected alternatives. The additional flow will also require a modification to the plant New Jersey Pollution Discharge Permit Elimination System (NJPDES) Permit.

Any proposed plants such as those required by Alternatives 1, 2, 3, 6, and 7, will also require a separate Treatment Works Approval. The discharge of the plant, regardless if it is a surface water discharge or a land application discharge to ground water will also require a NJPDES permit. A surface water discharge will require a stream study, if one has not recently been completed. Land application will also require additional studies be completed on the selected land application site.

STREAM TOTAL MAXIMUM DAILY LOADS (TMDLS)

NJDEP and other government bodies issue TMDLs as means of reducing a particular pollutant or contaminant in an impacted stream or water body. The adoption of TMDLs is a long process in which stream segments, or water bodies are observed and studied for pollution impacts, then restrictions for discharge of specific pollutants are adopted. TMDLs will, for example, limit the amount a specific chemical such as mercury, than can be discharged into the stream. These limits reduce that amount of pollutant which enters the stream, and thus reduces the impairment. Currently neither the Crosswick's Creek nor the Rancocas Brook (in the study area) has listed TMDLS. There have been studies reviewing impacts of mercury, phosphorous, Total Suspended Solids (TSS), Arsenic, and turbidity for portions of these water bodies, but no limits have been placed. Should a TMDL be adopted, it could restrict a surface water discharge in that stream segment.

DIVISION OF WATER SUPPLY PERMITS

The NJDEP governs the construction and operation of public supply drinking water systems under the Division of Water Supply Bureaus of Safe Drinking Water and Water Allocation based on the requirements of the Safe Drinking Water Act (NJAC 7:10) among other legislation. The Bureau of Safe Drinking Water will require permits for the construction of the water system distribution network, interconnections, water mains, water treatment facilities, water supply sources, water storage facilities, system management, etc. Permits fees vary depending on the extent of the permit and the type of facility being permitted. This Bureau also permits the operation of such facilities. The Bureau of Water Allocation, however, issues permits for the right to divert water from a given source for use. Water Allocation permits typically requires expansive hydro geologic and engineering studies and long review periods. The application process could be expected to take a year or more to complete. The drilling of supply wells also requires a separate permit, though this application is made by the individual well driller, not the system owner.

WELL HEAD PROTECTION AREAS

Well Head Protection Areas (WHPA) are mapped, horizontal, delineations indicating the area where groundwater is captured by a pumping groundwater well. WHPA's are delineated in response to the response to the Safe Drinking Water Act Amendments of 1986 and 1996 and

are part of State's the Source Water Area Protection Program (SWAP). All PCWS wells in New Jersey (in both confined and unconfined aquifers) have a 50' radius WPHA controlled by the water purveyor to protect the well head from contamination. Public Community Water Supply Wells (PCWS) in unconfined aquifers have tiered protection areas which delineate the area of capture over two-, five- and twelve year periods based on a specific pumping rate. WHPA's require specific monitoring for contaminants and, as result, often limit the construction of specific types of development known to increase the potential for groundwater pollution. For example, construction of a sanitary sewer groundwater discharge is likely to be impacted if it is located near a WHPA, and may be restricted if located within a WHPA.

There are several small 3-tier WHPA for Non-community wells located near the New Hanover/ North Hanover border scattered throughout West Cookstown, Cookstown, and North Cookstown near County Rt. 616 and Cookstown-Browns Mill Road. Another cluster of Non-Community WPHA's is located in North Wrightstown along Georgetown-Wrightstown Road and Wrightstown-Sykesville Road. As previously stated, there are several Public Community Supply Wells located in the study area; however none of these wells have delineated WHPA's beyond the required well head buffers. Only three (3) Public Community WHPA's are delineated in the member municipalities, and all three are located to the east of the Plumsted Growth Area.

SOIL EROSION & SEDIMENT CONTROL

The construction of any sanitary sewer collection system and/or treatment plant, including the sewer pipes, manholes, pumps stations, etc will require a Soil Erosion and Sediment Control certification from the appropriate County Soil Conservation District. Construction of a water distribution system, water plant, and elevated storage will also require Soil Conservation District Certification. Construction of the public supply drinking water wells may also require certification, but it will depend on the area disturbed. Fees for these permits are based on area of disturbed and include a review fee and an Inspection/Compliance fee. The fees vary based on County of jurisdiction. Given the complexity and extent of the collection networks to be constructed, the soil disturbance will also require a Request for Authorization (RFA) for Stormwater Discharge Associated with Construction Activities.

