



AN ASSESSMENT OF WASTE AND DREDGING ISSUES RELATING TO LANDFILL CAPACITY IN THE STATE OF DELAWARE

W. Michael McCabe
& Ciara O'Connell

McCABE & ASSOCIATES
ENVIRONMENTAL CONSULTING

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Relating to Landfill Capacity
in the State of Delaware

Prepared by

**W. Michael McCabe
&
Ciara O'Connell**

McCABE & ASSOCIATES
ENVIRONMENTAL CONSULTING

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I. INTRODUCTION

A. OVERVIEW

Delaware faces a number of issues relating to municipal solid waste (MSW), sludge and dredge spoil disposal with both near and long-term impacts that require immediate attention and resolution. Because of its small size, siting landfills and dredge disposal sites has been a challenge for Delaware, particularly in heavily populated northern New Castle County. Planning horizons to explore options and settle on solutions, which normally span decades, have been compressed as possible alternatives have narrowed.

Within a short period of time public policy decisions will need to be made to provide adequate capacity for MSW and sludge disposal for New Castle County, as well as adequate dredged material capacity for the Port of Wilmington.

Each of these decisions will have significant fiscal, institutional and environmental impacts. Each decision is interwoven to some degree with those affecting others because they involve related sites and stakeholders. The range of decisions and the organizations and interests involved combine to reveal a complex overlay of choices and objectives. On the surface some of these appear to be in competition, but a closer examination reveals a mutuality of interest that can benefit all stakeholders. At the very least, improved integration and coordination of these decisions will support more effective implementation of the final choice. Moreover, if these linked decisions are coordinated, the resulting collaboration will enhance project outcomes and accrue greater public benefits in a number of areas.

A range of alternatives to conventional solutions exists with varying degrees of impact and likely public acceptance. It is that range of options compared to current direction that needs further examination and evaluation. Choices made today will set the direction for future decisions that will affect capacity options decades from now. Therefore, selections need to be made with a view not only to today's immediate needs, but also to future requirements.

The issues that are entwined involve a number of public institutions and private interests as well as a number of sites. The report deals with each component and its related issues more thoroughly, but for purposes of the overview the primary sites and key players are:

- Cherry Island Landfill, owned and operated by Delaware Solid Waste Authority;
- Wilmington Harbor North, owned by DSWA and operated by the U.S. Army Corps of Engineers for disposal of Port of Wilmington dredge material;
- Wilmington Harbor South, owned and operated by the U.S. Army Corps of Engineers as a tandem site with WHN for disposal of Port of Wilmington dredge material; and
- Pigeon Point Landfill, owned primarily by the City with portions held by DSWA and the Delaware River and Bay Authority and closed to MSW. The site is currently being regraded with stabilized sludge from the City of Wilmington's sewage system.

Each of the key players is facing challenges and demands relating to site capacity that affect the future of their operations and the cost and quality of service they provide. Simply stated, these demands are as follows:

- DSWA needs to have a cost-efficient, reliable and environmentally sound means of disposing of approximately 1,000,000 tons of MSW generated annually statewide that is currently landfilled, of which New Castle County accounts for approximately 638,000 tons;
- The City needs to have a cost-efficient, reliable and environmentally sound means of disposing of 60,000 thousands of tons of sewage sludge generated annually by Wilmington and New Castle County;
- The Army Corps of Engineers and the Port of Wilmington need capacity to place approximately 500,000 to 750,000 tons of dredged material per year in order to have adequate clearance from the river bottom for ships to dock.

Each of these demands is currently met by a system of disposal sites, several of which are nearing capacity. At each one of these sites the clock is ticking on when they reach their limits. But even projected dates on capacity limits are uncertain and dependant on factors such as volume and the rate at which material is deposited, stability concerns relating to how big the sites can get, and new approaches to limit material flow and manage the sites' physical conditions and characteristics.

Ultimate disposition of these major decisions involves numerous state and federal agencies and the General Assembly. But a subset of issues relating to other interests and objectives also need to be addressed. Overriding all of these decisions is public acceptance of the choices being pursued. This report reviews and examines the major factors involved in the disposition of these decisions.

B. SCOPE OF THE ASSESSMENT

In 2004, DNREC Secretary John Hughes engaged McCabe & Associates to conduct an analysis of the current and projected status of numerous issues surrounding the disposal of solid waste and dredge spoils in the State of Delaware while examining the interplay of various policy options and their consequences. Special attention is focused on capacity limitations at numerous disposal sites and the timeframes for reaching those limits. The assessment is not intended to chart a comprehensive roadmap for resolution of these issues, but to identify the broad range of interrelated disposal challenges facing the State and review options that address the need to plan for uninterrupted disposal before limits are reached. The document is intended to facilitate discussions between various stakeholders in an effort to resolve the challenges posed by a capacity shortage.

The principal scope of the assessment focuses on how these issues interrelate and an evaluation of opportunities for greater cooperation and collaboration toward finding solutions. The facts surrounding conventional aspects of the waste/dredged material issue were reviewed, and new information and perspectives also were assessed. Alternatives to current methods of refuse disposal, dredged material disposal and landfill management were briefly examined and reviewed for feasibility. However, *in-depth technical and economic assessments of the options were beyond the scope of the evaluation.*

This assessment focuses primarily on policy issues confronting Delaware and is not intended to be a comprehensive regional review. Nonetheless, the nature of the issues and available options often involve multi-state cooperation. As a result, relevant regional factors were examined.

C. METHODS

The foundation of this assessment rests on an impartial analysis of current and projected waste/dredged material issues.

Relevant studies, reports, documents and news clips were reviewed for background and insight into the policy, technical and logistical complexities of these issues.

The primary source of information comes from documents referenced throughout the report and interviews with key players involved in the various issues. More than 50 individuals were interviewed. These interviews included but were not limited to:

- Waste stream managers and experts
- State and local officials
- Community group representatives
- Federal agency representatives
- Commercial waste businesses
- Affected industry

A preliminary draft was completed in March 2005. The draft was sent to key organizations and individuals who had been interviewed for factual review. Factual revisions as a result of this review were incorporated into the final report.

Many individuals assisted in the preparation of this report. The authors wish to acknowledge the following individuals for their significant contributions:

Pat Canzano, COO, Delaware Solid Waste Authority
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D. ASSESSMENT AUTHORS

The assessment was managed and administered by McCabe & Associates and was directed by its principal, W. Michael McCabe.

McCabe brings to the project more than 30 years of background and experience in environmental policy development within the legislative, executive and judicial branches of government at federal and state levels. Prior to establishing McCabe & Associates, he served more than five years as a senior policy maker and manager at the U.S. EPA. McCabe held the post of Deputy Administrator from 1999-2001 and served as EPA Regional Administrator for the Mid-Atlantic States from 1995-1999. Prior to his work at EPA, McCabe held senior management positions on congressional committee and member staffs and non-profit organizations.

Ciara O'Connell is an independent environmental consultant who has worked since 1999 on a variety of environmental issues including air permitting and compliance, brownfield redevelopment, RCRA Part B and solid waste facility permitting. From 1996 through 1998, she worked as a program environmental scientist for Environmental Alliance, Inc., where she specialized in Title V, hazardous waste and solid waste permitting for facilities in Delaware, Pennsylvania, Maryland and Virginia. Prior to that, Ms. O'Connell worked as a program analyst in DNREC's Pollution Prevention Program. Ms. O'Connell received a Masters of Environmental Management from Yale University in 1995.

The findings and recommendations in this report represent the views of the project authors and do not necessarily reflect the views of DNREC management and staff or individuals interviewed for the report.

McCabe & Associates
ENVIRONMENTAL CONSULTING

610.388.9625

E. KEY FINDINGS – EXECUTIVE SUMMARY

General Issues

1. Delaware faces a number of significant issues relating to solid waste, biosolids and dredged material disposal that require immediate resolution before capacity limits are reached and disposal alternatives are no longer viable. These issues are interrelated and involve a number of public institutions and private and community interests, as well as a number of sites. Resolution of these issues would benefit greatly by a coordinated and collaborative approach.
2. Each of the principal stakeholders faces challenges and demands relating to site capacity that affect the future of their operations and the cost and quality of service they provide. Simply stated, these demands are as follows:
 - DSWA needs to have a cost-efficient, reliable and environmentally sound means of disposing of approximately 1,000,000 tons of MSW landfilled statewide each year, with approximately 638,000 tons being landfilled in New Castle County;
 - The City needs to have a cost-efficient, reliable and environmentally sound means of disposing of 60,000 tons of sewage sludge generated annually by Wilmington and New Castle County;
 - The Port of Wilmington needs capacity to place approximately 500,000 to 750,000 tons of dredged material per year in order to have adequate clearance from the river bottom for ships to dock.
3. Decisions are pending that will determine how waste materials are managed for both the short term and long term. These decisions include:
 - Pending permit application to expand Cherry Island Landfill. Without the requested expansion, DSWA claims the landfill will reach capacity at current fill rates in 2009;
 - Designation of a disposal alternative to Wilmington Harbor North, one of two alternating facilities operated by the U.S. Army Corps of Engineers for dredged material from Wilmington Harbor. Wilmington Harbor North is projected to reach capacity in 2009;
 - Resolution of City of Wilmington/New Castle County stabilized sludge disposal and reuse. Current reuse application reaches capacity in two to three years.
4. There is no consensus on when waste landfills or dredged material disposal areas will reach capacity. Capacity limits are dependent on factors such as:
 - Volume and fill rates;
 - Site stability;
 - Expansion feasibility;
 - Site management;
 - Material flow management

5. These issues are intertwined and related in ways that have a ripple effect, such as:
 - Future expansion of CIL depends on annexing adjacent Wilmington Harbor North. The timeline for transfer is uncertain;
 - Cherry Island Landfill limit could affect other DSWA facilities, particularly Sandtown outside Dover;
 - Expansion of Cherry Island Landfill puts pressure on communities located nearby that feel they shoulder a disproportionate burden of New Castle County's waste problem;
 - Fly ash from area power plants is used to create stabilized sewage sludge, which is currently used to regrade Pigeon Point Landfill. If the ash and the sludge cannot be beneficially reused in sufficient quantities, DSWA is obligated to accept the material at CIL at a significantly reduced tipping fee rate;
 - The type of and rate at which recycling is adopted will extend landfill capacity depending on whether it is residential MSW only or all MSW.

Solid Waste Issues

1. Cherry Island Landfill in New Castle County is reaching its fill limit as a result of design limitations, height restrictions in its current permit and a fill rate of approximately 2,046 tons per day. Under current conditions, capacity will be reached sometime over the next five years.
2. Capacity constraints in New Castle County can be ameliorated through:
 - An increase in CIL's height and volume;
 - A reduction in CIL's fill rate;
 - An expansion of CIL into adjacent property used by the Corps for dredged material disposal;
 - A new landfill; or
 - A combination of these factors.
3. There is no landfill capacity shortage in Kent and Sussex Counties. The Sandtown Landfill located south of Dover in Kent County has more than 55 years of capacity at current fill rates and could accommodate waste from New Castle County.
4. MSW generation is growing faster than predicted – an 18 percent increase in four years -- putting additional pressures on solutions for disposal and volume reduction.
5. DSWA has applied to DNREC for an expansion permit that would extend the life of the landfill by approximately 15 years (approximately 12 million tons). To expand capacity, the landfill height would be increased, stabilizing berms would be built and advanced drainage systems would be installed. The acquisition of the adjacent property currently used for dredged material disposal could bring an additional 13.5 million tons (or 15 to 20 years) of disposal capacity.
6. Opposition to the expansion from local citizen groups raises concerns that range from environmental issues (air quality, groundwater and surface water

contamination) to quality of life issues (environmental justice, odor, noise, truck traffic and declining property values).

7. The Delaware Solid Waste Authority is responsible for developing, adopting and implementing Delaware's Statewide Solid Waste Management Plan (SSWMP). The Plan represents the framework for DSWA to carry out its responsibilities for planning and managing the State's solid waste. The last comprehensive plan was issued in 1994.
8. The 1994 Plan specifically identifies *landfill avoidance* as the primary goal for waste management. Other goals such as "recycle and reuse 35% of household solid waste" and "recover resources, including energy from at least 50% of combustible solid waste" were not met, due both to Authority decisions and to factors beyond its control.
9. Prior to 1999, throughout the 1990s, DSWA shipped an average of 210,000 tons of MSW annually to a waste-to-energy facility in Chester, PA. Currently, out-of-state incineration is used only minimally as a disposal option (less than 10,000 tons per year) because of costs and revenue loss. The Chester facility still has capacity to take at least 500,000 tons annually, although that capacity may soon be filled by waste from New York City. In-state incineration is prohibited by a de facto ban on plant siting.
10. The recycling rate in Delaware for residential MSW is only 4 percent of all MSW. When commercial recycling is added, the rate of recycling for all municipal solid waste rises to approximately 22 percent, well below the national average of 28 percent and EPA's national goal of 35 percent. Delaware's recycling program involves a combination of systems ranging from voluntary drop-offs at recycling "igloos", to limited curbside programs, to oil filter, used motor oil and electronic goods recovery programs operated by DSWA. Senate Bill 225, Governor Ruth Ann Minner's draft recycling legislation, proposes recycling goals of 30 percent for residential MSW and 50 percent for commercial MSW.
11. If residential MSW recycling reaches a 30 percent rate, capacity at CIL would be expanded approximately 4.4 years over a 20-year period (this assumes the landfill expansion plans are permitted). If recycling of all MSW, including commercial, reaches a 40 percent rate, capacity at CIL would increase by approximately 13.3 years over the same period.
12. Significant reductions in the volume of MSW slated for disposal can most readily be achieved through recycling and waste-to-energy. Both of these options face formidable barriers in terms of costs, start-up and public acceptance. New waste disposal and conversion technologies are largely unproven on a large scale and are still in the development and pilot stage.
13. Siting a new landfill in New Castle County would help ease capacity constraints on Cherry Island, but if a site could be found, it would take an estimated ten years to complete design work, permit preparation, regulatory review, public review, site preparation and construction. This timetable exceeds the landfill's projected

capacity limit of less than five years under current fill rates. DSWA has said that it has not identified a site of sufficient size that is also able to meet siting requirements in New Castle County.

Dredging Issues

1. Two alternating confined disposal facilities (CDFs) operated by the U.S. Army Corps of Engineers are used for dredged material from Wilmington Harbor. The Harbor needs to be dredged every 8 months so that shippers that use the Port of Wilmington are assured of water depths that can accommodate their vessels. Wilmington Harbor North, one of the two CDFs, is projected to reach capacity by the end of 2009. The other site, Wilmington Harbor South, cannot be used as a stand-alone disposal facility because of the need for regular dewatering and maintenance. When used as an alternate site, WHS is expected to reach its capacity limit in approximately 35 years.
2. In 2002 the Corps and DSWA reached an agreement that allows WHN to expand and allow placement of dredged material up to and against the Cherry Island Landfill slopes to an elevation of +65 feet. The use of the landfill slopes for filling alleviated the necessity for construction of a cross dike and increased the capacity of the area. The Corps agreed to line the slopes with bento-mat and provide DSWA with a “takeover date”, at which time all dredged material placement operations would cease. Initial discussions projected a January 2010 turnover. Because of the uncertainty of shoaling rates and the uncertainty with respect to designing higher containment dikes, a decision by the Corps on the turnover date has not been finalized. There seems to be some disagreement between the Corps and DSWA on the nature of the agreement and turnover date, with the Corps claiming a later date due to lower shoaling rates which makes for more capacity than envisioned when the 2002 agreement was reached. Whatever the final resolution of this issue, it is likely that any Corps plan to continue using WHN for dredge disposal past 2010 would have to be renegotiated.
3. Due to recent large and costly modifications to the WHN and WHS disposal area in the last five years, the amortized cost for disposal, which is the price that the Corps charges the Port for use of the disposal areas, has been recalculated, resulting in a substantial increase in this fee. The Port of Wilmington has benefited from below-cost disposal charges in years past. The latest agreement negotiated with the Corps in 2004 reflects a 275 percent increase from the previous agreement and indications are that the price will continue to rise to reflect actual disposal costs. As disposal costs increase, the range of economically feasible disposal alternatives broadens.
4. The Corps is required to perform a dredged material management plan (DMMP) if it determines that there is insufficient capacity to accommodate maintenance dredging for the next 20 years. A preliminary DMMP has been prepared but has not been released as an official draft for agency and public comment. The DMMP is the basis for the administrative process used to investigate alternative methods of disposal and alternate disposal areas and to identify the best option for new capacity for Wilmington Harbor dredged material.

5. In its preliminary DMMP, the Corps screened 39 disposal options including developing new disposal sites near the Port. No new sites were determined to be feasible and the Corps finally settled on a preferred alternative that would utilize two existing CDFs -- Killcohook in New Jersey and Biddles Point in Delaware along the C&D Canal -- as alternating sites with WHS. This would involve an "exchange." Dredged material from the Delaware River main channel maintenance normally deposited in New Jersey would be sent to Biddles Point in exchange for Wilmington Harbor material being pumped to Killcohook. The Corps asserts there would be no net increase in dredged material deposited in New Jersey through the exchange.
6. The preferred alternative is unlikely to be supported by New Jersey. Killcohook is located along the New Jersey shoreline, however, because of a colonial era mapping anomaly, two of its three disposal cells are located within the expanded border of New Castle County, Delaware. As might be expected, New Jersey officials do not see this as justification for dumping Delaware dredged material on their side of the Delaware River. New Jersey's willingness to accept dredged material from Delaware is impeded by their concern that they already accept large quantities of main channel maintenance material and would be required to take even more if the channel is deepened as proposed. In addition, Delaware's recent decision to deny a permit for construction of BP's LNG terminal caused some New Jersey officials to call for retaliation. The current interstate political climate is not conducive to a ready resolution of this issue.
7. Even though the preferred alternative had the best benefit-cost ratio, it is still costly. Initial construction costs are approximately \$26,300,000. The Corps estimates average annual costs over the 50-year life of the project at \$4.4 million per year. Disposal costs would be \$7.85 per cubic yard compared to the current cost of \$1.68 per cubic yard that the Corps charges the Port.
8. There are options not fully explored in the DMMP that could potentially provide additional capacity in the short-term and long-term and/or eliminate the disposal requirement entirely. These options require additional study. They include:
 - Extending the life of WHN through a more aggressive approach towards dewatering and consolidating the filled material;
 - Expanding WHN using stabilized sludge and/or a dredged material blend as construction material, depending on its consistency and the concentrations of environmental contaminants;
 - Using dredged material that would normally be disposed of in a CDF for a variety of purposes ranging from construction material to fill for environmental restoration projects, again depending on its consistency and the concentrations of environmental contaminants;
 - Relocating the main berths that are currently on the Christina River out to the Delaware River and discontinuing dredging the Harbor. Relocation would allow the berths to benefit from the 40-foot depths provided by the Delaware River's main channel that is regularly maintained by the Corps for navigation purposes. The Port currently has one berth situated on the river – the

roll-on/roll-off berth for automobiles. This berth accommodates ships with a 36-foot draw and never has to be dredged.

- Piping dredged material directly to New Jersey.
9. An examination of the proposed deepening of the main channel of the Delaware River from its current depth of 40 feet to 45 feet reveals that disposal sites for the deepening do not directly compete for capacity with disposal sites designated for dredging Wilmington Harbor. While there is no direct competition for disposal site space, concerns expressed by New Jersey officials related to the deepening compound their concerns about the proposal to pump material to Killcohook.

Sewage Sludge Issues

1. Approximately 60,000 tons of sewage sludge is generated annually by the wastewater treatment system that serves the City of Wilmington and parts of New Castle County. While the City owns the plant and contracts for its operation, New Castle County generates approximately 70 percent of the treated wastewater, with the remainder generated by the City itself.
2. VFL Technologies operates a biosolids treatment facility under contract with the City's wastewater treatment plant operator, USFilter, to convert the plant's sewage sludge into a usable product called "stabilized sludge." VFL has overall responsibility for managing sludge disposal from the facility.
3. The regional power utility Delmarva Power (formerly Conectiv) contracts with VFL to take all of the fly ash (approximately 100,000 tons/year) created through coal combustion at its power plant in Edgemoor, New Castle County. Even though Delmarva Power has limited on-site capacity for disposal of its fly ash, it would run out of space in less than a year if it had to dispose of all of its ash in its landfill. Thus, USFilter's contract with VFL to stabilize the sludge takes care of two waste streams. This has allowed both the City and Delmarva Power to dispose of their wastes in an economical and environmentally acceptable manner.
4. Since January 2003, stabilized sludge has been utilized in a cap enhancement project at the former Pigeon Point Landfill to promote better drainage and reduce leachate production. The regrading plan at Pigeon Point called for approximately 1.5 million tons of stabilized sludge material to be used as bulk fill over a period of nine to ten years at approximately 150,000 tons per year. However, in the twelve months between September 2004 and August 2005, VFL delivered more than 362,000 tons of stabilized sludge to Pigeon Point Landfill, more than double the annual placement amount originally planned. If fill rates were to continue at this level, this management option would be available for only an additional two to three years.
5. Of the 362,000 tons of stabilized sludge being placed annually at Pigeon Point, approximately 200,000 tons of materials come from out-of-state – primarily from regional power plants. In effect, the annual amount of mixture from outside Delaware exceeds the annual total originally planned for Pigeon Point and

contributes to reaching project completion prematurely. This and other limitations posed a level of uncertainty that caused the City to examine alternative means of disposal.