In addition to the above permitting requirements, the existing soils within the region also play roles in the selection of possible discharge to ground water disposal sites and in the selection of construction sites/routes. There are many soil types within the Joint Base region. The major

soil types located in the area of expected construction are widely varying in terms of their suitability for use for ground water disposal of treated wastewater effluent. One of the major factors contributing to suitability of a site to be used for the groundwater disposal is the depth to seasonal high water table level. Ideal disposal sites would have depths to groundwater greater than 4' to 6', and are classified under hydrologic groups A and/or B. Class C & D soils have depths to ground less than 4' below grade. In addition, Class A and B soils are more permeable and easily drained. Class C & D soils are less permeable and more conducive to flooding. In addition, areas with shallow seasonal high water tables also present difficulty for the construction of trenches for underground construction. High water tables will require construction crews to "de-water" the trench in order to construct the pipelines in dry conditions needed.

As a result, alternatives involving the construction and/or expansion of wastewater treatment plants should consider sites with Class A or B soils such as those in the Collington, Lakehurst, Pemberton, Evesboro, Hammonton, and Tinton Formations. Areas to avoid in locating groundwater disposal sites, or deep trenches would be sites located within the Adelpia, Atison, Keyport, Manahawkin Muck, Mullica, Freehold, and Shrewsbury formations. Sites located in flooded areas such as those in Fluvaquents soils should be avoided. Soil borings and geologic testing will be required during future phases to confirm the location of utility trenches and possible groundwater disposal sites.

Based on information available from the NRCS website and the Soil Survey for Ocean County, and Soil Survey for Burlington County (1971), it appears that the Cookstown Region has a greater area of hydrologic Type A and B soils than the Plumsted area. The Highway 616 (Maple Avenue) corridor has areas of the most suitable soils (Type A), but much of Plumsted is located in Type C or D soils. Type C or D soils will greatly limit available land in Plumsted to construct a treatment plant or effluent disposal site. Large portions of North Hanover between the Joint Base and New Hanover and Highway 537 appear to be Class B type soils, but the soils degrade to Class D near the Plumsted border.

OTHER CONSTRAINTS

In addition to the environmental restrictions described above, there are other constraints which should be considered in siting any new infrastructure. There are restrictions on above ground construction in the Joint Base APZs, which will limit locations for structures such as new

treatment plants and elevated water storage tanks. In addition inter-basin transfers of flow are frequently restricted due to the environmental impacts on source water. Frequently drawing water (potable or wastewater) from one watershed and discharging it into another (as in Alternatives No. 5 and 6), is disallowed due to replenishment requirements for streams and aquifers. Finally, impacts resulting from potential growth in non-designated areas must be addressed in the Growth and Wastewater Management Plan resulting from a selected alternative. For example, if infrastructure is constructed along roadways or near areas that are currently not in the Growth Areas, potential exists for individual property owners to request connection and increase potential growth. Areas slated for Farmland Preservation based on the Northern Burlington County Growth and Preservation Plan (GAPP) or State Plan will need to be restricted from joining the sewer service area (SSA) and thus restricted from unanticipated growth.

OWNERSHIP ALTERNATIVES

Another important aspect to consider during the discussion of the available alternatives for water and wastewater treatment is the alternative methods for ownership and management of the selected alternative. Methods for ownership and management of these systems are as varied as the alternatives themselves, but several of the common types are described below.

One common ownership model is the creation of “municipal or county utilities authority.” Utilities authorities are defined under the “Municipal and County Utilities Authorities Law” N.J.S.A. 40:14 B as “a public body created or organize pursuant to...this act and shall include a municipal utilities authority created by one or more municipalities and a county utilities authority created by a county.” Generally speaking municipal authorities are responsible for facilities within their boundaries, and regional authorities are responsible for shared or joint facilities. For example, Jackson Township Municipal Utilities Authority owns and operates the collection system and pump stations within Jackson Township as a municipal authority, whereas Ocean County Utilities Authority owns and operates its treatment plant as a regional authority.

Another model for ownership and management is a Joint Meeting. A Joint Meeting is defined as “the joint operation of any public services, public improvements, works, facilities, or other undertaking by contracting local units pursuant to a joint contract under section 14 of P.L.2007, c.63 (C.40A:65-14).” This would be two or more governing or contracting bodies joining together to provide utility services.

Individual municipal ownership is another option. Under this model, an individual municipality owns and operates the facilities as a department in the town, similar to a Department of Public Works.

The participating municipalities can also consider private ownership or franchise agreements between a municipality and a private utility such as NJ American Water Company are also possible for the facilities.

Depending on whether an ownership/management model is selected, one opportunity that may arise would be the feasibility of acquiring the WMUA from the Borough of Wrightstown and assuming control of the facility on a regional basis rather than through the municipality. In

other words, if an MUA is selected to manage the new infrastructure that MUA can assume control of the existing WMUA as part of their overall system and Wrightstown would then in turn be a customer of the MUA.

However, each type of ownership/management model has its own advantages and disadvantages (see below) and these considerations should be reviewed further in Phase II of this study, as some systems may be inappropriate for the selected Alternative.

Municipal Utility Authority (MUA)

Advantages:

- Focuses full administrative efforts on utilities.
- De-politicizes the process.
- Adds specialized and professional expertise.
- May improve implementation abilities by changing bond and debt ceiling limits.

Disadvantages:

- Isolates utilities services process from the public.
- Adds administrative costs.

Joint Meeting Water and Sewer Utility Department (shared services)

Advantages:

- Reduces individual municipalities' burdens by spreading out costs.

Disadvantages:

- Additional professional staff may not be cost-effective for rural municipalities with limited tax base.
- Utilities delivery implementation may become politicized.
- Infrastructure bonding could over-tax municipal credit and debt ceilings.
- May be difficult to get two or more municipal governing bodies to agree on contracts.

Municipal Water and Sewer Utility Department (for each jurisdiction)

Advantages:

- Streamlines utility decisions.
- Offers "hands-on" municipal involvement.
- Potential revenue source for municipality, after bonds paid off.

Disadvantages:

- Existing municipal staff and governing body may be overloaded with other responsibilities.

- Additional professional staff may not be cost-effective for rural municipalities with limited tax base.
- Utilities delivery implementation may become politicized.
- Infrastructure bonding could over-tax municipal credit and debt ceilings.

Joint MUA or County MUA

Advantages:

- Reduces individual MUA's burdens by spreading out costs.
- Many of the same advantages of municipal MUA.

Disadvantages:

- Further isolates utilities services process from the public.

Services Contracted to Vendors, including Joint Base

Advantages:

- Utilizes existing utilities service (Joint Base staffing already in place.)
- Potentially lower costs to municipalities.

Disadvantages:

- Isolates utilities services process from the public.
- Requires Department of Defense authorization.

RECOMMENDATIONS

Given the recommendations noted in this report, the Team evaluated each alternative based on the following criteria and impacts:

- Economic Viability
- Environmental Impacts and/or Permitting
- Geophysical Impacts and Constraints
- Political Acceptance
- Timing

Based on this analysis, the Team recommends that to provide sanitary sewer service to the study area, the alternatives listed in this section be considered for further analysis and evaluation. Alternatives not selected were done so for various reasons. These include: high construction costs, excessive distances which must be crossed, lack of available land, potential permitting/interbasin transfer challenges, limited available capacities, and/or redundant treatment plants to treat the wastewater flow from the four host communities discussed in this study.

COMMON ALTERNATIVE: NORTH WRIGHTSTOWN TO WRIGHTSTOWN MUA

As noted previously in this report, due to the limited potential available capacity at the Joint Base, and its close proximity to the WMUA facility, it is recommended that flow from the North Wrightstown section of North Hanover be directed to the WMUA for treatment and discharge.

- Expansion of the existing WMUA facility would provide the additional capacity needed to handle the potential future flow demands from North Wrightstown, as well as, any anticipated growth from Wrightstown Borough. Presently, the current capacity is capable of handling existing flow from North Wrightstown and the Borough of Wrightstown.
- An interconnection into the WMUA system can potentially be provided via the existing 12” PVC main installed beneath Fort Dix Street. This main was constructed at minimum slope and has a carrying capacity of over 1.1 MGD.