6. In 2004, the City of Wilmington Department of Public Works hired a local environmental engineering firm to evaluate opportunities to beneficially use stabilized sludge and dredged material for Port needs. The report argues that because of the unique site stability issues and desired staging characteristics, stabilized sludge could be used to expand the WHN site by placing the material on the exterior and top of existing dikes and that large counterberms could also be built with the material to stabilize the site and allow for significant vertical expansion. The report adds that the use of stabilized sludge will make WHN more viable for DSWA's expansion plans.
7. The report concludes that there is the potential for use of more than four million cubic yards of stabilized sludge at WHN and Pigeon Point representing 20 years of placement capacity for the City. In addition, if each site expands, there is the possibility of as much as an additional 20 years capacity. The report acknowledges that significant engineering evaluation and multi-party collaboration is required for this proposal to be adequately assessed.

NOTE: Recommendations based on these and other findings examined in detail follow at the end of the document.

II. MUNICIPAL SOLID WASTE AND LANDFILL CAPACITY IN DELAWARE

Delawareans landfilled almost one million tons of municipal solid waste (MSW) in 2004 and this number is expected to rise as the state's population and economy continue to grow. Already, waste generation has increased faster than originally predicted just three years ago. This has caused landfill capacity projections to be revised and adds new urgency to the search for solutions to future disposal needs, particularly in New Castle County where the main landfill is predicted to reach capacity by the end of 2009. The following discussion reviews the current system for managing MSW in the State and examines proposed options for future management, including landfill expansion and mandatory residential recycling.

A. BACKGROUND

Municipal solid waste, or MSW, is commonly known as garbage or trash. It consists of everyday items such as product packaging, grass clippings, furniture, clothing, food scraps, office and classroom paper, bottles and cans, boxes, wood pallets, newspapers, appliances, automobile tires, consumer electronics, and batteries.¹ MSW does not include construction and demolition debris, automobiles, biosolids (sewage sludge), or industrial process wastes. Even though these materials may sometimes be disposed in municipal waste landfills, they are handled and considered separately from MSW. Sources of MSW include residential (homes), institutional (schools, libraries, prisons), commercial (offices, restaurants, small businesses), and some industrial sources. While the state's landfills accept a small amount of non-MSW, for purposes of this report, all landfilled waste will be considered MSW.

MSW is often categorized as durable goods (e.g., appliances, furniture, carpets, tires, batteries), nondurable goods (e.g., newspapers, magazines, office papers, junk mail, disposable diapers, clothing), containers and packaging, and other wastes (i.e., yard wastes, food wastes, and miscellaneous).

Franklin Associates, a consulting firm that conducts a national MSW report annually for the U.S. EPA, completed a similar study for the DSWA in September 2002 in order to quantify and characterize MSW generation, resource recovery and disposal in Delaware.² The study broke down the composition of Delaware's municipal solid waste as follows:

¹ U.S. EPA, *Municipal Solid Waste in the United States: 2001 Facts and Figures*, October 2003

² Franklin Associates, Ltd., *Assessment of Delaware Solid Waste Discards in 2000 and the Potential for Recycling of Materials*, September 2002

Table 1: Composition of Delaware MSW

Waste Category	Percentage of MSW Waste Stream
Durable Goods	14.3
Nondurable Goods	21.6
Glass Packaging	3.2
Steel Packaging	1.0
Aluminum Packaging	0.7
Paper and Board Packaging	15.3
Plastics Packaging	3.9
Yard Waste	26.1
Food Waste	9.6
All Other Wastes	4.4

Of the MSW generated in Delaware, approximately 60 percent of the waste stream is generated by the residential sector, with the remaining 40 percent contributed by the commercial sector.³ These percentages are similar to those for the nation as a whole.

Over the past forty years, MSW generation across the country has grown from 88 million tons in 1960 to 230 million tons in 2001.⁴ This is partly a function of a growing population. But the rate of generation, measured per capita, has also almost doubled from 2.7 pounds per person per day in 1960 to 4.6 pounds per person per day in 2001.⁵

Delawareans, too, are generating more MSW at a faster rate. In fiscal year (FY) 2000,⁶ DSWA reported landfilling statewide a total of 843,000 tons of MSW, including some non-municipal solid waste. By FY 2004, the total landfilled had risen to nearly 995,000 tons (64 percent of which was disposed of at the Cherry Island Landfill) – an eighteen percent increase in MSW generation in only four years. The following chart shows the actual amount of MSW landfilled in Delaware in FY 2000 and projected amounts for FY 2005 and the next twenty years. In order to estimate future landfill demands, two compound annual growth rates (CAGRs) were utilized. The more conservative CAGR of 0.37 percent is based on 1997 U.S. Census population projections for Delaware.⁷ The more aggressive CAGR of 1.37 percent was calculated using actual population growth for Delaware since July 2000.⁸ Assuming current MSW management practices, Delaware’s annual landfilling needs are projected to grow to between 1,017,000 and 1,080,000 million tons by 2010 and to between 1,075,000 and 1,324,000 million tons by 2025. Given the actual growth in tons landfilled observed over the last five years, the projected values may be on the low side.

³ Franklin Associates, Ltd., *Assessment of Delaware Solid Waste Discards in 2000 and the Potential for Recycling of Materials*, September 2002, p. ES-6

⁴ U.S. EPA, *Municipal Solid Waste in the United States: 2001 Facts and Figures*, October 2003

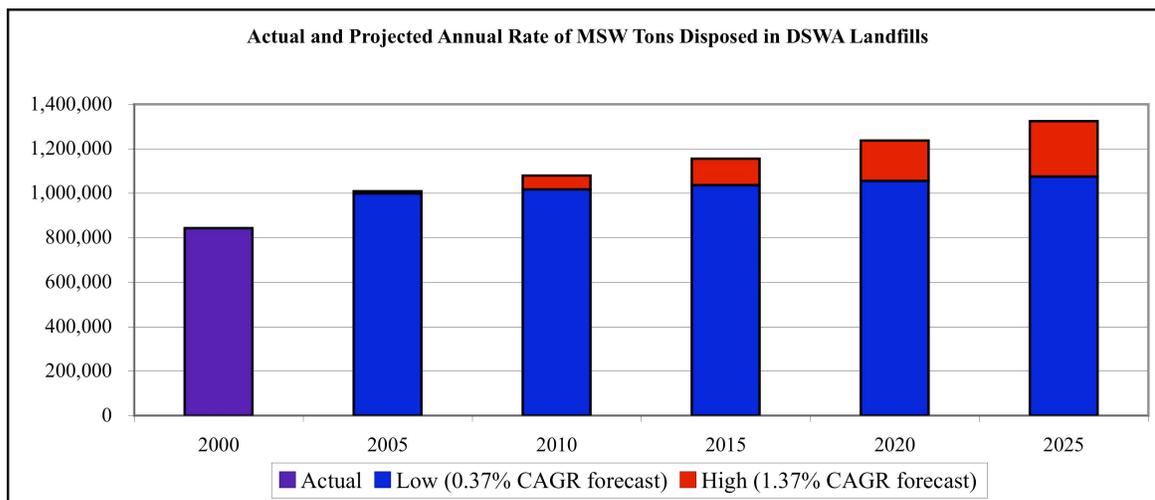
⁵ Ibid

⁶ DSWA maintains its records on a fiscal year of July to June, rather than a calendar year.

⁷ U.S. Department of Commerce, *Population Projections: States, 1995-2025*, May 1997

⁸ U.S. Department of Commerce, *Annual Estimates of the Population for the United States, and for Puerto Rico: April 1, 2000 to July 1, 2004*, December 2004

Chart 1



B. MSW MANAGEMENT IN DELAWARE

1. Delaware Solid Waste Authority

Until the early 1970s, Delaware’s municipal solid waste was managed haphazardly by local communities using an incoherent arrangement of public and private collection and open burning and dumping of trash as common disposal methods. Few safeguards existed to protect the environment from the hazards associated with land disposal or incineration. At this juncture, Governor Russell Peterson transferred responsibility for solid waste management from the Board of Health to the Department of Natural Resources and Environmental Control (DNREC).⁹ In August 1974, DNREC completed the “State Plan for Solid Waste Management” which recommended the formation of a statewide authority to manage solid wastes on a statewide basis. Acting on this recommendation, the General Assembly established the Delaware Solid Waste Authority in August 1975, which began operating in 1976.

The enactment of Title 7 Delaware Code, Chapter 64, created the DSWA and charged it with implementing solid waste disposal and resource recovery systems and providing solid waste management services throughout the state. In addition to creating the Authority, the new legislation (under §6404(c)) included the establishment or development of:

- A statewide comprehensive program for management, storage, collection, transportation, utilization, processing and disposal of solid waste
- A program for the maximum recovery and reuse of materials and energy resources derived from solid wastes

⁹ Delaware General Assembly Joint Sunset Committee, *Joint Sunset Committee 2004 Final Report*, June 10, 2004

- A program for protecting the State’s land, air, surface, and groundwater resources from depletion and degradation caused by improper disposal of solid waste
- A program for disposal of infectious waste, giving special attention to the management and operation of an infectious waste facility
- A program in cooperation with the U.S. EPA, or other federal and state agencies, for the demonstration of systems and techniques of materials recovery, market development, and reuse
- A statewide solid waste management plan, which provides the framework for DSWA to carry out its solid waste management responsibilities.

To achieve these aims and enable it to implement the statewide solid waste management plan, the legislature endowed the DSWA with many functions and powers, which include but are not limited to the following:

- Manage, operate and maintain solid waste disposal and resource recovery facilities;
- Provide solid waste management services, recover material and energy resources from solid wastes, and produce revenues from these services sufficient to support the Authority and its operations on a self-sustaining basis;
- Coordinate efforts directed toward source separation for recycling purposes and assist in the development of industries and commercial enterprises within the State based upon resource recovery, recycling and reuse;
- Develop and implement a licensing program for waste haulers;
- Set and charge reasonable fees for the services it performs;
- Determine the location and character of any project to be developed under Chapter 64 without the need to obtain land use approval;
- Issue bonds or notes to finance any project to meet the purposes of Chapter 64;
- Control the collection, transportation, storage and disposal of solid waste to facilities owned, operated or controlled by the Authority;
- Contract when possible with municipal, county and regional authorities, state agencies, individuals or firms to provide waste management services and to operate and maintain solid waste disposal and processing facilities.

a. DSWA Board and Staff

The DSWA is governed by a Board of Directors that is responsible for setting policy and making decisions regarding operations, programs and planning. The Board is also required to adopt a Statewide Solid Waste Management Plan to provide the framework for current and future solid waste management decisions.¹⁰

The Board of Directors consists of seven members appointed by the Governor. With the exception of the Chairman, who serves at the pleasure of the Governor, all board members must be confirmed by the Senate. Directors are appointed to three-year terms, although 5 of the 6 current members have served more than 10 years, and three have served 24 years or more. The composition of the board and the tenure of its members are issues that were raised by some of the individuals we interviewed who characterized the Board as “too

¹⁰ www.dswa.com/about/about_board.htm

political” and in need of “a broader perspective.” It was suggested that one of the directors should have some experience in the solid waste industry.

Day-to-day management of the Authority is overseen by the Chief Executive Officer, N.C. Vasuki. The CEO is responsible for recommending the agency’s organizational structure, and for planning and implementing a comprehensive statewide solid waste management program.¹¹ Mr. Vasuki, who has announced his retirement, has served as CEO/General Manager since 1991 and prior to that served from 1976 to 1991 as General Manager. He is assisted in his managerial duties by the Chief Operating Officer, Pasquale Canzano, who has been with DSWA for 27 years, first as Chief of Engineering from 1977 to 1991, and from 1991 to the present in his current position.

Discussions with members of the waste hauling industry revealed a generally high regard for the DSWA management. Said one hauler, “Delaware is one of the better states to deal with. [DSWA] is the best run and you can get someone with decision-making authority on the phone. The same thing goes for DNREC.” Mr. Vasuki was described as well respected throughout the country for being innovative, open-minded and knowledgeable regarding approaches to waste management. Some outside the industry criticized the Authority for emphasizing revenues over landfilling alternatives.

b. Statewide Solid Waste Management Plan (SSWMP)

The Authority is responsible for developing, adopting and implementing Delaware’s Statewide Solid Waste Management Plan (SSWMP). The Plan represents the framework for DSWA to carry out its responsibilities for planning and managing the State’s solid waste. The last comprehensive plan was issued in 1994, with amendments to the Plan having occurred periodically following the public notice and hearing process. In addition, DSWA has issued annual and subject-specific reports that deal with emerging issues. While it is now outdated, the 1994 plan provided direction that has influenced DSWA’s planning and operations over the past ten years. Other states are required by law to review and/or update their plans on a more regular basis. Ohio is required to review its plan every three years; Arkansas’ plan requires annual review. New Jersey is in the midst of the public review process for updating its plan, which requires updates every two years. Pennsylvania updates its plan every two years.

In its last plan, DSWA established overall policy objectives and goals for solid waste management. The goals were wide-ranging and directed the Authority to achieve an aggressive set of benchmarks. Among them were goals for recycling and material recovery and development of a system for achieving those goals, including:

- Recycle and reuse 35% of household solid waste through materials markets by 2001
- Recover resources, including energy from at least 50% of combustible solid waste by 2001
- Recover resources, including energy from at least 70% of combustible solid waste by 2010

¹¹ Delaware General Assembly Joint Sunset Committee, *Joint Sunset Committee 2004 Final Report*, June 10, 2004

- Plan a statewide system with potential for growth to meet the adopted goals for recycling and resource recovery
- Maintain a fifteen year reserve for Statewide landfilling capacity

Some of the Plan's key objectives directed the Authority to:

- Assess new technology through research and development, and incorporate the findings into new and existing projects
- Incorporate flexibility into the SSWMP to adjust to future changes in waste characteristics
- Identify special wastes generated in the State, evaluate current management practices, and recommend courses of action

The 1994 Plan also specifically identifies *landfill avoidance* as the primary goal for waste management.¹² This goal and those above were to be used, in conjunction with projections for solid waste generation, to guide the Authority's planning decisions. Although the projections for MSW generation were remarkably close to actual values, some of the Plan's stated goals were not met, due both to Authority decisions and to factors beyond its control. For instance, DSWA's ability to meet the goals outlined in the Plan has been influenced by legislative and judicial decisions, such as the *Carbone* case, which ended state regulatory flow control, and the passage of Delaware's SB 280, which in effect bans incineration within state borders. While the Authority definitely had to adapt to these changing market conditions to remain viable, it chose to resist until recently publicly driven efforts to develop curbside recycling. DSWA's success in meeting the stated goals should be considered within the context in which the goals were originally established, as well as in light of industry and regulatory changes that have occurred since 1994.

1) *Resource Recovery*

In stressing landfill avoidance, the 1994 SSWMP placed a heavy emphasis on waste-to-energy (WTE) as a preferred waste handling method. At the time the SSWMP was released, DSWA was still producing refuse-derived fuel (RDF) from MSW at the Delaware Reclamation Plant (DRP) in New Castle. Originally intended for the adjacent Energy Generating Facility (EGF), a 600 ton-per-day WTE facility that was shut down in 1990, the RDF was sent to a WTE facility in Chester, Pennsylvania until the ultimate closure of the DRP. These events did not deter the Authority from continuing to promote the consideration of WTE as a primary source of waste management.¹³

The reasons for this from the Waste Authority's perspective are clear. Combusting MSW in a waste-to-energy incinerator promotes the dual benefits of reducing the volume of waste requiring disposal (by 90 percent), therefore extending landfill life, and producing energy as a useful byproduct. However, it is not without controversy as was demonstrated with the passage of Senate Bill 280 in 2000. Public opposition to incinerators, which led to the bill, makes siting of a waste-to-energy facility in the state extremely difficult. Despite this strong policy statement by the General Assembly on the siting of facilities within the State, the use of out-of-state facilities is not barred and could be used as the

¹² DSWA, *Statewide Solid Waste Management Plan (SSWMP)*, Adopted May 1994, p.64

¹³ Ibid

DSWA did throughout the 1990s, when it sent shipments of MSW to the Chester facility in quantities up to 1,000 tons per day. More discussion of WTE follows further in this report.

2) *Recycling*

While DSWA has not been able to utilize WTE in-state to meet its resource recovery goals, a certain degree of landfill avoidance is still attainable through recycling. DSWA established the Recycle Delaware program as a voluntary drop-off program for residential recycling. However, Recycle Delaware currently produces only a 4% residential recycling rate. While the Authority has been extremely successful in developing innovative and nationally-recognized recycling programs for certain materials, such as oil filters, electronic goods and junk mail, the Recycle Delaware program has fallen severely short of the SSWMP's stated goal of recycling and reusing 35% of household MSW. In May 2003 DSWA launched a subscription recycling service that currently serves approximately 5000 households in New Castle County. However, numerous parties are now calling for legislatively-mandated recycling programs in order to raise the residential MSW and overall MSW recycling rates. The Recycling Public Advisory Council's proposed mandatory curbside recycling program and Governor Minner's proposed voluntary recycling program are discussed in detail in later sections.

3) *Landfill Capacity*

Since 1994, the Authority has been able to meet its goal of maintaining a 15-year reserve of landfill capacity *statewide* (although the SSWMP only contains solid waste projections for ten more years, through 2015). Based on DSWA's current fill estimates (which do not include increases in annual waste generation), statewide capacity is approximately 17 years.¹⁴ However, in New Castle County, landfill reserve seems to have run up against the reality of shrinking capacity, a lack of new sites and rapid growth in southern portions of the county. Cherry Island Landfill (See Figure 2), which in FY 2004 accepted approximately 64 percent of the state's MSW, has less than 5 years of capacity remaining at currently permitted height restrictions. The expected life of the landfill was originally much longer. However, ongoing monitoring indicated higher than planned pore pressure readings and a reduction in the factor of safety that required the Authority to change its filling patterns and utilize setbacks to increase the landfill's stability. Consequently, these changes shortened the available life.

Much has happened in the area of MSW management both nationally and in Delaware in the last decade. Besides the closure of the DRP and the passage of SB 280, DSWA has had to face the end of state-regulated flow control and rapid growth in some areas of the state. This has placed additional pressures on landfill capacity at Cherry Island and spurred plans for expansion. The Authority is generally regarded as having managed its responsibilities and changing circumstances well. However, the Statewide Solid Waste Management Plan serves as a policy document where results can be measured, current conditions assessed and new objectives set in the context of transparent and robust public discourse. All of these points underscore the need for an updated Plan that reflects current conditions.

¹⁴ DSWA, *FY2004 Closure and Post Closure Care Cost Estimate Memorandum*, July 23, 2004

2. Environmental Regulation of MSW

The Department of Natural Resources and Environmental Control's role in the state's solid waste management system is to ensure that solid wastes are handled in a manner that protects human health and the environment. DNREC's Solid and Hazardous Waste Management Branch (SHWMB) is responsible for all permitting, inspection and regulatory activities for the generation, disposal, transportation and recycling of solid and hazardous waste in Delaware. This includes:

- All landfill permitting, inspection and enforcement;
- All transfer station, resource recovery and transportation permitting, inspection and enforcement;
- All solid waste regulations and program development;
- Waste material beneficial reuse;
- Recycling and composting facility approvals;
- Waste tire management; and,
- Bottle bill regulations and administration.

With regard to recycling, DNREC conducts various outreach activities to increase public awareness of recycling opportunities. It also supports the Recycling Public Advisory Council through administrative support, by providing research funding, and by offering technical assistance for recycling Grant Assistance Program grant applicants and recipients.

One of several Memorandums of Understanding (MOUs) between DSWA and DNREC formalizes quarterly meetings between the agencies to address issues of mutual interest, including policy concerns and DSWA projects.¹⁵

In 1994, DNREC also participated in the planning sessions conducted by DSWA to identify goals and objectives for the Statewide Solid Waste Management Plan. While DNREC staff has the opportunity to comment on DSWA's planning approach as part of the public hearing process, the extent of the Department's involvement in any future update of the SSWMP remains unclear.

3. MSW Collection

a. Waste Hauling

While the types of MSW may not vary significantly from household to household throughout Delaware, the way it is collected once it is generated differs significantly throughout the state. In incorporated areas in New Castle County, municipal crews serve 87 percent of households, including Newark and Wilmington (with the exception of 5,000

¹⁵ Delaware General Assembly Joint Sunset Committee, *Joint Sunset Committee 2004 Final Report*, June 10, 2004

households in large apartment buildings in Wilmington under private contract).¹⁶ Thirteen percent of households are served through municipal contracts with a private hauler, such as those in place in Delaware City and Middletown. Unincorporated areas account for 74 percent of households in New Castle County, only five percent of which self-haul their trash. The remaining 95 percent utilize subscription service with one of at least 10 private hauling companies.¹⁷ Ninety percent of the subscription service market is held by Waste Management, Inc. and BFI, with Independent Disposal Services holding approximately five percent of the market.¹⁸

In Sussex County, a higher percentage of residents self-haul their waste to collection stations or landfills (16%). Five municipalities provide municipal pickups with their own crews (4%). The remaining 80 percent of residents receive curbside collection service provided by private haulers, whether through subscriptions service or paid for by their municipality. Approximately 11 private haulers offer curbside service in Sussex County.

Kent County differs from the other two counties in that the county is divided into 87 collection districts which are then awarded on the basis of a competitive bid process. Currently, BFI holds the contract which lasts for a period of three years, with one-year options. The districts cover over 8,650 households, or roughly 17 percent of Kent county residents, with the remainder having municipal pick-up (19%), using private haulers (55%) or self-hauling (9%). Approximately 11 private haulers operate in Kent County.

In addition to municipal solid waste hauling, a small amount of recyclables collection is occurring in pockets throughout the state. A handful of municipalities use their own crews to collect some degree of recyclables (Camden, Delaware City, Wilmington) and/or yard waste (e.g. Newark) to be used for mulching. Starting in May 2003, DSWA began offering a subscription-based service for curbside collection of recyclables in parts of New Castle County, expanding to the whole county in September 2004 and to Kent County in September 2005.

b. Licensing

There are 32 private and 14 municipal waste haulers licensed by DSWA. All solid waste collectors that deliver solid waste to DSWA facilities are required to possess a license issued by DSWA, but do not pay a fee for the license. Waste haulers are also required to obtain a Solid Waste Transporters Permit from the Department of Natural Resources and Environmental Control (DNREC) in order to legally transport solid waste in the state. Transporters pay an annual permit fee of \$300.

c. Tipping Fees

Once MSW has been collected, the majority of it is delivered to one of three operating landfills in the state. Until 1992, DSWA charged a different tipping fee at each of the county landfills. In 1992 the system changed to a Statewide User Fee System in which all landfills charge the same tipping fee. In June 2005, the tipping fee for municipal solid waste at all of the facilities rose to \$61.50 per ton, up from the \$58.50 per ton price that

¹⁶ DSM Environmental Services, Inc., *Evaluation of Enhanced Residential Waste and Recyclables Collection and Processing for New Castle County*, October 15, 2003

¹⁷ Ibid

¹⁸ Ibid

had remained constant for eleven years. Special wastes have higher tipping fees, such as tires (\$145.00 per ton) and asbestos (\$100.00 per ton plus \$100 per truckload). Self-hauling residents pay \$1.00 per bag at collection stations.

d. Differential Disposal Fee Program (DDFP)

Prior to 1994, state and local governments could dictate that the municipal solid waste generated within their borders be directed to local waste disposal facilities. In 1994, this practice, known as flow control, was outlawed by the U.S. Supreme Court's decision in *Carbone (v Clarkstown, New York)*, thereby threatening the financial commitments local governments and waste agencies had made in municipal solid waste management systems. In 1999, DSWA responded to this ruling by instituting the Differential Disposal Fee Program (DDFP) as a way of keeping waste coming to its landfills and ensuring more predictable waste flow (and fees) to its facilities. Those haulers that enter into a five-year, exclusive contract with DSWA to bring all of their solid waste collected in Delaware to its facilities receive an annual rebate based on the tonnage delivered. The rebate is \$13.50 per ton at the Cherry Island Landfill and \$10.00 per ton at the Sandtown Landfill, Jones Crossroads Landfill and Pine Tree Corners Transfer Station. Between July 2003 and June 2004, all but three of the licensed haulers in Delaware participated in the DDFP. A new five-year contract began on July 1, 2005 at which time the "at the gate" tipping fee for municipal solid waste increased to \$61.50 per ton, while the rebate amounts remained the same. In addition, DDF customers pay only \$42.00 per ton for dry waste at the Sandtown and Jones Crossroads landfills.

4. Waste Disposal into State Landfills – The Heart of the Issue

The majority of Delaware's municipal solid waste has historically been managed through landfilling. Throughout the 1990s, DSWA shipped between 500 and 1,000 tons per day of MSW to a waste-to-energy facility in Chester, Pennsylvania, averaging almost 210,000 tons annually. However, this practice stopped in 1999 and DSWA now manages Delaware's municipal solid waste exclusively through landfilling and some recycling programs. Delaware landfills do not accept waste that is generated outside the state (Title 7 Del. Code §6428 expressly prohibits the deposit of waste generated out-of-state in facilities owned and/or operated by the Authority; however, as a public instrumentality, DSWA could request the state law changed).

The DSWA owns and manages four landfills in Delaware, three of which are active. DSWA closed the fourth, Pigeon Point Landfill, in 1985, but continues to manage the site's post-closure care activities. DSWA also operates five collection stations in Kent and Sussex Counties, as well as a transfer station and an intermediate processing facility for recycling in New Castle County. Each of the operations is described in the following sections.

a. Landfills

1) *Southern Solid Waste Management Center (SSWMC)*

The Southern Solid Waste Management Center (SSWMC) opened in September 1984 and is located in Sussex County at Jones Crossroads, approximately 7 miles west of Millsboro.

The complex is 572 acres in size, with 200 acres devoted to landfilling and 372 acres used for buffers areas, weighing and maintenance facilities, and other purposes.¹⁹ The Southern Landfill (also known as Jones Crossroads Landfill or Rt. 20 Landfill) is constructed entirely aboveground due to the high water table in the area. Leachate produced in the landfill is either recirculated back into the landfill or transported to Cherry Island Landfill and pumped to the City of Wilmington's Waste Water Treatment Plant (WWTP) for treatment. A landfill gas collection system that captures and flares off landfill gases collected approximately 30.4 million cubic yards of landfill gas in FY 2004.

On average, the landfill accepts approximately 724 tons of MSW per day (based on 312 operating days per year). In FY 2004, the facility landfilled 225,800 tons of solid waste.²⁰ DSWA estimates that the current active landfill cell will fill in 2014. The entire landfill is expected to provide capacity for an additional 28 years.

2) *Central Solid Waste Management Center (CSWMC)*

The Central Solid Waste Management Center is located in Sandtown, Kent County, approximately 13 miles southwest of Dover. Opened in October 1980, the site encompasses 771 acres. Leachate at the site is managed by recirculation through the landfill or by treatment at Wilmington's WWTP. A landfill gas collection system captures and flares off landfill gases at a single location. In FY 2004, the gas collection system collected and flared 23.8 million cubic yards of landfill gas.

On average, the CSWMC handles approximately 419 tons of solid waste per day. The facility landfilled 130,700 tons of solid waste in FY 2004. DSWA estimates that the current active landfill cell will fill in 2016. The entire landfill is expected to provide capacity for at least 50 years.

3) *Cherry Island Landfill*

The Cherry Island Landfill (CIL), also known as NSWMC-2, is one of two landfills that comprise the Northern Solid Waste Management Center. The other, the former Pigeon Point Landfill (NSWMC-1), is closed and is addressed in the next section.

The Cherry Island Landfill (CIL) occupies 238 acres on a 513-acre site in the southeastern part of the City of Wilmington, east of I-495 and south of 12th Street. The CIL is bounded on the east by the Delaware River, on the south by the Christina River, and on the north by the City of Wilmington's Wastewater Treatment Plant settling ponds. The facility, which opened in September 1985 with the closure of the Pigeon Point Landfill, received an average of approximately 2,046 tons of MSW per day and landfilled more than 638,200 tons in FY 2004.²¹

a) *Current Landfill Design and Capacity*

The Cherry Island Landfill's design differs markedly from the other two active MSW landfills in the state, which were constructed on solid ground with synthetic liners.

¹⁹ DSWA, *SSWMP*, p. 32

²⁰ DSWA, *DSWA 2004 Annual Report*

²¹ *Ibid*

The CIL is situated atop a former Army Corps of Engineers dredged material disposal site. Since the dredged materials were hydraulically deposited and fine-grained, their consolidation through drainage occurs very slowly over time.²² However, the landfill designers determined that the naturally slow drainage process could be hastened if waste was placed in the landfill according to a specific design scheme and schedule. This process would also have the effect of consolidating the dredged material below.²³ Because of its low permeability, DNREC deemed the 40-to-60 feet of dredged materials thick enough and with an appropriate hydraulic conductivity to qualify as a natural liner. Except on the side slopes of one perimeter berm which is lined with a geosynthetic clay liner, the landfill's liner system consists of the natural dredged materials liner.

When originally designed, the landfill was expected to have disposal capacity until approximately 2017. However, several factors have shortened the expected lifespan. First, as noted earlier, Delawareans are generating more waste at a faster rate than was predicted when the landfill was opened. Second, as will be described below, the Authority was forced in 1999 to make changes to CIL's fill plan, which decreased remaining capacity.

DSWA has installed in and around the landfill approximately 300 geotechnical instruments (including inclinometers, piezometers, total pressure cells, settlement plates and thermistors) that record indicators of landfill stability. In 1999, some monitors began indicating higher than planned readings of pore pressure (pressure of water in the void spaces in the underlying soils). The same year, Schnabel Engineering Associates evaluated the landfill's stability for DSWA and determined that "enhancements were needed to allow continued waste disposal."²⁴ At that time, DSWA altered its plan for placement of waste in the landfill in order to preserve its integrity and maintain safety. That move also had the consequence of decreasing the available disposal volume. Currently, the CIL is expected to reach capacity by the end of 2009 without significant improvements. DSWA has submitted an application to vertically expand the landfill, with the most recent revision calling for a final height of 195 feet. The expansion, described in more detail in following sections, was expected to extend the life of CIL by approximately 20 years, based on a projected annual average disposal quantity of 1,000,000 cubic yards per year.²⁵ DSWA now estimates a more conservative additional capacity of 15 years based on increasing MSW generation rates.

In addition, adjacent land called Wilmington Harbor North, which is owned by DSWA but is currently being used by the Army Corps of Engineers for disposal of dredged material from Wilmington Harbor, was expected to be available as early as 2004. DSWA now expects the parcel to be available in 2010²⁶ based on an agreement reached with the Corps in 2002; however, there seems to be some disagreement with the Corps on the nature of the agreement and handover date, with the Corps claiming a later date due to lower shoaling rates which makes for more capacity than envisioned when the 2002 agreement was reached.

²² DSWA, *SSWMP*, p. 29

²³ Discussion with Pasquale Canzano, DSWA

²⁴ GeoSyntec Consultants, *Application for Solid Waste Permit Modification (Cherry Island Landfill Expansion Project)*, Volume 7, p. VIb-2, June 2004

²⁵ *Ibid*, p. VIb-80

²⁶ DSWA, *DSWA 2003 Annual Report*

As will be discussed further in the report, because of a shortage of readily available capacity for dredge material disposal, proposals have been made that would delay handover by approximately five years beyond 2009. DSWA estimates that WHN could provide an additional 13.5 million tons of disposal capacity.²⁷ Once the Authority regains control of the parcel, they expect to take two to three years to dewater and consolidate the dredged material and further prepare the site to accept solid waste.

b) *Leachate and Landfill Gas*

Management of the landfill is not limited to determining the placement of solid waste within the structure. It also includes managing leachate, which is created by liquids, primarily precipitation, percolating through the landfill, and managing landfill gases, such as methane and hydrogen sulfide, that are created as wastes decompose.

Leachate Collection System

Precipitation that falls on the landfill percolates through the structure and mixes with other liquids present in the waste. Collectively, this is known as leachate and may contain contaminants such as ammonia, heavy metals or suspended solids, depending on the composition of the waste handled. The CIL was designed with an extensive leachate collection system, which captures the leachate and pumps it to the City of Wilmington Wastewater Treatment Plant. The system also removes some of the water present in the underlying dredged material layer and conveys it to the treatment plant as well. In FY 2004, 90.3 million gallons of leachate and pore water from the unconsolidated soils in the underlying dredge layer from CIL was collected and treated.

The collection system includes 47 sampling points to monitor production, as well as the quality of groundwater and surface water in the vicinity of the site. Some controversy exists over the degree to which potential leachate losses may have impacted underlying aquifers. The Columbia Aquifer, directly beneath the site, is known to be contaminated, due both to brackish water and to historic industrial land use in the region. However, the deeper lying Potomac Aquifer, which is not known to be contaminated, represents the principal water supply aquifer in northern New Castle County. As such, the DNREC Water Resources staff is currently working with DSWA to develop a plan to more precisely determine the direction and rate of local and regional groundwater flow and to identify additional monitoring wells downgradient of the site. DSWA reports that results of its groundwater analysis indicate landfilling operations have not impacted groundwater quality at the CIL.²⁸

Landfill Gas Collection System

Under U.S. EPA regulations, large municipal solid waste landfills are required to operate landfill gas collection and treatment systems. This is due to the fact that the natural decomposition of solid waste in landfills produces numerous, potentially harmful air emissions, including: methane gas, which contributes to global warming; volatile organic compounds, which contribute to smog; hydrogen sulfide and other air pollutants. U.S.

²⁷ Ibid

²⁸ DSWA, *DSWA 2003 Annual Report*, p.26

EPA estimates that the CIL produces more than 100 tons of methane gas and more than 50 tons of non-methane organic compounds per year.²⁹

In 1990, DSWA installed the initial landfill gas collection system at the CIL with 50 gas collection wells and candle flares. In July 1995, DSWA contracted for the construction of a landfill gas processing plant to remove water from and compress the gas, which is then transported via pipeline to Delmarva Power's Edgemoor power plant where it is converted into electricity. The landfill gas management system is owned and operated by Cereza Energy, Inc., under contract to DSWA. Cereza is responsible for the design, installation and operation of the system.

In recent years Cereza and DSWA have been at odds over the operation of the gas collection system. Cereza officials admit that that previous forecasts of landfill gas production seriously underestimated the amount of gas produced, which exceeded projections by 20 to 25 percent.³⁰ It is estimated that the approximately 28.7 million cubic yards collected in FY 2002³¹ represents only about half the gas believed to have been produced inside the landfill.³² DSWA contends that piping and other equipment was undersized and therefore could not adequately collect and transport the gas. Clogged equipment and monitoring and maintenance problems, for which DSWA was cited in March 2004, also prevented adequate gas collection and may have contributed to unpleasant odors in the I-495 corridor.

In response, throughout 2002 and 2003 Cereza added nearly 120 new gas wells and more than five miles of additional piping and other equipment upgrades, including a larger back-up flare and a larger compressor. In addition, the facility made use of a passive flare system to burn off excess gas and reduce odors. The site also received a permit for two 3,000 ft³/min open flares for use at times when gas delivery to Delmarva Power is curtailed or prevented (DSWA has applied to replace these with two low-NO_x closed flares). Since these upgrades, DSWA estimates that the landfill gas collection system now processes approximately 10.8 million cubic feet of landfill gas per day.³³

Landfill Gas Violations and Enforcement

Between March 1 and October 27, 2003, DNREC cited DSWA for odorous emissions incidents on six separate occasions. As a result, DNREC fined DSWA for violating State air and solid waste regulations and proposed corrective action including:

- improvements to the landfill gas transmission lines, compressor capacity and soil cover;
- implementation of monitoring and surveying; and,
- use of odor neutralizers and/or masking agents.³⁴

²⁹ U.S. EPA, Region 3, *Press Release: EPA and Delaware Enforce Clean Air Act Standards at Cherry Island Landfill*, March 2, 2004

³⁰ The News Journal, *Committee extends probe of solid waste authority*, June 5, 2004

³¹ DSWA, *DSWA 2002 Annual Report*, p. 25

³² *Ibid*

³³ DSWA responses to questions, December 10, 2004

³⁴ *Ibid*

In May 2004, the Authority submitted applications for a horizontal gas extraction system and a temporary geomembrane cover which are designed to reduce landfill gas emissions and odors. DNREC issued permits for these two enhancements in February 2005.

c) *Applications to Expand and Improve CIL*

As recently as 1999, DSWA predicted the CIL would be accepting wastes as late as 2015.³⁵ However, due to factors discussed previously such as accelerated filling and the uneven settling, it now appears available capacity will be exhausted by the end of 2009. Recognition of this fact prompted DSWA to examine options for future waste disposal.

Expansion Alternative Selection

Around 2000, DSWA began investigating alternatives to handle waste disposal into the future. The options examined, which are presented in the table below,³⁶ included various combinations of:

- Residential and commercial recycling, including construction of a materials recovery facility (MRF),
- Exporting waste to out-of-state waste-to-energy (WTE) facilities
- “Ash-for-trash” arrangements where an out-of-state WTE facility would accept DSWA’s MSW in exchange for residual ash disposal in a DSWA facility,
- Construction of a landfill at a new site,
- Transfer MSW to DSWA landfills downstate, and
- Vertical expansion of Cherry Island Landfill to 290 feet

After performing detailed cost-benefit analyses of the various options, DSWA selected vertical expansion of the CIL (Option #9 below) citing advantages which included existing infrastructure, already completed siting, low environmental impact and long-term solid waste disposal until at least 2037. Gaining use of the adjacent dredged material disposal property currently employed by the Army Corps of Engineers could add an additional 13.5 million tons of solid waste disposal capacity to the site as a whole (equivalent to 15 to 20 years of capacity at current disposal rates).³⁷

³⁵ The News Journal, *Plans to expand landfill opposed*, March 17, 2003

³⁶ From DSWA Cherry Island Landfill Public Workshop PowerPoint presentation, www.dswa.com

³⁷ DSWA, *DSWA 2003 Annual Report*, p. 37

**Table 2
Future Waste Disposal Options Considered by DSWA**

Option #	Option Description	Capital Costs	Operational Costs & Revenues	Impact on Landfill Life	Annual Amount to Landfill
1	MRF Only (recycle 87,400 TPY)	\$8.2 M	MRF Costs: \$7M/yr MRF Rev.: \$2.9M/yr	6 years MRF operation = 1 year gained at CIL	437,600 TPY
2	MRF (recycle 87,400 TPY), CIL Vertical Expansion	\$74.2 M	Costs: \$7M/yr Revenues: \$2.9M/yr	Gain approx. 20 years at CIL beyond 2006 (plus Corps site could add 24 more years)	437,600 TPY
3	MRF (recycle 87,400 TPY), out-of-state WTE (280,600 TPY)	\$8.2 M	WTE - \$40/ton MRF Costs - \$7M/yr MRF Rev. - \$2.9M/yr	Every 1 year of operation gains 2 years at CIL (until 2025)	157,000 TPY
4	Out-of-state WTE (368,000 TPY), "ash-for-trash" (184,000 TPY)	None	WTE: \$12/ton	Extend CIL capacity to 2012	341,000 TPY
5	Out-of-state WTE (368,000 TPY), Landfill	None	WTE: \$40/ton	Extend CIL capacity to 2025	157,000 TPY
6	New landfill site	\$109 M	N/A	Use CIL until new landfill available with 27-year life	525,000 TPY to new landfill
7	Transfer waste to other DSWA landfills	\$36 M for new transfer station, new cells at CSWMC	N/A	Exhausts capacity at CSWMC in 17 years versus current 62 year capacity	525,000 TPY to CSWMC landfill
8	Residential and commercial MRFs (recycle 81,2000 TPY), landfill residuals	\$7 M/MRF	Costs: \$8.7 M/MRF Rev.: \$4.6 M/MRF	Extend CIL capacity to 2010	443,800 TPY
9	CIL Vertical Expansion	\$66 M	N/A	Provide disposal until 2037 (Plus 24 more years from Corps site)	525,000 TPY

Source: Cherry Island Landfill Public Workshop PowerPoint presentation

Some have argued that DSWA used unrealistically high capital cost estimates (\$8.2 million) and annual operating cost estimates (\$7 million per year) and low annual revenue estimates (\$2.9 million) for the Materials Recovery Facility (MRF), thus skewing the alternative selection in favor of landfill expansion. In a study for the Recycling Public Advisory Council, DSM Environmental Services, Inc. estimated that DSWA could construct the necessary single-stream processing capacity (at the existing Intermediate Processing Facility at Pigeon Point) for much less - between \$3.9 and \$4.7 million.³⁸ DSM also estimated annual operating and maintenance costs to run approximately \$3.0 million

³⁸ DSM Environmental Services, Inc., *Evaluation of Enhanced Residential Waste and Recyclables Collection and Processing for New Castle County*, October 15, 2003, p. 31-32.

per year³⁹ and annual revenue to run approximately \$4.8 million.⁴⁰ Under these conditions, MRF operations would be expected to nearly break even, showing a small loss or profit depending on how recyclables' values fluctuate in the market.