- New infrastructure – Two new pump stations; one on Fort Dix Ave, and one on the SE corner of North Wrightstown will be required to transfer flow into the WMUA facility. Individual collection system for North Wrightstown, which would require permitting.
- This alternative has the benefits of allowing North Wrightstown to move ahead quickly with its TDR development, and provides Wrightstown with needed customers to bring relief to current rate payers. In addition, this alternative does not require interbasin transfers; however, for expansion of the facility a stream study will be required.

ALTERNATIVE 2: PLUMSTED TO JOINT BASE, COOKSTOWN REGION TO NEW CENTRAL PLANT

This alternative includes the construction of a Sanitary Sewer Pump Station in Plumsted to direct flow to the Joint Base facilities, and construction of a new plant to treat flow from the Cookstown Region. This alternative was selected for various reasons: one, it allows individual municipalities within the study area to move forward with their phase of the construction at their own pace/demand. Two, soil conditions for potential groundwater discharge were more favorable in the Cookstown Region and three, since alignment of the force main from Plumsted would travel through New Hanover it provided the opportunity for some of the growth areas to connect into the force main thus further reducing the size of the overall central plant.

- New Infrastructure – This alternative would require construction of a central plant located in the Cookstown Region with a maximum daily treatment capacity of 1.9 MGD. Construction of a Main Pump Station and 38,225 LF force main in Plumsted to connect the downtown area to the Joint Base. Construction of smaller pump stations to convey flow from the individual growth areas to either the new treatment plant or connect into the Plumsted force main. Construction of collection systems in all three Townships. This will require individual permitting for each collection system.
- This alternative utilizes existing NJPDES permitted plants to treat and discharge the effluent from North Wrightstown and Plumsted. This significantly reduces the permitting and design effort, for this portion of the work. However, any expansion of the existing treatment facilities will require additional studies in accordance with NJDEP requirements. In addition, pump station construction is generally more straightforward, less specialized, has equipment more readily available, and can be completed in shorter time periods, which will allow Plumsted to move forward with its public sewer system on a faster timeline.

- As a new plant, the Cookstown Regional Plant will require NJPDES and NJDEP TWA permits, which every plant requires. The new plant will require preliminary design and investigation to determine the optimum site and type of discharge. This additional time will also allow North Hanover enough time to finalize its TDR development system, and optimize plant sizing and construction phasing.

ALTERNATIVE 4: PLUMSTED AND COOKSTOWN REGION TO JOINT BASE

This alternative includes the conveyance of all sewage flow from New Hanover, Plumsted and North Cookstown to the existing Joint Base wastewater facility for treatment and discharge. This alternative was selected for various reasons. First, the existing Joint Base facility eliminates the need to construct a new treatment facility. This reduces the potential permitting/environmental study process associated with a new treatment facility. This alternative also allows growth areas to move independently of one another as need/demand increases.

- New Infrastructure – Construction of several pump stations and force mains in the Cookstown, West Cookstown, North Cookstown and Plumsted areas and connection into a joint force main to the Joint Base treatment plant. Construction of individual collection systems in all three Townships.
- This alternative utilizes existing NJPDES permitted plants to treat and discharge the effluent. This significantly reduces the permitting and design effort, in addition, pump station construction is generally more straightforward, less specialized, has equipment more readily available, and can be completed in shorter time periods. Also, by utilizing the existing Joint Base and Wrightstown Treatment Plants, there is less start-up time required, and flow can be treated as the collection system is built.

For the potable water system, the Team would recommend that the municipalities remain on the existing well system to handle current water demand. This will allow additional time to finalize any studies associated with expansion of the WMUA facility, as well as, construction of the new water treatment facility for the Cookstown Region. Ultimately to address future growth, expansion of the WMUA and construction of a new water treatment facility is recommended. If expansion of WMUA is not feasible then construction of a larger water

treatment facility or two smaller water treatment facilities can be investigated.

Negotiations with private entities or the Joint Base though potentially feasible could be a lengthy process that may impact potential growth in the study areas, therefore, at this time the Team would not recommend proceeding with those alternatives. This can be further verified during Phase II of this study.

APPENDIX

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