Landfill Expansion Applications

In April 2003, DSWA submitted to DNREC an application for a \$66 million expansion and repair project which would increase the height of CIL from its currently permitted limit of 172 feet to 288 feet. The expansion project would “slightly increase the permitted area, but would [sic] dramatically increase capacity by steepening the side slopes and adding height to the landfill.”⁴¹ Since the original application, DSWA has submitted two revisions, in September 2003 and June 2004. The current expansion application requests a smaller increase in the landfill's height to 195 feet. The vertical expansion is designed to both improve overall stability of the landfill, as well as provide additional solid waste disposal capacity. With the expansion, the projected life expectancy of the CIL would be approximately 20 years based on an available volume of 20,700,000 cubic yards (including waste, daily cover and immediate cover soils).⁴² DNREC is currently reviewing the application for expansion.

To expand capacity at the CIL, the DSWA plan calls for construction of a mechanically stabilized earth (MSE) wall and stabilizing berm along three sides the landfill, including those facing the Delaware and Christina Rivers.⁴³ The 60-foot vertical walls would be constructed of earthen materials and reinforced with a plastic grid which allows the walls to achieve a steeper than normal slope, and hence greater height and volume in (almost) the same footprint. Additionally, by placing overburden pressure on the subsoils, the MSE wall helps to consolidate them, increasing their strength and stability.⁴⁴

As will be discussed further in the report, disposal of the City of Wilmington's WWTP sludge also contributes to the shortage of landfill capacity in general. Currently, VFL mixes the City's sludge with fly ash from the nearby Delmarva Power plant and several out-of-state power plants to create stabilized sludge that could be used in limited construction projects. Proposals have been developed for using this material in construction applications in CIL expansion plans.

The subsurface and perimeter improvements to the CIL also include the installation of prefabricated vertical drains (PVDs) or wick drains, which are intended to strengthen the landfill foundation by accelerating the release of liquids within subsoils at the perimeter of the landfill. The drains are designed to transmit water flow up and down a polypropylene core, while preventing infiltration of fine particles from adjacent soils.⁴⁵ The PVDs would be inserted through the subsoils into the Columbia Formation where they would “act as

³⁹ Derived from Table 9, *ibid*

⁴⁰ Recycling Public Advisory Council, MOA Report Summary: Statewide Curbside Recycling Program, January 4, 2005, p.14.

⁴¹ DSWA, *Cherry Island Landfill Expansion Project brochure*

⁴² GeoSyntec Consultants, *Application for Solid Waste Permit Modification (Cherry Island Landfill Expansion Project), Volume 7: Design Report*, June 2004, p. VIb-80

⁴³ DSWA, *DSWA 2002 Annual Report*, p.8

⁴⁴ DSWA, *Cherry Island Landfill Expansion Project brochure*

⁴⁵ *Ibid*

straws drawing water both to the surface for removal and to the Columbia Formation below, depending on the amount of excess pressure” of liquids within the soils.⁴⁶ By alleviating hydraulic pressure, the wick drains should further enhance stability.⁴⁷

DSWA has argued that without the expansion, it may be forced to ship wastes to downstate landfills (or to out-of-state facilities), which could potentially drive up disposal costs. DNREC is currently reviewing the expansion application.

d) *Citizen Concerns and Complaints*

Since DSWA’s initial announcement that it was seeking to expand the CIL, citizen opposition has been vocal and organized. Concerns range from environmental issues (air quality, groundwater and surface water contamination) to quality of life issues (odor, noise, truck traffic and declining property values).

Odor

In the summer of 2002, DNREC began fielding increased citizen complaints about odors in the Edgemoor area of New Castle County. Residents from east Wilmington to southern Brandywine Hundred have complained about odors in the I-495 corridor that some say are so strong they “can wake [one] from a dead sleep”.⁴⁸

While one single source of the odors has not been identified, the CIL has most likely contributed to the problem to some degree. It is speculated that the same factors that have led to increased methane production in the landfill – such as accelerated filling and precipitation infiltration – could also be responsible for an increase in odorous, non-methane gases.

In response to the complaints, DSWA has taken several steps to identify and address the sources of odors. As discussed previously, Cereza has made improvements to the landfill gas collection system including the addition of gas extraction wells, a larger pipeline, more miles of pipeline, a larger compressor and the use of back-up flares. DSWA also participated in the Edgemoor Odor Roundtable and sponsored its own odor studies.

Since April 2003, DSWA has participated in DNREC’s Edgemoor Odor Roundtable, which has studied the odor issues along the I-495 corridor. Participating industries, such as Delmarva Power, the City of Wilmington’s Wastewater Treatment Plant, VFL, IKO, DRPI Landfill and DuPont Edgemoor, reviewed their operations to identify potential sources of odors and possible remedies. During Phase I of the study, DNREC hired a consultant to “fingerprint” each facility’s emissions to determine, if possible, a unique chemical signature for each one.⁴⁹ Phase II attempted to match the fingerprints to samples collected during reported odor events. While the study did identify some matches, including some for the CIL, most odor events had multiple sources. The Roundtable is looking at several monitoring and data analysis enhancements for a possible follow-up study.

⁴⁶ Ibid

⁴⁷ DSWA, *DSWA 2002 Annual Report*, p.8

⁴⁸ The News Journal, *Scientist targets source of stench*, June 5, 2003

⁴⁹ Edgemoor Odor Roundtable, *Edgemoor Odor Roundtable Fact Sheet*,

www.dnrec.state.de.us/dnrec2000/divisions/awm/aqm/odors/pdf/odorfactsheetsround.pdf

Potential sources of odors at CIL were examined in three additional studies prepared for DSWA, two by Entrix, Inc. and one by the University of Delaware. The University of Delaware study evaluated the nature of odors from the stabilized sewage sludge product (sewage sludge mixed with fly ash) produced by VFL, Inc. and which had been used as a cover material at CIL (and is now used in recontouring the Pigeon Point Landfill). The study, which measured odorants in sewage sludge alone, fly ash alone and the stabilized sewage sludge product, suggested that the sludge is the source of the odors and that fly ash does not mitigate those odors.⁵⁰

The initial Entrix study attempted to model potential migration of odors from landfill gas and stabilized sewage sludge to populated areas.⁵¹ A follow-up study performed revised landfill gas modeling using gas generation rates after improvements to the landfill's gas collection system. The studies determined that landfill gas odors (measured in H₂S) could be detected at or above 10 ppb in residential areas, particularly those west and northwest of the landfill. Prior to the gas collection system upgrades, H₂S may have been detected in a 13-mile radius around the landfill, with 2-to-4 mile wide extensions projecting up to 37 miles away. Post-upgrades, the modeling demonstrated significant decreases in the odor radius (to 6 miles) and the width (1-to-2 miles) and length (up to 17.5 miles) of plume extensions.⁵²

While Entrix determined that the stabilized sludge could produce off-site odors, it concluded that these would likely be insignificant relative to those created by the city's Wastewater Treatment Plant adjacent to the CIL. However, Entrix noted that the potential for volatilization could be further reduced by implementing stabilized sludge management practices such as mixing the material with soil and minimizing disturbances once the material is placed.⁵³

Quality of Life

Residents living close to the landfill have expressed concerns that the expansion will exacerbate existing odor, noise and air quality problems, making economic revitalization even more difficult in already blighted neighborhoods. This raises issues of environmental justice where historically poor communities composed of minority populations with little political clout have had undesirable industrial and public works facilities located in their midst. In this instance, public health and quality of life are perceived as threatened by truck traffic, noise, dust, and the looming presence of the landfill that already stands at approximately 100 feet.

Residents who live near the landfill feel the expansion will guarantee they will have to bear the brunt of the hazards and nuisances for decades to come, while residents in other parts of the county are spared these impacts. Some argue that another waste disposal option should be located closer to the source of the waste, whether it be above the C&D canal where according to DSWA, more than 70 percent of the waste in New Castle County is

⁵⁰ University of Delaware, *Odor Source Characterization at the Cherry Island Landfill in Wilmington, Delaware (Project 1)*, July 2003

⁵¹ Entrix, Inc., *Air Quality Assessment - Cherry Island Landfill*, June 2003

⁵² Entrix, Inc., *Air Quality Assessment: Amendment - Cherry Island Landfill*, March 2004

⁵³ Entrix, Inc., *Air Quality Assessment - Cherry Island Landfill*, June 2003, p. 4-6.

currently generated, or below the canal, where much of the county's new growth is occurring (and hence future waste generation).

Stephanie Bolden is a resident of and the Councilwoman for the City of Wilmington's Third District, which includes the Cherry Island Landfill. She opposes expanding the landfill for all of the reasons described above, in particular the visual blight and odor issues. She has worked with activist groups to mobilize local residents against the expansion. About increasing the landfill's permitted height she says, "My residents won't support it. I won't support it."

Groundwater

In addition to odor, regulators and citizens have expressed concerns over the potential for groundwater contamination beneath the landfill. Responding to the Authority's plan to utilize wick drains to dewater the subsoils beneath the CIL, DNREC in October 2003 called for construction of new groundwater monitoring wells to clarify "uncertainties about pollution risks" at the landfill.⁵⁴ DNREC is concerned that the use of wick drains in earlier projects at the site in the mid-1990s may have been responsible for the presence in a well adjacent to the Christina River of elevated levels of ammonia and iron, both potential indicators of leaking landfills.⁵⁵ DNREC is also concerned that their use in this project could result in contamination entering the Colombia Aquifer (which is already contaminated and not a drinking water source) and passing into the deeper Potomac Aquifer, which is the primary drinking water supply aquifer in northern New Castle County. DNREC's Division of Water Resources is currently working with DSWA to develop a plan to more precisely determine the direction and rate of local and regional groundwater flow and to identify additional monitoring wells downgradient of the site.

Other concerns

Some residents and environmental groups oppose the expansion because they feel the DSWA has not put enough effort into developing effective waste reduction and recycling programs that would reduce the amount of waste generated and needing disposal. A 2002 Franklin Associates report estimates that while Delawareans generate about 25 percent more municipal solid waste per capita than the rest of the nation,⁵⁶ they recycle it at less than half the national average of 28 percent.⁵⁷

DSWA is also in litigation with the landfill gas contractor, Cereza Energy, Inc. from whom it wishes to take control of the gas collection system. DSWA feels that Cereza's collection system was undersized, a factor that is responsible for methane releases and odor problems at the landfill.

4) *Pigeon Point Landfill*

The former Pigeon Point Landfill is located on Lambson's Lane in New Castle, southeast of the City of Wilmington. The majority of the site is owned by the City of Wilmington,

⁵⁴ The News Journal, *Landfill pollution risks face scrutiny*, November 5, 2003

⁵⁵ Ibid

⁵⁶ Franklin Associates, Ltd., *Assessment of Delaware Solid Waste Discards in 2000 and the Potential for Recycling of Materials*, 2002, p. 1-12

⁵⁷ The News Journal, *Neighbors criticize landfill expansion*, June 1, 2003

with small portions held by the Delaware River and Bay Authority and DSWA. The City of Wilmington began operating the landfill in 1971, then ceded management to New Castle County in the late 1970s. The County ran the landfill until 1981, when DSWA took over operations. DSWA accepted wastes there until October 1985 when it closed the landfill under Delaware's Solid Waste Regulations and began post-closure monitoring and maintenance activities. Between 1971 and 1985, approximately six million tons of waste was disposed of there. The total thickness of the solid waste deposits ranges from 40 to 60 feet.⁵⁸

Currently, the capped surface of the landfill encompasses approximately 120 acres. Due to differential settlement of the material within, the top of the landfill is topographically irregular.⁵⁹ Beginning in 1995, stabilized sludge material was used on a limited basis to fill in depressions in the landfill surface in order to maintain topology. Eventually, a more formal cap enhancement plan was developed to recontour the landfill surface to promote drainage and reduce leachate production. The plan includes gradually placing fill material across the surface of the landfill, working from south to north, and creating an approximately 5 percent slope from the center of the landfill to the edges to allow rainwater to runoff.⁶⁰ Work on the plan began in January 2003.

Under the regrading plan, stabilized sludge was to be utilized at Pigeon Point at a rate of 150,000 tons per year over nine to ten years.⁶¹ However, the actual placement rate over the past year has been more than double the original target. Between September 2004 and August 2005, stabilized sludge was placed at the site at an average rate of almost 30,200 tons per month, or more than 362,000 tons per year. This higher rate of placement occurred largely because DSWA stopped utilizing stabilized sludge as daily cover at Cherry Island Landfill due to the fact that the material's consistency inhibited vehicle traffic on the landfill and to citizen complaints about odors. If placement continues at this rate, the regrading will be complete within two to three years and another use will have to be found for the stabilized sludge. If, due to a lack of other options, the City is forced to landfill its sludge, it will have to pay the "at the gate" per ton tipping fee, which would cost the City almost \$3.7 million annually based on current sludge generation rates and tipping fees.

A more detailed discussion of sludge and its impact on landfill capacity occurs later in the report.

b. Collection Stations and Transfer Stations

1) Collection Stations

DSWA currently operates five collection stations throughout Delaware. Four are located in Sussex County (Bridgeville, Ellendale, Long Neck, Omar) and one is located in Kent County (Cheswold). The stations provide a means of drop-off waste disposal for residents of rural areas where subscription service is not offered. The charge is \$1 per bag (up to 33 gallons). Users can further reduce the amount they pay by utilizing the Recycle Delaware

⁵⁸ www.dswa.com

⁵⁹ Duffield Associates, *Conceptual Evaluation: Partnering Opportunities for the City of Wilmington*, June 2004, p. 5

⁶⁰ Ibid

⁶¹ Ibid

Center available at the collection station. Approximately only ten percent of the state's population self-hauls its trash.

2) *Transfer Stations*

- **Pine Tree Corners Transfer Station** - Opened in April 1991, it is located three miles south of Odessa on Road 25 West. The site occupies 81.5 acres and provides residents and commercial haulers with an alternative to bringing their trash to the Cherry Island Landfill. On average, 224 tons per day of MSW are delivered to Pine Tree Corners, compacted, loaded and then transported via transport truck to the CIL in northern New Castle County. The facility is permitted to receive an average of 350 tons per day, with peaks up to 550 tons per day.
- **Pigeon Point Transfer Station** - Located in New Castle, DSWA's Delaware Recycling Center is home to both the Intermediate Processing Facility (IPF) and the Pigeon Point Transfer Station (PPTS). At the IPF, recyclables collected under the Recycle Delaware program are cleaned and further sorted (depending on the end-use), and then shipped to markets. Residual non-recyclable materials are moved through the PPTS and transferred to CIL. The PPTS is permitted to handle up to 2,000 tons per day of recyclables and MSW.
- **Future Transfer Stations** - DSWA has recently begun construction activities for two new transfer stations to open in 2005 in Kent and Sussex Counties. A third transfer station, to be located in Dover, is in the planning stages. All of the projects are intended to improve service and reduce labor and fuel costs associated with waste transportation. The Milford Transfer Station, slated to open in December 2005 or January 2006, is permitted to accept up to 350 tons per day and 30,000 tons per year of MSW. A Resort Transfer Station, designed to respond to the rapid development occurring in eastern Sussex County, will be located near Millsboro on Route 5. That facility may accept up to 500 tons per day of MSW.

3) *The Delaware Recycling Center (DRC)*

The Delaware Recycling Center (DRC) is located on Lambson's Lane in New Castle. The DRC receives and processes materials collected through the Recycle Delaware program, as well as from commercial establishments and municipalities that operate recycling programs for their own local residents and customers. At the Intermediate Processing Facility (IPF), the materials are further sorted, cleaned of contaminants, and baled if needed. Processed materials are then transported to available markets to be recycled into new products.

Also part of the DRC, the Pigeon Point Transfer Station (PPTS) handles recyclables and recycling residuals and is permitted to receive up to 2,000 tons of recyclables and MSW daily.

The DRC also processes used oil filters collected through the Oil Filter Recycling Program and accepts electronic goods from Delaware schools, residents and businesses under the

Electronic Goods Recycling Program. Both of these programs are described in more detail in the following section.

5. Recycling

The benefits of recycling are numerous and well known. Manufacturing products from recycled materials decreases consumption of raw materials, saves energy, reduces environmental damage from industrial, commercial and residential wastes, and lowers greenhouse gas emissions. Of course, most pertinent to this discussion is the fact that recycling saves landfill space.

Delaware's recycling rate for residential solid waste is only four percent. The commercial sector recycles significantly more, bringing overall municipal solid waste recycling rate to approximately 22 percent. However, this is still below the national average of 28 percent and that of surrounding states – Virginia (29 percent), New Jersey (38 percent), Maryland (29 percent) and Pennsylvania (27 percent).⁶² This is due to the fact that Delaware's primary residential recycling program, Recycle Delaware, is a voluntary, drop-off program that is used by only 20 to 30 percent of residents.⁶³

A few curbside recycling programs operate sporadically throughout the state. Some municipal programs such as Camden and Delaware City have received grant monies through DNREC to start municipal collection of recyclables. Wilmington collects recyclables in some areas of the city although the program does not generate much volume. In May 2003, DSWA launched its own voluntary curbside recycling program which now serves residents of New Castle County and Kent County; as of September 2005, it included approximately 5,000 households.

With the submission of the Cherry Island Landfill expansion application, recycling once again came into the spotlight, with both residents and lawmakers calling for curbside recycling programs. With the goal of increasing the residential recycling rate to 30 percent, in January 2005 the Recycling Public Advisory Council (RPAC) presented draft legislation mandating statewide residential curbside recycling. While that legislation failed to gain sponsorship in the Legislature, it did provide a foundation for Governor Minner's own recycling legislation. In her 2005 State of the State address the Governor said, "Increasing recycling in Delaware is an idea whose time has come and, if put off, may not come again. It is the right and responsible thing to do and I ask those with an open mind to help me propose the most responsible way to do it."⁶⁴ Her residential curbside recycling legislation was introduced at the end of the 2005 legislative session and found co-sponsorship from nearly two dozen members as Senate Bill 225.

Both the RPAC legislation and Senate Bill 225 are discussed in detail below, along with other current MSW recycling efforts in the state.

⁶² BioCycle, *The State of Garbage in America*, January 2004

⁶³ Recycling Public Advisory Council, *MOA Report Summary: Statewide Residential Curbside Recycling Program*, January 4, 2005, p. 6.

⁶⁴ Governor Ruth Ann Minner, *Delaware State of the State Address*, January 25, 2005

a. Recycle Delaware

In 1990, DSWA launched the Recycle Delaware (RD) program, a statewide voluntary program that allows residents to bring their separated recyclables to any of approximately 145 drop-off centers throughout the state. The RD centers are generally located within a 5-mile radius of most residential areas and consist of specially-marked containers into which residents deposit materials. Most RD centers accept newspapers, junk mail, plastic bottles, cans, glass, corrugated cardboard, household batteries and plastic grocery bags. Some RD centers also accept motor oil, used oil filters, and textiles. A DSWA-hired contractor collects the materials from the RD centers and transports them to DSWA's Intermediate Processing Facility at the Delaware Recycling Center in New Castle. There, the materials are further separated, sorted, baled and shipped to recycling markets. The program generates an average of 1,500 tons of recyclable material every month⁶⁵ and approximately 96 percent of the materials collected through the Recycle Delaware program are sent to markets to be recycled. In FY 2004, approximately 20,102 tons of recyclables were received at RD centers.⁶⁶

The Recycle Delaware program is recognized as one of the most successful and comprehensive drop-off recycling programs in the country. However, a recent report estimated that only 20 to 30 percent of New Castle County households use the Recycle Delaware program on a regular basis.⁶⁷ As such, only 14 percent of potentially available recyclables from NCC households are being recycled, resulting in a countywide recycling rate of six percent of RSW.⁶⁸ Statewide, the residential recycling rate is estimated to be only four percent of the MSW.

DSWA points out that while the agency made approximately \$1.1 million from the sale of recyclable materials in FY 2003, its collection and processing costs exceeded \$4.3 million, for a net loss of over \$3.2 million. However, according to research conducted under the Recycling Public Advisory Council discussed in later sections, a MRF managing single stream recyclables could operate at a profit in excess of \$1 million annually.

DSWA's other recycling programs include a residential curbside recycling program (discussed in the next section), as well as:

- **Electronic Goods Recycling** – In FY 2003 and FY 2004, DSWA annually collected over two million pounds of used electronics, including computers, televisions, telephones and audio equipment from Delaware residents, schools and business. This is more than the combined total collected for Virginia, West Virginia, Pennsylvania and Maryland.⁶⁹ More than 85% of the materials collected through the EGR program were recycled or reused.
- **Used Motor Oil Recovery** – Used motor oil deposited at Recycle Delaware centers is collected (through a subcontractor) by Delaware City-based Valero (formerly

⁶⁵ DSWA, *Working With You to Protect Delaware's Quality of Life* brochure

⁶⁶ DSWA, *DSWA 2004 Annual Report*

⁶⁷ DSM Environmental Services, Inc., *Evaluation of Enhanced Residential Waste and Recyclables Collection and Processing for New Castle County*, October 15, 2003

⁶⁸ Ibid

⁶⁹ Recycling Public Advisory Council, *Fourth Annual Report*, January 2005

Premcor) and is reprocessed. In FY 2004, 1,397 tons of used motor oil was recycled through the program.⁷⁰

- ***Oil Filter Recycling*** – DSWA’s oil filter program was the first statewide oil filter program in the country. DSWA collects over 1.2 million of the approximately 1.4 million oil filters sold annually in Delaware from over 485 service stations and other businesses and over 60 Recycle Delaware centers throughout the state. The filters are processed through an Oil Filter Kruncher, a machine that crushes up to 10 filters at a time, extracts residual oil, and compresses the filters into ten-pound steel briquettes. These are sold to CitiSteel USA, Inc. in Claymont which mixes them with other steel for recycling.⁷¹ Ninety-nine percent of the residual oil in the filters is collected and sent to Valero for re-refining. DSWA processed 496 tons of used oil filters in FY 2004.
- ***USPS Junk Mail*** – DSWA works with over 12 United States Postal Service offices to divert Undeliverable Bulk Business Mail (UBBM), or “junk mail”, from the MSW stream. In FY 2004, DSWA recycled 1,041 tons of junk mail through this program.
- ***Construction and Demolition (C&D) Waste Recovery*** - In FY 2002, DSWA began a construction and demolition (C&D) waste recovery program. The Authority collects the material at its landfills and ships it to a Baltimore or Philadelphia company that processes the construction waste by recovering wood, aggregates, and metals and removing other unwanted debris prior to shredding and screening. The processed material is then returned to DSWA and used as daily cover material (as Recover Mat or Barrier) or on roadways throughout its landfills in place of stone.⁷² DSWA recovered and reused more than 68,000 tons of C&D materials in FY 2004.

b. DSWA’s Curbside Recycling Program

In May 2003, DSWA launched a pilot curbside recycling program for residents of Brandywine Hundred and expanded the service to all households in New Castle County in September 2004. The program was further expanded to Kent County in September 2005. For \$6 per month, the program offers weekly pick-up of separated recyclables in a DSWA-provided blue bin and material-specific bags. DSWA charges an additional \$3 per month for weekly collection of up to 4 bags of yard waste, including grass clippings, leaves and brush less than two inches in diameter. DSWA has also initiated a pilot program with the City of Dover to determine the existence of economic and/or technical efficiencies associated with serving high population density areas. The curbside recycling service will be offered there at a reduced rate of \$4 per month, with intent of enrolling at least 500 families. DSWA is discussing initiating a similar pilot program with the City of New Castle.

DSWA uses specially outfitted recycling trucks to collect the recyclables, which include corrugated cardboard, plastic bottles, steel and aluminum cans, glass, junk mail, newspapers and magazines. Collected materials are processed at the DSWA’s Intermediate Processing Facility (IPF) where they are further sorted if necessary and then shipped to recycling markets. Yard waste is transported to the Cherry Island Landfill

⁷⁰ Ibid

⁷¹ DSWA, DSWA Oil Filter Recycling Program brochure

⁷² DSWA, *DSWA 2002 Annual Report*, p. 12

where it is chipped and shredded. It is then offered free to residents or used on the landfill as alternate daily cover.

As an additional incentive to enroll in the program, DSWA created “Partners In Recycling”. Under this initiative, eight of the private trash haulers in New Castle County offer discounts to residents who sign up for DSWA's Curbside Recycling program. Discounts vary from \$1.00 to \$2.00 to 10% off of the cost of monthly trash pick-up.

As of September 2005, approximately 5,000 of the 200,000 households in New Castle County, or 2.5 percent, were enrolled in the curbside recycling program. It is worth noting that a study completed for DSWA by DSM Environmental Services, Inc. indicated that the voluntary subscription curbside program alone is not capable of achieving a 30 percent RSW diversion goal.⁷³

c. Recycling Assistance Grant Program

DNREC's Solid and Hazardous Waste Management Branch administers a grant program known as the Recycling Assistance Grant Program (RAGP) which aims to foster community-based programs to expand RSW recycling efforts. Using criteria developed by the Recycling Public Advisory Council, DNREC selects from among eligible applicants, such as municipalities, educational institutions, non-profits, and community organizations, to receive a portion of each year's matching grant funding. Examples of eligible projects include development of recycling and yard waste composting programs, recyclables curbside collection, design of “Pay-As-You-Throw” programs, or other projects aimed at reducing RSW generation and/or disposal.⁷⁴ Grant recipients must provide 25% of total project funding in cash or an equivalent valuation of in-kind services. In FY 2004 and 2005, nearly \$50,000 in state money was awarded annually in matching grant funds. \$174,000 was allocated between FY 2001 and FY 2003.

While the RAGP has had some success in promoting small scale projects, the size of the funds is not adequate to fund start-up of programs in the larger municipalities where the most impact can be made. In its 2000 report “A Course of Action to Increase Recycling in the State of Delaware,” the Citizens Work Group on Recycling recommended annual grant funding of \$500,000 per year to raise the RSW diversion rate to 25 percent. In each of its annual reports, the Recycling Public Advisory Council has also recommended increasing grant funding (up to \$150,000 by 2005) in order for RAGP to have any meaningful impact on recycling. It has also suggested that the RAGP's effectiveness has been hampered by the lack of a Materials Recovery Facility (MRF) to process commingled recyclables from curbside collection.

d. Recycling Public Advisory Council (RPAC) and Curbside Recycling

In September 2000, then Governor Thomas R. Carper signed Executive Order No. 82 which established a goal of a 30 percent diversion rate for recyclables from Delaware's residential solid waste stream and created the Recycling Public Advisory Council (RPAC) to investigate means to achieve that goal. Under Governor Ruth Ann Minner, RPAC has

⁷³ DSM Environmental Services, Inc., *Estimated Statewide Residential Recycling Rates*, November 2004

⁷⁴ DNREC, RAGP literature

continued to pursue ways to increase residential recycling and the Governor again endorsed the 30 percent recycling goal for RSW in her 2005 State of the State address.

The Council is a nine-member body comprised of a cross-section of interests throughout the state including: one member each from DNREC, DSWA and the Delaware Economic Development Office (DEDO); one member each from the recycling industry and the waste hauling industry; one member representing county governments; one member representing municipal governments; and two members representing environmental or citizens' groups.

RPAC was charged with advising DNREC and DSWA on all aspects of recycling, including designing a methodology for measuring recycling rates and developing possible outreach activities to achieve the 30 percent goal. Since 2000, RPAC has studied a variety of potential methods to increase the capture rate for recyclables in the residential portion of the waste stream. During that same period, public and legislative interest in recycling increased, particularly in light of the proposed CIL expansion, and culminated in several pieces of proposed legislation that urged exploring curbside recycling options.

Spurred by these efforts and civic awareness, on January 6, 2004, RPAC, DNREC and DSWA entered into a Memorandum of Agreement (MOA) in order to evaluate the feasibility of and costs associated with implementing a statewide mandatory curbside recycling program in Delaware. Throughout 2004, the Council met numerous times to quantify recyclables, to assess costs, collection systems and funding mechanisms, and ultimately to develop draft legislation to require mandatory curbside recycling.

1) Objectives and Tasks of the MOA

RPAC, DNREC and DSWA were charged with recommending a method for collecting and processing recyclables statewide (including yard waste), recommending funding mechanisms for such a system, and drafting legislation to implement the recommendations.⁷⁵ In order to develop their recommendations the MOA parties completed a number of tasks, including:

- Assess the statewide composition of the residential solid waste stream
- Identify and quantify those materials that can be removed through source separation and curbside collection
- Study mandatory curbside recycling programs in practice nationwide for use in developing potential models for Delaware
- Estimate costs and revenues of a mandatory curbside recycling program and identify potential funding sources

2) RSW Recyclables and Yard Waste Characterization

In 2003, working on behalf of RPAC, DSM Environmental Services, Inc. (DSM) used the data in a 2002 report by Franklin Associates on recycling to develop recyclable material categories and estimate residential collection values for New Castle County. Under the MOA, this information was extrapolated to residential solid waste in Kent and Sussex counties using 2000 U.S. Census data to create a statewide picture of potential recyclables. That profile is presented in Table 3.

⁷⁵ RPAC, *Draft MOA Report Summary*, November 2004

Table 3⁷⁶				
RSW Estimated Annual Recyclables Generation by County (in Tons*)				
Materials Considered Curbside Recyclable	Generation			
	Statewide	New Castle	Kent	Sussex
PAPER				
ONP: News, Magazines, Phone Books	34,210	21,894	5,474	6,842
Junk Mail				
Office Papers	3,050	1,952	488	610
Third Class Mail	9,950	6,368	1,592	1,990
Other Commercial Printing	11,700	7,488	1,872	2,340
Total Junk Mail	24,700	15,808	3,952	4,940
Cardboard	9,800	6,272	1,568	1,960
Boxboard				
Folding Cartons	9,360	5,990	1,498	1,872
Other Paperboard Packaging	350	224	56	70
Bags and Sacks	4,230	2,707	677	846
Total Boxboard	13,940	8,922	2,230	2,788
TOTAL PAPER	82,650	52,896	13,224	16,530
BOTTLES AND CANS				
Glass Bottles	21,580	13,811	3,453	4,316
Steel Cans	6,460	4,134	1,034	1,292
Aluminum Cans and Foils	3,235	2,070	518	647
Plastic Bottles: PET	3,974	2,543	636	795
Plastic Bottles: HDPE	4,017	2,571	643	803
TOTAL BOTTLES AND CANS	39,266	25,130	6,283	7,853
Total, All Recyclables	121,916	78,026	19,507	24,383
<i>Percent of Available Recyclables</i>	<i>100%</i>	<i>64%</i>	<i>16%</i>	<i>20%</i>
<i>Percent of Total Residential Solid Waste</i>	<i>24%</i>	<i>15%</i>	<i>4%</i>	<i>5%</i>
<i>Percent of Total RSW, at 65% capture</i>	<i>15.6%</i>	<i>9.8%</i>	<i>2.6%</i>	<i>3.3%</i>
Total, All Recyclables, Less Glass	100,336	64,215	16,054	20,067
<i>Percent of Total Residential Solid Waste</i>	<i>19.7%</i>	<i>12.6%</i>	<i>3.1%</i>	<i>3.9%</i>
<i>Percent of Total RSW, at 65% capture</i>	<i>12.75%</i>	<i>8.2%</i>	<i>2.0%</i>	<i>2.55%</i>

*Based on data collected for the year 2000

The data indicate that if 100 percent of all curbside recyclable materials were collected, a RSW recycling rate of 24 percent (121,916 tons) would be achieved. However, RPAC recommended excluding glass from the mandatory recycling program because of the material's several drawbacks: broken glass contaminates other recyclables, increases wear and tear on equipment, and increases processing costs; and, recycled glass has a low recycling market value. Therefore, with glass removed from the available total, potential recyclables drop to 100,336 tons. In addition, curbside collection programs typically only capture 65 percent of the materials available. A 65 percent capture rate would therefore equate to an overall RSW recycling rate of only 12.75 percent. This is 3.5 times more

⁷⁶ Based on Table II from RPAC's *MOA Report Summary: Statewide Residential Curbside Recycling Program*, January 2005

materials than are currently collected through the Recycle Delaware drop-off system, but far off the 30 percent recycling goal for RSW.⁷⁷

In order to reach the 30 percent goal, RPAC determined that yard waste, which comprises approximately 23 percent of the RSW stream, would also have to be diverted from the state's landfills. DSM, which completed a yard waste study for RPAC, estimated that 45,200 tons of yard wastes are currently diverted from RSW disposal through municipal collections of leaves, brush and other trimmings, and through DSWA's mulching of yard waste materials that arrive at its facilities. However, DSM estimated that banning yard waste from the state's landfills will further reduce the amount of RSW disposed by over 58,100 tons annually.⁷⁸ As such, RPAC recommended that DNREC adopt a similar strategy to that of many states in the region and ban yard waste from Delaware's landfills. (Alternatively, DSWA could impose its own yard waste ban.) The following table, prepared by DSM, illustrates the projected impact of such a ban on the residential solid waste stream and MSW stream as a whole.

Annual Delaware Yard Waste Recycling (In Tons)				
Disposition of Yard Waste	Total		Residential (90% of Total)	
	Pre Yard Waste Ban	Post Yard Waste Ban	Pre Yard Waste Ban	Post Yard Waste Ban
Yard Waste mixed w/ MSW & Disposed In DSWA Landfills	95,600	31,000	86,040	27,900
New offsite Yard Waste recycling	0	45,200	0	40,680
New onsite Yard Waste recycling*	0	19,400	0	17,460
Yard Waste diverted, mulched and used at DSWA Landfills	4,500	4,500	4,050	4,050
Yard Waste diverted through Municipal and Private mulching	45,724	45,724	41,152	41,152
Total Yard Waste Generated	145,824	145,824	131,242	131,242
<i>Total Yard Waste recycled</i>	<i>50,224</i>	<i>114,824</i>	<i>45,202</i>	<i>103,342</i>
% of Yard Waste recycled	34%	79%	34%	79%
* Onsite recycling includes homeowner/business use of mulching mowers and on-site composting.				

3) ***Mandatory Curbside Recycling Model***

After examining several recycling systems in practice in other states, in the fall of 2004 RPAC devised a mandatory recycling model to integrate with Delaware's unique collection system. The model has the following features:

- ***Single-stream collection of recyclables*** – Residents would be required to separate recyclables from trash but would not be required to sort them before

⁷⁷ RPAC, *MOA Report Summary: Statewide Residential Curbside Recycling Program*, January 4, 2005

⁷⁸ Ibid

⁷⁹ DSM Environmental Services, Inc., *Yard Waste Ban Report*, September 15, 2004

placing them out for collection. Table 3 above identifies all of the materials (excluding glass) that would be collected curbside in one container.

- ***Establishment of a MRF*** – DSWA would build and manage a Materials Recovery Facility (MRF) at Pigeon Point for sorting, processing and marketing the recyclables collected statewide. There would be no tipping fee at the MRF. At the anticipated 65% capture rate and using current market values, recyclables revenues are expected to be approximately \$4.8 million, which should cover the costs of MRF operations. Losses would be covered by a dedicated fund (see below).
- ***“Privatization” of collection*** - This model is similar to the current trash collection system in which municipalities, private homeowners and existing districts would be responsible for contracting with private haulers (or municipal crews) for curbside collection of recyclables, as well as responsible for the cost of that collection. Haulers would be required to provide their customers with curbside recycling service, either directly or through contract with a recycling collection company. If private collectors could not provide the service, DSWA would collect using its subscription service.
- ***Self-hauling provisions*** – Self-haulers, while not required to obtain subscription service, would still be required to separate recyclables from trash (as a single-stream) and deposit them at drop-off centers at DSWA landfills and transfer stations.
- ***Elimination of the Recycle Delaware drop-off program.*** From the outset of discussions on mandatory curbside recycling, DSWA stated that if a mandatory program were legislated, all Recycle Delaware Centers would be removed, as the program would no longer be necessary. DSWA would maintain drop-off recycling facilities at the landfills and some transfer facilities to accommodate self-haulers only.
- ***Phase-In*** of counties, with service implemented in New Castle County first, and expanding to Kent and Sussex Counties one year later.

RPAC members felt that the privatization model would cause the least disruption in the current collection system for homeowners, municipalities and counties, private haulers and state agencies, and would allow for a maximum of private sector involvement, as required under Title 7, Chapter 64. The single-stream nature of the system was designed to maximize capture rates with relatively low collection costs and a high degree of convenience for the homeowner.

a) *Costs*

Even though the establishment of a MRF will improve the sale of recyclables from their current levels (higher volume, better prices), revenues would not be enough to cover the costs of collection and processing. Therefore, the costs of collection would be assumed by the homeowner, either through subscription service with private haulers or through municipal fees. DSM estimated that the monthly cost of collection would range from approximately \$3.00 to \$7.00 per household, depending on several factors, including whether recyclables are picked up concurrently with trash or on separate days.

b) *Funding*

In order to cover start-up costs, particularly for equipment, RPAC recommended establishing a \$5 million reserve from the State of Delaware General Fund to be made available in the form of grants to the municipalities. The funds would be authorized as a one-time appropriation and would be phased out over a period of time (probably 2008), with the intent that the municipalities' programs would become self-sustaining.⁸⁰

RPAC also recommended establishing a dedicated fund to offset DSWA's operating costs for the MRF when those costs exceed the revenue from the sale of recyclables. The fund would also cover the costs of education, research and program enforcement. The fund would be financed through a waste-end assessment on all privately collected solid waste in Delaware, excluding hazardous waste, on a per-ton basis, which is not expected to exceed \$3 per ton.

4) *Mandatory Yard Waste Diversion*

As stated previously, RPAC recommended banning yard waste from disposal facilities in the state. It is anticipated that 30 percent of the diverted yard waste would be managed at the point of origin, through grasscycling (i.e., using mulching mowers and leaving grass clippings in place), composting, and mulching.⁸¹ The remaining yard waste would be collected curbside by the residents' existing private hauler or municipal crew, at an expected cost of \$3 to \$5 per month. RPAC recommended that this material be managed through several low- or intermediate technology composting facilities to be constructed throughout the state, and operated either by the private sector or by DSWA if no private operators choose to participate. Operation of these composting or yard waste recycling facilities would be funded through tipping fees.

While generally garnering support from industry and the public alike, the proposed ban on yard waste has generated numerous questions regarding who would handle the yard waste, as well as how and where would it be processed. Questions were raised over land requirements and siting, economic impacts on affected groups, odor and other environmental issues, and timing of the ban. These concerns were still unresolved in June 2005 when Governor Minner proposed her own recycling legislation (discussed in Section II.B.5.e), which also calls for a landfill ban on yard waste. In the summer of 2005, DNREC formed the Yard Waste Management Committee to help address the many uncertainties associated with the ban. Comprised of a cross-section of stakeholders (public and private; regulatory, industry, and municipal), the Committee's objectives are to:

- Review, revise and develop a plan for the management of yard waste in Delaware
- Develop guidelines for yard waste mulching and composting facilities
- Identify private sector interest in yard waste mulching and composting
- Identify markets for mulch and compost.

⁸⁰ RPAC, *MOA Report Summary: Statewide Residential Curbside Recycling Program*, January 4, 2005

⁸¹ *Ibid*

Subcommittees are meeting independently to address the issues specific to each element of a yard waste program: Separation/collection/transportation; Processing; Marketing/Business Model; and Education. The Yard Waste Management Committee aims to have a draft plan for statewide yard waste management by Christmas 2005.

5) *Landfill Life Expectancy and Net Impact of Mandatory Recycling*

As stated previously, Cherry Island Landfill in New Castle County will soon reach its fill limit, due in part to design limitations. Under current conditions and at an average current fill rate of 2,046 tons per day, capacity will be reached by the end of 2009. (DSWA's planned expansion of CIL would add approximately 12 million tons capacity; an additional 13.5 million tons capacity would become available with the acquisition of the adjacent Army Corps of Engineers property.) There is no near-term landfill capacity shortage in Kent or Sussex Counties, and the Sandtown Landfill in Kent County has approximately 55 years of capacity at current fill rates, without assuming further growth in annual waste generation.

RPAC estimated that achieving a 30% RSW recycling rate would result in an 18% reduction in total tonnage of materials landfilled (assuming RSW is 60% of total MSW; $30\% \times 60\% = 18\%$). The following table (Table 5), wherein the authors of this report have revised "Table I" from RPAC's Memorandum of Agreement Report Summary ("RPAC MOA Report"), shows the anticipated landfill impacts from diverting 30% of RSW through curbside recycling and a yard waste ban, as well as from diverting 40% of MSW as a whole. Table 5 differs from the MOA Report Table I in that the "Annual Landfilled Tons" have been updated to reflect actual 2004 tonnages (CIL – 638,000 TPY; Sandtown – 131,000 TPY; Jones Crossroads – 226,000 TPY). Furthermore, Table 5 presents different landfill life expectancies than Table I. This is due both to the higher 2004 tonnages and to the fact that the 2004 tonnages already exceed the predicted annual tonnages (CIL – 635,000 TPY; Sandtown – 125,000 TPY; Jones Crossroads – 225,000 TPY)⁸² which DSWA used in calculating the individual landfill life expectancies.⁸³

The landfill life expectancy calculations have assumed constant values for annual waste generation. However, annual waste generation has grown historically (albeit inconsistently) and can be expected to do so in the future. Therefore, the actual landfill life expectancies will probably be shorter than those predicted below. For example, the life expectancy shown below for CIL assuming expansion is permitted (19.9 years) would be reduced by approximately 2 years if corresponding waste generation were to grow at a rate of 1% per year, or would be reduced by approximately 5 years if waste generation were to grow at a rate of 3% per year.

⁸² DSWA, *FY 2004 Closure and Post Closure Care Cost Estimate* memorandum, July 23, 2004

⁸³ DSWA, *DSWA 2004 Annual Report, 2004 Financial Report, Note 6*

Table 5 ⁸⁴				
Landfill Impacts From 30 % RSW and 40 % MSW Recycling Rates				
	Cherry Island	Sandtown	Jones Crossroads	Statewide
Annual Landfilled Tons (2004)	638,000	131,000	226,000	995,000
RSW Portion of Landfilled Tons @ 60 %	382,800	78,600	135,600	597,000
Tons RSW Recycled @ 30 %	114,840	23,580	40,680	179,100
<i>Net Annual Landfilled Tons</i>	<i>523,160</i>	<i>107,420</i>	<i>185,320</i>	<i>815,900</i>
Net Total Recycled	18 %	18 %	18 %	18 %
Current Design Life Expectancy in Years – With CIL Best Case Scenario (2009)	5.0	55.3	27.9	16.8
Design Life Expectancy in Years With 30 % RSW Recycling	6.1	67.5	34.0	20.5
Design Life Expectancy in Years With 40 % MSW Recycling	8.3	92.2	46.5	28.0
Design Life Expectancy in Years with Permitted CIL Expansion	19.9	55.3	27.9	26.4
Design Life Expectancy in Years With CIL Expansion & 30 % RSW Recycling	24.3	67.5	34.0	32.2
Design Life Expectancy in Years With CIL Expansion & 40 % MSW Recycling	33.2	92.2	46.5	44.1

DSM's calculations for RPAC were based on DSWA's application to DNREC for expansion of the CIL.

The table highlights the fact that a long-term solution would not be realized at Cherry Island with mandatory residential recycling and a yard-waste ban *alone*. Over a twenty-year timeframe (which would entail some degree of landfill expansion), recycling and the yard waste ban have a greater impact on CIL capacity, particularly when the recycling goal is increased from 30 percent of residential MSW to 40 percent of total MSW. When this occurs, the landfill life rises from approximately 24.3 years to 33.2 years.

e. Senate Bill 225 - Governor Minner's Draft Recycling Legislation

As described above, RPAC's proposed legislation sought to achieve a 30 percent residential recycling goal through mandatory residential curbside recycling and a ban on yard waste in the state's landfills. However, RPAC was not able to find sponsorship for the legislation. Subsequently, Governor Minner's office drafted her own recycling legislation, which garnered co-sponsorship by nearly two dozen legislative members and was introduced to the legislature on June 15, 2005 as Senate Bill 225. The highlights of her proposal include:

- ***Voluntary recycling at the state level*** – Unlike the RPAC legislation, S.B. 225 does not mandate statewide curbside recycling, but instead allows local governments to choose to establish mandatory or voluntary programs.

⁸⁴ Format and percentages derived from Table I, Ibid

- ***Recycling franchise districts*** - Unincorporated areas could establish recycling franchise districts (similar to Kent County's trash districts), either through petitions by residents or through the county. The existing trash collection system would remain intact. Franchise districts could create efficiencies in collection and processing, thereby keeping costs lower.
- ***Zero tipping fee for recyclables*** - No tipping fee would be charged for recyclables delivered to the Material Recovery Facility (MRF) or to DSWA transfer facilities.
- ***\$3 per ton assessment fee*** - DNREC would collect a \$3 per ton assessment fee on solid waste collected and/or disposed of in the state (excluding hazardous waste and recyclables actually recycled). The fees would generate an estimated \$3 million annually.
- ***Establishment of a Delaware Recycling Fund*** which would be used to fund specific activities designed to enhance the state's recycling rate. Revenue for the fund would be generated through the \$3 per ton assessment fee described above. The monies collected would be used to:
 - Fund the ***Local Governments Recycling Grants Program***, a competitive program to assist counties and municipalities with the start-up costs of establishing source-separated recyclables collection programs, with an emphasis on single-stream curbside collection. The grant program would begin in 2006 and would be offered annually through 2012.
 - Fund studies to evaluate the potential for recycling the commercial MSW and for improving the curbside recycling program
 - Fund public outreach and education programs to promote curbside recycling, organic yard waste management and the Local Governments Recycling Grants Program.
 - Pay DSWA's capital and operating costs to manage source-separated single-stream recyclables without imposing a tipping fee. (If available funding is insufficient to cover these costs, DSWA could impose a tipping fee to cover the shortfall).
- ***Ban on organic yard waste disposal at landfills*** – The ban would require generators to separate organic yard waste from other solid waste and transporters to deliver yard waste to designated processors, starting January 1, 2007. The bill encourages the development of private processing facilities, with DSWA managing the yard waste if the private operations fail to materialize. DSWA would be permitted to charge a tipping fee at processing facilities in order to cover its operating costs.
- Continuation of the ***Recycling Public Advisory Council***
- ***Establishment of recovery goals*** for residential and commercial municipal solid waste. Recovery goals for RSW would be 20 percent by January 2008, 25 percent by January 2009 and 30 percent by January 2010. The recovery goal for commercial MSW would be 50 percent by January 2010.

The bill was referred to the Senate Natural Resources & Environmental Control Committee on June 29, 2005 and will therefore not be acted on until the next legislative session at the earliest. In the meantime, legislators, RPAC, DNREC, DSWA and other stakeholders will likely debate its pros and cons.

f. Commercial Recycling

Commercial waste constitutes approximately 40 percent of the MSW generated in Delaware and therefore represents a crucial piece in any plan to raise the state’s overall MSW recycling rate and reduce landfill deposits. According to the 2002 Franklin Associates recycling study completed for DSWA, the commercial sector is already recycling materials at a much higher rate than the residential sector – more than 35 percent⁸⁵ versus 4 percent through the Recycle Delaware drop-off program.⁸⁶ Table 6 shows the quantities of materials commercial entities reported recovering from the MSW stream for FY 2004. It is worth noting that this data is self-reported and not verified, and therefore categories may be over-reported or under-reported. Furthermore, it may include materials that were not generated in Delaware, but were collected by Delaware businesses.

Table 6: Materials Recovered from Delaware Businesses in FY2004⁸⁷			
Material Collected	Tons	Material Collected	Tons
All Aluminum	4,703	Polystyrene	266
All Other Non-Ferrous Metals	5,110	Mixed Glass	1,522
Automotive Batteries	1,932	Corrugated Cardboard	1,917
Newspapers	27	Yard Waste	41,414
Plastic Bottles	73	Tires	9,516
Office Paper	2,484	White Goods	10,249
Junk Mail	388	Other (vegetable oil, ink, soil, etc.)	148,389

In addition to the independent commercial recycling described above, recycling of commercial wastes occurs through several DSWA programs. Many commercial establishments and public agencies currently participate in DSWA programs such as those for oil filter recycling and electronic goods recycling.

Other states have implemented mandatory commercial MSW recycling programs that have included requirements for recycling office paper, cardboard, newspapers and beverage containers by government agencies, schools, libraries, and office buildings with 20,000 square feet or more of office space. The feasibility and impact of implementing such programs in Delaware will require more detailed study of the commercial sector to thoroughly understand the composition of the waste stream, the quantities of materials generated and their potential for recycling. DSWA, in cooperation with Parkowski, Guerke & Swayze, P.A., is funding a statewide study of commercial solid waste in order to better understand the potential for beneficial reuse of these materials and the subsequent potential impact on landfill capacity. Beginning in September 2005, the study will be

⁸⁵ Franklin Associates, Ltd., *Assessment of Delaware Solid Waste Discards in 2000 and the Potential for Recycling of Materials*, Table 9, p. 2-4.

⁸⁶ RPAC, *MOA Report Summary: Statewide Residential Curbside Recycling Program*, January 4, 2005

⁸⁷ From *DSWA 2004 Annual Report, 2004 Recycling Report*

conducted by DSM Environmental Services, Inc., the same group that completed the residential recycling study for RPAC. DSM hopes to complete a report by the end of 2005. In addition, Governor Minner's draft legislation, Senate Bill 225, also provides funding for a study to evaluate the status and potential for recycling the commercial component of MSW. As Table 5 suggests, when recycling goals are expanded to include all parts of the municipal solid waste stream, including commercial waste, the impacts on landfill life expectancy can be great.

g. Bottle Bill

In 1982, the Delaware Legislature passed the Litter Control Act/ Beverage Container Law. Finding that beverage containers were a major source of non-degradable litter in the state, the General Assembly sought to create incentives to their reuse and/or recycling by instituting a refundable deposit system for all non-aluminum beer, ale, malt, carbonated soft drink, mineral and soda water containers less than 2 quarts⁸⁸. (Aluminum cans are not included.) Under the law, stores must charge consumers a five-cent deposit on all of the above-mentioned beverage containers. Upon return of the container to the store, the consumer is to be refunded the five cent deposit.

However, many consumers do not return the containers and hence do not collect the refund. The deposits paid remain the property of the wholesaler or retailer who sold the beverages. Because no official reporting requirement exists, it is unknown precisely how many containers are generated, how much is paid in deposits and how much in deposits go unclaimed. As part of a recycling feasibility assessment it completed for DSWA in 2002, Franklin Associates estimated the quantity of eligible containers to be 93,296,470 and total deposits paid to be \$4,664,820, for the year 2000.⁸⁹ It further calculated that the deposits redeemed totaled \$1,774,940, leaving \$2,889,880 unclaimed.

In some states with "bottle bills", such as California and Hawaii, unclaimed deposits are used by the state to support recycling infrastructure and education. Currently, Delaware's legislation does not enable the State to acquire the unclaimed deposits. However, members of the public and others have suggested that the legislation be changed to allow unclaimed funds to be used to support recycling efforts in the state.

6. Sunset Review

During 2004 the DSWA underwent sunset review, a periodic legislative review of state agencies, boards and commissions to determine their public need and effectiveness in meeting that need. Typically, an agency, board or commission is reviewed once every six or seven years. The process is administered by the Delaware General Assembly's Joint Sunset Committee (JSC), a bipartisan ten-member committee comprised of five senators and five representatives. With the help of public hearings that are held during legislative session, the JSC recommends the continuance, consolidation, transfer or termination of an agency, board or commission.

⁸⁸ Delaware Code, Title 7, Chapter 60, Subchapter III. Beverage Containers

⁸⁹ Franklin Associates, Ltd., *Assessment of Delaware Solid Waste Discards in 2000 and the Potential for Recycling of Materials*, p. 2-8

In reviewing the DSWA, the Joint Sunset Committee held three public hearings in order to gather additional information and elicit opinions about the DSWA from agency staff, sub-contractors, DNREC representatives and the general public. Public comments ranged from being complimentary of DSWA for being well-run and innovative, to calling for an end to the Authority. Numerous complaints focused on the Cherry Island Landfill, particularly related to odor and other quality of life issues. In addition, many comments expressed the need for mandatory recycling.

On May 31, 2005, the Joint Sunset Committee voted unanimously to again continue its sunset review of the Delaware Solid Waste Authority into 2006. A final report will be issued subsequent to the review's conclusion. The outcome of the Sunset Review could have a substantial impact on the future of the DSWA.

C. OPTIONS FOR ADDRESSING LANDFILL CAPACITY LIMITS

1. Update the Statewide Solid Waste Management Plan (SSWMP)

As stated previously, the SSWMP represents a framework for DSWA to carry out its responsibilities for planning and managing the State's solid waste. However, DSWA has not undertaken a comprehensive update of the Plan for more than ten years, although the Plan has been amended twice in the past five years in order to address changes in regulatory and market conditions. For instance, over the past decade plus, significant regulatory and other changes have occurred (the end of flow control, passage of SB 280, closure of the Delaware Reclamation Plant), as well as changes in the state's population, development and the economy, with consequences for how solid waste is handled in Delaware. DSWA has met its obligations to manage Delaware's solid waste and has responded to changes in the waste management business by adapting the goals set in 1994 to meet new demands as well as new limitations. However, the process of adaptation has largely been without the benefit of considered public review and oversight. A revised and updated plan would provide the public with important tools to discuss and debate the options for managing solid waste in the coming decades. If a revised plan had been available before the application was made to expand Cherry Island, it would have provided the public and policy makers with the means to adequately assess the expansion, as well as options, and the opportunity to contribute to the Authority's decision-making process. Ideally, this would have resulted in more consensus surrounding the final choice and greater public acceptance. The Statewide Solid Waste Management Plan should be revised and updated for public review and comment as soon as possible.

2. Expand Cherry Island in accordance with permit application

The path of least resistance is to move ahead with DSWA's expansion plan, which buys another approximately 15 years of capacity. When combined with the landfill space available when DSWA assumes control of WHN, capacity extends out approximately 35 years. (However, an alternate confined disposal facility or other management option for deposition of dredged material is then required to replace WHN.) In the short term, this may be the most convenient course to take; however, once expansion plans are underway it is difficult for decision makers to reverse course. Currently, there are a few short-term options that offer significant opportunities for waste disposal or landfill avoidance such as sending the waste downstate or out of state to another landfill or WTE facility. However,

these options have not been publicly debated in the context of the landfill expansion application. Decisions of this magnitude require thorough evaluation and public input – another reason the Statewide Solid Waste Management Plan should be revised and updated.

3. Ship Waste Out of New Castle County

In lieu of expanding Cherry Island landfill or in combination with other options, DSWA could consider shipping solid waste out of New Castle County for disposal either in downstate landfills or in out-of-state facilities. With a landfill and transfer stations in each county, Delaware's solid waste does not have to travel very far from the point of generation to the place of disposal. While this would be unusual for Delaware, it tracks trends occurring in other parts of the country. According to Solid Waste Digest, for the United States as a whole, solid waste travels an average of 50 miles from origination to disposition. Distance alone should not eliminate options from consideration, whether they are in-state or out-of-state, but should be included in a comparative analysis of various options and combinations.

a. Ship to Downstate DSWA facilities

This scenario involves haulers transporting the solid waste collected in New Castle County to either Pigeon Point Transfer Station (PPTS) or Pine Tree Corners Transfer Station (PTCTS) where it would be consolidated and placed into larger trailer trucks and transported to the Sandtown Landfill southwest of Dover. Sandtown Landfill has capacity to serve Kent County for more than 55 years, based on current filling rates. If the approximately 2,046 tons per day that is currently disposed at CIL were transferred to Sandtown, it would shorten that landfill's remaining available life to less than 10 years. If a portion of that amount, for instance waste from southern New Castle County, were sent to Sandtown, the fill rate would be less and the capacity would be extended.

PPTS is permitted to receive up to 2,000 tons per day, which currently includes sorted recyclables and residuals. PTCTS is currently permitted to receive up to 350 tons per day (it can receive up to 550 tons per day under special circumstances such as holiday weekends, but must still maintain the 350 tons per day average over a week). Already, PTCS's daily limit is frequently met and waste haulers are diverted to Sandtown on occasion. Consequently, the downstate transportation scenario would likely entail some or all of the following: utilizing PPTS; increasing the PTCTS daily limit and expanding the facility; and/or building another transfer station in New Castle County to accommodate the volume of solid waste. DSWA estimates that transporting waste from PPTS or Pine Tree Corners Transfer Station to Sandtown landfill would cost between \$25.00 and \$35.00 per ton based on its current contract with Waste Management, Inc. and on past experience.⁹⁰ Increases in fuel costs over the last year have not been factored into these estimates.

It may be worth noting that should CIL close, DSWA is currently not obligated to transport MSW from New Castle County to downstate landfills. Under the Differential Disposal Fee (DDF) program, which currently runs from July 1, 2005 through June 30, 2010,

⁹⁰ DSWA responses to questions, December 10, 2004

contracted haulers are obligated to dispose of their waste at a DSWA facility. With a CIL closure, this could be done at PTCTS, Sandtown or Jones Crossroads. However, once the daily limit at PTCTS is met, the haulers would be forced to take their waste to Sandtown landfill or Jones Crossroads landfill. And the Authority would not be required to accept waste at Pigeon Point Transfer Station and pay to transport it, even if the facility has capacity. Faced with the high fuel prices, labor costs and inconvenience of transporting waste to Kent or Sussex Counties, waste haulers would be likely to argue (probably in court) that the original conditions under which they signed the DDF contract had been altered, thereby nullifying the contract and the obligation to take waste to DSWA facilities. Of course, DSWA would be likely to counter (also in court) any such attempt to void the DDF contract.

b. Out-of-State MSW Disposal

Another option for DSWA is to transport waste consolidated at existing (and potentially future) stations to landfills and/or waste-to-energy facilities outside Delaware. Pennsylvania and Virginia continue to be the top two waste importing states in the country. In 2004, Pennsylvania and Virginia imported approximately 10.1 million tons⁹¹ and 7.8 million tons of solid waste respectively.⁹² (New Jersey and New York account for more than 90 percent of the solid waste that is imported in Pennsylvania.⁹³ In Virginia, 42 percent of out-of-state waste comes from Maryland, 24 percent from New York and 16 percent from Washington, DC.)⁹⁴ In 2003, the last calendar year for which statewide reporting is available, Maryland was a net exporter of solid waste, importing less than 1,000 tons of MSW. Of the 24 counties in Maryland, 13 counties were either transporting their waste out-of-state or evaluating plans to do so.⁹⁵

Consequently, Pennsylvania and Virginia represent the most likely candidates for out-of-state waste disposal for Delaware. Both have many landfills – (Virginia with 60, Pennsylvania with 49) and each has five waste-to-energy facilities. However, when considering the out-of-state disposal option, several factors merit consideration including available capacity, tipping fees, transportation costs, and some states' attempts at reverse flow control legislation.

1) Available Capacity

Some controversy exists regarding the amount of available waste disposal capacity in Pennsylvania. In 2002, the Pennsylvania Waste Industries Association (PWIA) released a solid waste disposal capacity study estimating that only approximately 7 years of available capacity remained in Pennsylvania. Citing unnecessarily long permitting time frames and “harms/benefits” regulations that have further increased permitting costs, delays and denials, the PWIA predicted that disposal capacity in the eastern half of the state would be

⁹¹ Pennsylvania Department of Environmental Protection (PADEP) website - <http://www.depweb.state.pa.us/news/cwp/view.asp?a=3&q=467169>

⁹² Virginia Department of Environmental Quality (VADEQ), *Solid Waste Managed in Virginia During Calendar Year 2004*, June 2005, p.i.

⁹³ PADEP website - <http://www.depweb.state.pa.us/news/cwp/view.asp?a=3&q=467169>

⁹⁴ VADEQ, *Solid Waste Managed in Virginia During Calendar Year 2004*, June 2005, p.i

⁹⁵ Maryland Department of the Environment, *Solid Waste Managed in Maryland, Calendar Year 2003*, September 2004

exhausted in less than two years.⁹⁶ While it is true that the majority of imported waste from New York and New Jersey is disposed in eastern facilities, there is still capacity available. Several landfills including GROWS, IESI Bethlehem and IESI Blue Ridge located in the eastern part of the state have recently received permits to expand their capacity.

Furthermore, there is waste-to-energy capacity available 20 minutes from Wilmington. Discussions with the Covanta (formerly American Ref-Fuel) Chester County facility reveal that they too have significant available capacity in their 1.2 million tons per year plant. While they recently signed a contract with Philadelphia for 100,000 tons per year, they are actively pursuing a long-term contract with New York City (for twenty years), for between 400,000 and 500,000 tons per year. The decision will likely be made after the November 8, 2005 Mayor's race. Acquisition of this contract would most likely eliminate the possibility of any long-term contract with DSWA for more than 500 tons per day. The WTE facilities located in Lancaster, Montgomery and Bucks Counties have less available capacity as they are smaller facilities that primarily serve the needs of their municipalities.

Virginia's acceptance of out-of-state solid waste in general and MSW specifically has increased in recent years. Of the 7.8 million tons of solid waste Virginia received from out-of-state in 2004, 5.9 million tons was MSW, up from 5.5 million tons in 2003.⁹⁷ However, according to Virginia's Department of Environmental Quality, as of June 2005, the state estimated approximately 16.1 years of available municipal solid waste landfill capacity remaining. Capacity also remains available at the state's waste-to-energy facilities, such as those in Alexandria and Fairfax County which are actively seeking solid waste inputs.

While it is apparent that available capacity exists in Pennsylvania and Virginia, it is unclear how long it will last as facilities try to acquire long-term contracts.

2) *Tipping Fees*

The following table presents the average tipping fees for disposal facilities in Virginia and Pennsylvania according to Solid Waste Digest.⁹⁸

State	Number of Landfills	Average Tip Fee	Number of WTE Facilities	Average Tip Fee
Pennsylvania	49	\$56	5	\$57
Virginia	60	\$40	5	\$46

Specifically, the Covanta WTE facility in Chester County, Pennsylvania quoted a tipping fee between \$43/ton and \$46/ton, depending on length and size of contract. The Covanta

⁹⁶ Pennsylvania Waste Industries Association, *PWIA Insight: The Waste Disposal Capacity Crunch*, November 2002

⁹⁷ VADEQ, *Solid Waste Managed in Virginia During Calendar Year 2004*, June 2005, p.i

⁹⁸ Solid Waste Digest, Volume 14, Number 6 and Volume XV, No. 7

facilities in Fairfax County and Alexandria, Virginia charge fees between \$49/ton and \$55/ton.

Two of the closest landfills in Pennsylvania, the GROWS landfill and Tullytown landfill, both located in Falls Township, in Bucks County, charge \$67.00/ton at the gate, although negotiated contract prices could be lower depending on tonnage and length of contract. Virginia landfill tipping fees range from \$27.50 to \$58 per ton, although negotiated prices would also depend on contract length and tonnage landfilled.

Total disposal costs would have to consider the cost of transporting the solid waste to the facility, whether by truck or by rail, as is discussed below. Loss of revenue for DSWA to support its activities also must be factored into comparative analyses.

3) *Transportation Options and Costs*

Obviously, just as solid waste is currently moved via truck within the state, it could also be transported via truck out-of-state. Transportation costs would correspondingly increase with distance to the facility. One waste hauler interviewed estimated that transporting the waste from Pigeon Point Transfer Station (PPTS) to the Chester WTE facility would cost approximately \$10 per ton, which includes roundtrip labor, fuel and vehicle depreciation and maintenance.⁹⁹ DSWA estimates that transporting waste from PPTS or Pine Tree Corners Transfer Station to Sandtown landfill would cost between \$25.00 and \$35.00 per ton based on its current contract with Waste Management, Inc. and on past experience.¹⁰⁰ This cost would need to be added to the tipping fee at the out-of-state facility to arrive at the true disposal cost. Increases in fuel costs over the last year have not been factored into these estimates.

While Delaware's waste is transported via trucking, some municipalities, such as Boston and New York City have found that as the distance to the disposal facility increases, rail transport becomes more economical than truck hauling of waste. In fact, more than 50 cars and 200 containers of trash already move daily from northeastern states through Wilmington to landfills in southern states.¹⁰¹

This option could potentially be utilized in Delaware as well to transport solid waste to Virginia or other southern states. Norfolk Southern's Edgemoor rail yard is located across I-495 from Cherry Island. John Lassahn, a former Conrail employee specializing in rail marketing, operations and costs, has suggested that in the area between I-495, Hay Road and the City of Wilmington's Waste Water Treatment Plant, space exists to consolidate and load solid waste into 20-foot intermodal containers that are placed on railcars. Railcars can carry up to four of the containers, which can hold approximately 20 to 22 tons of trash each, or up to 90 tons per railcar.¹⁰² Rail haulage costs (to the railroad) would run approximately \$1.50 to \$2.00 per mile per car and include bringing the railcars and containers back empty. Ultimately, transportation costs to DSWA would entail some degree of mark-up on the railroad's haulage costs, as well as costs for leasing the cars and the intermodal containers.

¹⁰⁰ DSWA responses to questions, December 10, 2004

¹⁰¹ The News Journal, *Move trash to landfills by rail*, July 25, 2004

¹⁰² Conversations with John Lassahn, December 6, 2004 and October 13, 2005

This scenario could possibly be expanded if necessary for solid waste generated downstate by using existing Norfolk Southern routes situated near those areas.¹⁰³

More research needs to be conducted into the costs of actual routes, as well as the costs to construct the necessary waste handling facilities and to upgrade available sites. But the infrastructure exists to make this a scenario worth considering.

4) *Reverse Flow Control*

When contemplating shipping waste out of state, decision makers need to be cognizant of some states' attempts at reverse flow control of interstate waste. In an effort to get around the *Carbone* decision, states are trying to devise legal ways to restrict solid waste generated in other states from crossing their borders and entering landfills in their states. On September 23, 2004 a House Energy and Commerce Subcommittee passed interstate waste legislation H.R. 4940, the Municipal Solid Waste Responsibility Act of 2004, by a vote of 12 to 4. The bill would allow states to prevent out-of-state trash from entering their landfills without a host community agreement or state permit or contract.¹⁰⁴ Under H.R. 4940, states could limit the amount of trash any incinerator or landfill accepts. The facilities would be required to submit yearly reports to the state on how much and what types of trash they receive. Recycling materials would be exempt.

Around the country, similar bills have been proposed before the state legislatures. While laws passed in 1999 to limit imports of waste into Virginia were deemed invalid by the courts, legislative efforts are continuing to enact similar bills in that state, as well as elsewhere in the country. For instance, in Michigan, where approximately 20 percent of waste disposed of in Michigan landfills originates from out-of-state, Michigan lawmakers recently introduced an assortment of legislation in attempts to end out-of-state solid waste disposal in Michigan facilities. Similar legislation could be proposed in states where Delaware could choose to send its solid waste.

However, it should be noted that this type of legislation has typically invited lawsuits from waste haulers, with court decisions favoring the hauling industry. As such, reverse control does not currently represent a serious threat to sending waste out-of-state.

4. Landfill Alternatives

Until now, this report has mainly examined solid waste management options centered on landfilling as the primary disposal method. The following discussion presents some alternative methods, from the proven and highly utilized waste-to-energy to other developing, but untested technologies.

a. Waste-to-Energy (WTE)

Waste-to-energy technology is an established and well-proven means of municipal solid waste disposal. In 2002, approximately 600 WTE facilities in 35 countries processed 130 million tons of MSW to produce electricity and/or steam. According to the Integrated

¹⁰³ Ibid

¹⁰⁴ NACO Legislative Bulletin, September 24, 2004, www.naco.org

Waste Services Association, in 2003 the 89 waste-to-energy facilities operating in 27 states in the United States combusted an estimated 29 million tons, or 13 percent of the MSW produced and generated nearly 2,700 MW of electricity.¹⁰⁵ With European Union regulations mandating the reduction of landfilling, WTE is on the rise in Europe, as well as around the globe. Per capita, the use of WTE is nearly three times higher in countries such as Japan, Denmark and the Netherlands than in the U.S. And since 2001, nearly 50 new WTE facilities are either operating or under construction worldwide.

1) *Technology Description*

Simply put, waste-to-energy facilities combust waste to produce energy in the form of electricity and/or steam. A typical WTE facility produces between 400 KWh and 600 KWh per ton of waste processed. The higher the moisture content of the waste stream, the lower the efficiency of the WTE facility. The three main types of WTE technology are:

- **Mass Burn** plants generate electricity and/or steam by combusting in a single stationary chamber unprocessed MSW (i.e., only items too large to go through the feed system are removed from the waste input). The capacities of typical mass burn plants range from 10 to 3,000 tons of MSW per day.
- **Modular** plants, like mass burn plants, combust MSW without preprocessing, but use two vertically mounted combustion chambers. They have significantly smaller combustion capacities than MB plants (5 to 300 tons per day) and are often prefabricated off-site for quick assembly where needed.
- **Refuse-Derived Fuel (RDF)** plants first process MSW by removing recyclable and/or noncombustible materials from the waste stream, which improves combustibility. The remaining waste is then shredded and sorted into a dense uniform fuel known as RDF. RDF may be burned in a dedicated combustor on-site or can be shipped off-site for use as fuel in facilities that “co-burn” fossil fuels.¹⁰⁶ The capacities of dedicated RDF facilities range from 250 to 3,050 tons per day.

2) *Management of Pollutants*

WTE technology is not totally benign. In the 1980s, EPA identified WTE facilities as major sources of mercury, dioxin and furan emissions. However since the promulgation in 1995 of Maximum Available Control Technology (MACT) regulations, the U.S. WTE industry has spent more than one billion dollars in retrofitting air pollution control devices (APCDs), resulting in significant reductions in emissions of air pollutants. Since 1995, mercury emissions from WTE facilities decreased by more than 95 percent and dioxin emissions declined by more than 99 percent over the same period.¹⁰⁷

In addition to APCDs, best management practices also help increase plant efficiency and reduce the formation and release of persistent organic pollutants (POPs) such as dioxins, furans, PCBs and hexachlorobenzene.

¹⁰⁵ Integrated Waste Services Association, 2004 Directory of WTE Plants

¹⁰⁶ Ibid

¹⁰⁷ Integrated Waste Services Association, www.wte.org/waste.html

In addition to air emissions, WTE facilities generate two types of ash: bottom ash, which tends to be low in persistent organic pollutants and resists leaching; and, fly ash, which tends to be higher in toxics. Fly ash and the filters that capture it need to be landfilled. Bottom ash may be reused in several applications, including road construction, fill materials and landfill daily cover.

3) *Pros and Cons of WTE*

a) *Benefits*

WTE as a MSW disposal alternative offers many benefits, the primary being the 90 percent reduction in volume and 70 percent reduction in weight of the feed waste. By its nature, WTE represents a readily available energy source, and since the implementation of Maximum Available Control Technology, one “with less environmental impact that almost any other source of electricity,” according to EPA.¹⁰⁸

WTE is also compatible with other waste management strategies such as recycling, with recyclables being removed either on site or prior to waste arrival at the facility. Magnets and other devices also remove metals prior to combustion and from the bottom ash for recycling. Communities with WTE facilities recycle their MSW at higher rates than communities without them.

b) *Cons*

While WTE can boast some positive benefits, it also suffers from a number of negative concerns:

- Creation of hazardous air pollutants, such as dioxins, furans and other persistent organic pollutants (POPs), as well as toxic metals such as mercury. These pollutants have been linked to asthma (due to particulates and sulfur dioxide), immune, nervous system, and cancer effects (due to dioxins and furans and mercury).
- Need to landfill ash – Some debate the safety of beneficial reuse projects using bottom ash and the ultimate fate of landfilling toxic fly ash, fearing groundwater and soil contamination.
- Major capital costs - Construction of a WTE facility represents a major capital investment, typically costing \$100 to \$200 million, depending on the size. Facilities can cover capital costs and operating expenses through tipping fees, the sale of energy and potentially the sale of recyclables.

4) *WTE in Delaware*

While DSWA currently relies on landfilling as its primary solid waste management method, the Authority has utilized waste-to-energy in the past. From 1990 through 2000, the Authority sent up to 1,000 tons per day of MSW to the Covanta facility in Chester,

¹⁰⁸ Nickolas J. Themelis, “An Overview of the Global Waste-to-Energy Industry”, Waste Management World, 2003-2004 Review Issue, July-August 2003, p. 40-47, www.seas.columbia.edu/earth/papers/global_waste_to_energy.html

Pennsylvania. Also, for a brief period between early 1988 and October 1991, a 600-ton per day waste-to-energy facility operated at the Delaware Reclamation Plant. DSWA did not own or operate the facility, but did provide refuse derived fuel for the facility before operating problems forced its closure.

As recently as 2000, a Tennessee-based company planned to build in New Castle a 25-megawatt WTE facility designed to burn 630 tons per day of waste construction wood and generate steam for electricity. However, extremely strong public opposition to siting the facility helped pass Senate Bill 280 which prohibits the construction of any incinerator within three miles of a school, church or residence. No attempts to site a WTE facility in the state have been made since the passage of SB 280, which is considered by many as a de facto ban on WTE in the state.

DSWA has stated that a WTE facility would require approximately 25 acres; however, the Authority has not performed a formal search for a WTE site. Finding a suitable WTE location in New Castle County under the siting restrictions imposed by SB 280 would appear to be impossible.

b. Other Technologies

While WTE remains the most fully-proven large-scale disposal alternative to landfilling, there are other technologies in various stages of industrial-scale development that merit further investigation as future disposal strategies. Some of these are discussed below. Of course decisions on the use of any of these or other technologies would have to consider capital and operating costs, the availability and quantity of solid waste, competing regional technologies, compatibility with existing solid waste management programs (e.g. recycling), and residues management, among other factors.

1) WastAway

The Bouldin Company of Tennessee has developed a proprietary process called WastAway that processes unsorted MSW into what it claims to be a stable, safe, odorless product similar in consistency to wood pulp and weighing 40 percent less than the input waste.

At its plant in McMinnville, Tennessee, the company processes 160 tons of MSW per week collected from nearby Warren County. The process takes 30 minutes to transform MSW through shredding, grinding and pressure heating into a product called Fluff. The Fluff can be further treated to create compost and growing media for the nursery, horticultural and agricultural industries and it has applications in soil reclamation and erosion control. The Fluff can also be extruded to make products such as landscape timbers, fencing, and park benches.¹⁰⁹

Currently, a typical dual-line WastAway system can process up to 100 tons of MSW per day or approximately 30,000 to 40,000 tons per year. It is estimated that a facility of this size would cost from \$3.5 to \$5.0 million.

¹⁰⁹ www.wastaway.com

Because of the small scale, this technology does not appear to be a total replacement for landfilling, but it represents a potentially complementary technology that could supplement landfilling if applications or outlets were found for the process end products.

Members of the Delaware Environmental Alliance for Senior Involvement (DeEASI) applied for a \$50,000 federal grant from U.S. EPA to fund a test of the WastAway process using municipal solid waste generated in Delaware but was turned down.

Under the grant, the Town of Newport would supply 30 tons of MSW to the WastAway plant in Tennessee for processing into the Fluff end-product would be blended with pine bark and would also be formed into rigid products such as park benches and fence posts. These materials would be returned to Delaware where they would undergo integrity and impurities testing by independent laboratories. DeEASI might reapply in the future.

2) *Plasma Arc Gasification*

Plasma gasification is a non-incineration thermal process that uses extremely high temperatures to completely decompose feed wastes into very simple molecules.¹¹⁰ The extreme heat applied under oxygen-starved conditions creates by-products that include a combustible, energy-rich gas and an inert gas-like slag. When carbon-based waste is used, the product gas is rich in hydrogen and carbon monoxide. This mix, called syngas, can be combusted to generate electricity or steam, producing carbon dioxide, nitrogen and water vapor as the primary atmospheric emissions. It can also be used as a chemical feedstock. The slag, which has low leachate characteristics, can also be utilized in construction, packaging and insulation applications. With the use of available air pollution control devices, generation of air pollutants are generally less than or equal to that of WTE facilities.

Another purported benefit of plasma gasification includes the tremendous volume reduction of input material. Manufacturers claim that for municipal solid waste, the volume reduction exceeds 250-to-1 (99.6 percent). Waste-to-energy incineration offers a volume reduction ratio of approximately 5-to-1 (80 percent). Another positive includes relatively small plant size.

The technology is currently being applied at two facilities in Japan with capacities of 10 tons and 166 tons per day respectively, with the second plant handling a mixture of two-thirds auto-shredder fluff and one-third MSW. Two plants are also planned for Poland. After hiring R.W. Beck to complete a study on the application of the technology to its MSW, Honolulu, Hawaii requested bids on a 1,000 ton per day plasma gasification facility. Georgia has also hired R.W. Beck to complete a similar study for that state's waste.

3) *Thermal Depolymerization*

Thermal Depolymerization (TD), also known as Thermal Conversion (TC) is a process that “mimics the natural processes that convert organic matter, under heat and pressure, into oil.”¹¹¹ The technology claims to take any number of hydrocarbons and organic feedstocks (including food wastes, tires, mixed plastics, MSW components, and sewage sludge) and

¹¹⁰ www.usplasma.com

¹¹¹ United Nations Environment Programme, *Draft Guidelines on BAT and BEP for Municipal Waste Incineration*, October 23, 2003

through the application of extreme heat and pressure under anaerobic conditions, produce clean, solid, liquid and gaseous alternative fuels and specialty chemicals.¹¹²

The technology is now in practice at a Carthage, Missouri, plant operated by Renewable Environmental Solutions, LLC (RES), a joint venture between Changing World Technologies, Inc. (CWT) and Conagra Foods. As of mid-2004, the plant was producing up to 200 barrels of No.4 crude oil per day using by-products from an adjacent turkey processing facility. The plant aimed to reach peak capacity by the end of 2004, at which time it expected to produce 500 barrels of oil per day,¹¹³ as well as natural gas, liquid and solid fertilizer and solid carbon.

The application of thermal depolymerization to MSW as yet is unclear. CWT sees the technology as one that can be applied in conjunction with other waste management strategies, such as by processing the residuals portion from recyclables collection and sorting, (or treating municipal sewage sludge). However, CWT does note that while the technology has been successfully applied to all of the “constituent organic elements of MSW,” research is still ongoing to design a facility to process a heterogeneous MSW stream.¹¹⁴ A report by the United Nations suggests that the thermal depolymerization process seems to be most effective with homogeneous waste streams, with results so far being inconsistent for mixed MSW.¹¹⁵

5. Site a New Landfill

One possible option for DSWA is to site a new landfill in New Castle County. Under Title 7, Chapter 64, DSWA is exempt from local zoning restrictions, but still must meet the landfill siting requirements under DNREC’s Solid Waste Regulations. DSWA admits that it is not currently considering other landfill sites, since the agency has not been able to identify a suitable site of at least 500 acres in New Castle County. As mentioned in the part of this report that deals with disposal sites for dredged material, the Army Corps of Engineers looked for a similarly sized site near the Delaware River and could not find a suitable location. DSWA states that prior to proposing the expansion of CIL in 2002, its staff prepared a detailed map showing where a landfill could **not** be placed due to airport restrictions and coastal zone impact. The Authority’s analysis indicated that these restrictions essentially limit any future site consideration to land below the C&D Canal.

Even if DSWA were able to identify a suitable location in New Castle County and determine that it meets all of DNREC’s siting requirements (e.g., floodplain, wetlands, public water supply), it would still have to face an inevitably tough public hearing process. DSWA estimates that under a best-case scenario, the time to complete design work, permit preparation, regulatory review, site preparation and construction would probably require ten years before a new landfill would be available. Before dismissing a new landfill as an alternative, a thorough review of potentially-available sites in the county should be completed.

¹¹² Renewable Environmental Solutions, LLC website: www.res-energy.com/technology/index.asp

¹¹³ www.res-energy.com/faq/index.asp

¹¹⁴ Changing World Technologies, Inc. website: www.changingworldtech.com/information_center/faq.asp

¹¹⁵ United Nations Environment Programme, *Draft Guidelines on BAT and BEP for Municipal Waste Incineration*, October 23, 2003

III. DREDGING

As has been outlined above, the sites designed to accept dredged material from the Port of Wilmington are a key component of the landfill issue. Wilmington Harbor at the mouth of the Christina River needs to be dredged every 8 months so that shippers that use the Port of Wilmington are assured of water depths that can accommodate their vessels. Maintaining dependable disposal sites is critical to sustaining a viable and competitive Port, which benefits the City, State and regional economy. At current dredging rates, one of two alternating confined disposal facilities (CDFs) will reach capacity by the end of 2009. The other site can only be used as a stand-alone disposal facility for an additional four to five cycles or approximately three to four years beyond 2009. At that time the site will require dewatering and raising of dikes, which takes approximately three years.

A. THE PORT OF WILMINGTON

The Port of Wilmington, located at the confluence of the Delaware and Christina Rivers (See Figures 1 and 2), is a deepwater port and marine terminal handling over 400 vessels per year with an annual import/export cargo tonnage of 5 million tons. The Port serves as a major Mid-Atlantic import/export gateway for a wide variety of maritime cargoes and trade. The Port handles a range of products for both import and export and has the distinction of being the leading East Coast port for refrigerated and perishable fruit and produce, handling more than 1.5 million tons per year of chilled and frozen products. According to the USACE, “The Port has effectively marketed its unique cold storage facilities to fruit traders and solidified its position as the number one fruit and banana port in the United States. The banana trade represented more than twenty percent of imports in 2001.”¹¹⁶

The Port of Wilmington is also recognized as one of the largest container ports on the Delaware River. The Port is equipped with state-of-the-art container cranes and container handling equipment that allow 35 containers to be moved on or off ships per hour.

Wilmington also serves as a shipping facility for Volkswagen and Audi imports and GM and Ford exports. In addition, private petroleum terminals handle more than 1 million tons of liquid bulk petroleum products at a specialized tanker berth at the entrance of the harbor.

The marine terminal supports approximately 2,800 direct and indirect well-paying jobs, including about 400 full-time longshoremen. The Port is owned and operated by the Diamond State Port Corporation, a corporate entity of the State of Delaware.

Part of its attraction is that it is readily accessible to U.S. East Coast markets via interstate I-95 and rail access via Norfolk Southern and CSX Transportation. Another selling point is its proximity to the Atlantic Ocean. Wilmington is the first deep-draft general cargo port in the Delaware River. By docking in Wilmington, shippers are 29 miles closer to the ocean shipping lanes than the Port of Philadelphia, thereby saving time and additional expense of sailing further up the Delaware River.

¹¹⁶ U.S. Army Corps of Engineers, *Dredged Material Management Plan (DMMP)*, p.10

Located on approximately 370 acres, Port facilities include eight deepwater general cargo berths, a tanker berth, a floating berth for roll-on/roll-off vessels on the Christina River, and an auto roll-on/roll-off berth on the Delaware River. Ship traffic includes tankers, container ships, barges and other general traffic requiring operating drafts of up to 38 feet. To accommodate the ships that use the Port, all of these berths and the Christina River harbor where they are located, must be dredged periodically with the exception of the auto berth which is located adjacent to the main channel of the Delaware River. However, not all of the berths are maintained to 38 feet in recognition of the need to reduce maintenance dredging requirements.

The lead agency for dredging is the USACE. The Philadelphia District of the USACE manages and coordinates dredging activities with the Port and DNREC. Currently, maintenance dredging is performed every eight months by the USACE. All of the costs of dredging the channel are considered federal. The cost of maintaining the berths is borne by the Port under a cost-sharing arrangement where the Port pays 25 percent of the costs. Approximately 400,000 to 700,000 cubic yards of silt and clay are removed from the river every eight months and are deposited in two Corps-maintained confined disposal facilities (CDFs): Wilmington Harbor North and Wilmington Harbor South. Failure to meet these dredging demands would severely impact Port operations in a fairly short period of time and ultimately would force closure of Wilmington Harbor.

The amount of dredged material being disposed of today is significantly less than has historically been dredged from Wilmington Harbor. In the past, as recently as three years ago, approximately 750,000 cubic yards was removed annually – 350,000 cubic yards more than current rates. Shoaling has not deposited as much material as in the past, but the exact reasons for this reduction are unclear and whether this pattern persists is uncertain. While the reduced shoaling has continued for the past three years, the Corps recently informed the Port that levels have begun to creep up slightly. This is an important factor when calculating the capacity of existing disposal sites and when assessing alternatives that were developed using the earlier higher disposal volume.

The dredging is usually accomplished with hydraulic dredges that typically pump three to four successive cycles of wet dredged material into one CDF where it settles and dries. The sites are alternated so that the material placed in one can dewater while the alternate site is being used. Most water from dredged material is discharged back into the river, while much is lost to evaporation. Even after “drying” the dredged material is still roughly equal parts soil and water.

B. DREDGE DISPOSAL SITES

There are currently two sites being used to dispose of dredged material from the Christina River: Wilmington Harbor North and Wilmington Harbor South (See Figures 1 and 2).

1. Wilmington Harbor North

The Wilmington Harbor North CDF is a 160-acre area that lies on the western portion of Cherry Island, north of the Christina River, and adjacent to the Port. Wilmington Harbor North (WHN) is adjacent to the Cherry Island (CIL) landfill that is located on land that has been used by the Corps for the past 80 years as a disposal area. DSWA and the Corps jointly hold title to portions of the site and, as has been previously discussed, it is part of DSWA's long-term landfill expansion plans. As has been noted in the section on CIL, the disposition of WHN is critical to the future of the landfill and the handover of the site from USACE to DSWA.

The timetable for WHN reaching its capacity limit as a CDF is unclear; however, the date that is most commonly referenced for planning purposes is 2009. Numerous factors enter into the capacity calculation, such as:

- **Site stability** – the lateral stability of the existing containment will determine by how much the site can be expanded to accommodate more material. The Corps has been conducting tests to determine stability for one last expansion phase. Depending on the results, the site could reach its limits in two years if there is no ability to expand.
- **New management techniques** --- provided the site is stable, more aggressive management techniques could extend capacity to 2015 and possibly beyond. These techniques, which could entail more efficient dewatering and filled material consolidation, and the options they offer will be discussed in detail further in the report.

In 2002 the Corps and DSWA reached an agreement that allows WHN to expand and allow placement of dredged material up to and against the Cherry Island Landfill slopes to an elevation of +65 feet. The use of the landfill slopes for filling alleviated the necessity for construction of a cross dike and increased the capacity of the area. The Corps agreed to line the slopes with bento-mat and provide DSWA with a "takeover date", at which time all dredged material placement operations would cease. Initial discussions projected a January 2010 turnover. Because of the uncertainty of shoaling rates and the uncertainty with respect to designing higher containment dikes, a decision by the Corps on the turnover date has not been finalized. There seems to be some disagreement between the Corps and DSWA on the nature of the agreement and turnover date, with the Corps claiming a later date due to lower shoaling rates which makes for more capacity than envisioned when the 2002 agreement was reached. Whatever the final resolution of this issue, it is likely that any Corps plan to continue using WHN for dredge disposal past 2010 would have to be renegotiated.

The uncertainty surrounding WHN and the limited amount of time available under the worst-case scenario requires decisions to be made soon. The Corps has not decided on which course to take pending an assessment of the factors above, resolution of institutional concerns and formal completion of the dredged material management plan discussed below.

WHN operates as an alternating site with Wilmington Harbor South to allow for continuous disposal capacity. When one area is receiving dredged material, the other is

drying out. Because the material is pumped in, the water content is very high. Dewatering is initially done by simple decanting and evaporation and subsequently by digging ditches and allowing water to drain off the site by gravity. Each area is designed to contain roughly three consecutive eight-month maintenance-dredging cycles before a drying cycle is necessary. While one area is being used, the other is being dewatered and reconstructed with heightened dikes for future use. This alternating pattern usually takes from 32 to 40 months.

The last disposal at WHN ended in August 2005. The site currently contains capacity to elevation +48 NAVD 88 (48 feet) with maximum dredged material capacity to elevation +60. The final level and ability to expand will depend on the ongoing engineering evaluation of dike raising alternatives. Disposal now shifts to WHS.

2. Wilmington Harbor South

The second disposal site, Wilmington Harbor South, is a 326-acre site located between the Port and the Delaware River extending south along the Delaware River (see Figure 4). It is the newer of the two sites and began operation in 1986. Site capacity is expected to extend beyond WHN, but projections on when limits are reached depend largely on the fate of WHN and whether a new tandem site can be established before WHN closes. When used as an alternate site, WHS is expected to reach its capacity limit in approximately 35 years. WHS cannot function as the sole disposal site for Wilmington Harbor dredging because of the need to allow for the wet dredged material to “shrink” over the three-year period when the alternate site is being used so that the dikes can be incrementally expanded vertically. Each dike raising is offset inward and constructed over the recent dredged materials with dried out dredged materials. The soft foundation conditions directly impact dike stability and limit the height of newly constructed dikes. That is why it is necessary for the area to be dried out. It is also important to note that each time the dikes are raised, the effective disposal area gets smaller, which is one of the main concerns with WHN and one of the biggest problems of splitting WHS in two, as discussed later.

WHS is the larger of the two sites. Dredged material disposal alternates between the northernmost end of the site and the southern end. This allows dredged material to be spread out more evenly over the site. WHS has currently reached elevation +25 and is projected to rise to elevation +60 (NAVD 88) when it reaches capacity.

3. The Port’s Maintenance Dredging Costs

The USACE is responsible for maintaining the channel depth required by the Port of Wilmington to operate. The Christina River was adopted as a Federal Navigation Project under the Rivers and Harbors Act of 1870 and dredging was initiated in 1896. Wilmington Harbor was built in 1924. The project was modified in 1960 to provide for channel depths and a turning basin opposite the marine terminal of 38 feet.

The costs of maintenance dredging of the channel are borne primarily by the USACE. The provision of new disposal capacity is cost-shared by the Port at 25 percent. The cost of berth dredging is borne by the Port. This is a typical cost-sharing basis for Federal Navigation Projects. Within the last five years the Corps has invested over 7 million dollars in the disposal areas at the Port resulting in a large increase in the amortized cost of

disposal. The costs of disposal area operations have significantly impacted the price that the Corps charges the Port for disposal of the material from its berths. Up until the latest contract issued in 2004, the Corps charged the Port \$0.55 per cubic yard for use of the federal sites for disposal. By using the same contractor that the Corps used to dredge the channel, the dredging costs were held to \$1.68 per cubic yard. This compares with recent regional Corps contracts ranging from \$2.00 to \$4.00 for disposal and \$4.00 to \$5.00 for dredging in the Schuylkill channel and C&D canal. Dredging costs in competing ports such as Baltimore, Maryland range from \$10.00 to \$15.00 per cubic yard for disposal and dredging costs of \$8.00 to \$10.00 per cubic yard. In northern New Jersey and New York City ports, the costs of disposal alone soar to between \$20.00 and \$60.00 largely because of extremely limited and expensive disposal options.

The USACE has signaled that the Port's attractive deal is going to have to adjust to the realities of increased replacement costs and disposal area operations costs. As a result, the latest contract pegged costs at \$2.00 per cubic yard for use of the federal site – a 275 percent increase – according to the Port's senior engineer Randy Horne. As substantial a jump as this might be, initial indications were that costs would exceed \$4.00 per cubic yard. In interviews, Corps officials indicated that future contracts would be higher. The reason they did not raise fees to the higher level this round was because Port officials made a compelling case that an increase from \$0.55 to \$4.00 would send shockwaves through the annual budget and more time was needed to adjust to price increases. Nonetheless, the Corps has put the Port on notice that costs will rise. With these increasing costs and the burden they place on managing the Port's budget, it opens the door to exploring alternatives to the existing arrangement that over the long term may be more cost effective.

C. PLANNING FOR WHN SHUTDOWN – THE DMMP

As the agency responsible for maintaining the navigation depths of Wilmington Harbor, the Corps is required to perform a dredged material management plan (DMMP) if an assessment determines that there is insufficient capacity to accommodate maintenance dredging for the next 20 years. Priority is given to sites that will reach capacity during the next 10 years. In October 1995, a preliminary assessment concluded that to accommodate the shoaling rate in the Christina River measured at that time, the existing WHN disposal facility would reach capacity by 2004. It was later determined that disposal capacity could be delayed until 2009 through a one-time only expansion of the Wilmington Harbor North facility, which included a collaborative approach with DSWA, whereby the USACE included the adjoining slopes of the CIL into the disposal facility.

The Corps undertook a preliminary DMMP in 2002-2003 in coordination with other cooperating agencies including: the U.S. Fish and Wildlife Service, the Delaware Department of Natural Resources and Environmental Control (DNREC), New Jersey Department of Environmental Protection (NJDEP), the U.S. Environmental Protection Agency and the National Marine Fisheries Service. According to the Corps' description of the project:

The DMMP for Wilmington Harbor is an investigation of alternative methods of disposal and alternate disposal areas for the Port of Wilmington. The plan serves to identify those areas and technologies that have the potential to provide sufficient disposal capacity for material likely to be dredged over a 20-year time period, or

longer. As part of the management plan studies, better management practices of existing confined disposal facilities, options to reduce shoaling, and beneficial uses of dredged material were investigated. Although not necessarily solutions in and of themselves, they were incorporated into the final recommended plan of improvement.

The first preliminary draft was completed before 2000. Another in a succession of preliminary draft DMMPs was completed in August 2003 but was never put in official draft form. Until it is in official draft form it will not be released pending, among other things, resolution of New Jersey's willingness to accept dredged material from Delaware – an issue that will be examined in detail further on in the report. A multi-step process was used to evaluate various dredged material disposal options and eliminate those that lacked serious potential. A wide-ranging list of alternatives was prepared, evaluated, pared down, ranked and the top three were recommended for a more detailed review. The final step looked more closely at all of the top choices from an engineering, geotechnical, and economic perspective. Documentation in accordance with the National Environmental Policy Act (NEPA) was also prepared during the selection process and integrated throughout the plan.

1. Historical Review and Preliminary Evaluation

Drawing on its long association with maintaining the Delaware River main channel for navigation and dredging the Christina River, the USACE launched the DMMP's initial screening with a thorough historical review of disposal alternatives. Previously considered disposal sites, historic documents, aerial photographs and maps were studied to determine whether there were any available disposal sites within the vicinity of the Port. A broad list of 39 alternatives that included non-site specific options was initially screened for feasibility (see Table 7).

Some of the early alternatives were eliminated due to economic and/or environmental constraints, such as Port closure, ocean dumping, submersible pumps and new jetty construction. Certain projects using dredged material, referred to as "beneficial uses," also were explored and eliminated. For example, wetland creation, brownfields development and mine reclamation did not make it past the preliminary screening. Issues ranging from sediment contamination to reliable year-to-year disposal assurances were given as reasons for dropping some beneficial use options. The Corps also authorized an engineering study to examine a variety of hydraulic structures and dredging techniques to determine if they were feasible. None were found to be economically feasible.

Included in their review was an examination of WHN expansion. The Corps determined that technically it could be expanded, however, some of the engineered improvements had not been done on this scale before. Under the best expansion scenarios studied, initial costs were estimated to be between \$60 and \$100 million for a gain of only 20+/- years. The Corps determined this option to have significant risk and eliminated it from further consideration. WHN expansion also conflicted with agreements reached in 2002 with DSWA that authorizes the Corps to use the site until it reaches capacity in 2009. As mentioned previously, at that point DSWA will take over the site and prepare it for expansion of the adjacent Cherry Island Landfill.

TABLE 7 – DMMP		
Preliminary Screening: List of Possible Alternative Actions		
(+)= viable action, (-) = non-viable action		
+	Close the Port	
+	Relocate Port to Delaware River	
+	New Upland Disposal Areas	
+	Reuse dredged material from Wilmington Harbor South and Wilmington Harbor North CDFs	Use as landfill caps, hazardous site covers, fill holes, construction materials, haul out (by trucks/train), mine disposal
+	Island Creation/Restoration	
+	New Aquatic Site	
(-)	Sediment traps upstream of existing project	
+	Agitation System	
+	Reduce/Eliminate Turning Basin (Sediment Trap)	
+	Aggressive management of Wilmington Harbor South and Wilmington Harbor North (Crust Management and Wicks)	
(-)	Build Wilmington Harbor South higher than currently designed	
(-)	Mix with cement and make erosion control blocks	
+	Ocean Dump	
(-)	Incinerate Material	
+	Delaware Bay Wetland Creation	
+	Delaware River Wetland Creation	
+	Dredge less material (Reduce authorized depth)	
+	Construct New North Jetty	
+	Extend South Jetty further into Delaware River	
(-)	Construct large tide gate at the mouth of the Christina	
(-)	Construct silt curtains at the mouth of the Christina River	
(-)	Transport dredged material to New Jersey in exchange for NJ solid waste transport to Delaware	
+	Use existing disposal areas in new Jersey (various)	
+	Create a shallow water habitat	
(-)	Dredge and dispose/pump in Delaware River directly from Christina River	
(-)	Sediment Traps on Delaware River above Trenton	
(-)	Thin layer disposal	
(-)	Farmland fill	
(-)	Farmland creation	
(-)	Urban Disposal / Brownfields Redevelopment (i.e., Camden)	
(-)	Upland creation for development	
(-)	Floc Dredged material and Riverine Disposal	
+	Do not dredge fluid mud	
+	Permanent pipeline to Chesapeake & Delaware (C & D) Canal Existing Disposal Areas	
+	Hopper Dredge from Christina and Pipe to C&D Existing Disposal Areas	
+	Portable, submersible pumps – pumps continually (create many smaller cells)	
+	Expand Wilmington Harbor South outward into Delaware River	
+	File Search and Report Review to investigate previous alternatives considered	
(-)	Expand Wilmington Harbor North	

As options made it through more rigorous review and several rounds of stiffer environmental, fiscal and institutional screening, the main threshold that had to be cleared was that the site or use (disposal alternative) had to accommodate sufficient capacity for disposal of almost 20 million cubic yards of capacity for at least 20 years beyond the base year 2009.

Once this key condition was met, eleven alternatives were ranked using the following criteria:

- Initial Construction Costs. Ranging from low (<\$5 million) to high (>\$10 million);
- Average Annual Costs. Ranging from low (<\$6 million) to high (>\$10 million);
- Environmental Impacts. Ranging from sites where dredging placement already occurs with low impact to high impact sites with high quality habitat value that would be lost; and
- Institutional Risk. Ranging from low risk sites with little or no political, social, economical, or logistical issues to high risk involving many of those issues.

Of the eleven, which included nine proposed or existing CDFs, the top three ranked were moved into the pre-final evaluation phase. These options included:

- Dredged Material Reuse as a Construction Material;
- Pedricktown, New Jersey CDF; and
- Biddles Point, Delaware CDF.

The Corps recognized that disposing of material that originated in Delaware in Pedricktown, New Jersey (See Figure 1) posed “institutional” problems, however, they calculated the operational benefits outweighed the costs of these problems. The authors of this report found that the institutional barriers, as defined by political antagonism expressed by New Jersey government officials and office holders, could not be easily dismissed and presented a formidable source of opposition. These concerns will be explored in more detail further in the report. Perhaps because of this opposition, one alternative that might produce a very favorable benefit-cost ratio, piping dredged material directly to New Jersey was not assessed. It should be.

The Corps devised an approach to address some of New Jersey’s anticipated resistance by looking to the next highest ranked CDF: Killcohook, New Jersey (See Figure 1). Similar to Pedricktown, Killcohook is owned and operated by the Corps for maintenance of the Delaware River main channel and has slightly larger capacity. It received a lower rank than Pedricktown because it had higher average annual costs than Pedricktown. What attracted the Corps to Killcohook was that while it is located along the New Jersey shoreline, because of a colonial era mapping anomaly, two of its three disposal cells (#2 and #3) are located within the expanded border of New Castle County Delaware. As might be expected, New Jersey officials do not embrace this technicality as justification for dumping Delaware dredged material on their side of the Delaware River.

2. DMMP Proposal

For the final phase of their investigation, the Corps took a more detailed look at the remaining options including an examination of geotechnical analyses, environmental impacts, engineering parameters, cost estimates and real estate requirements. The final four alternatives investigated were:

- No Action (Required by NEPA);
- Dredged Material Reuse as a Construction Material
- Biddles Point CDF
- Killcohook/Biddles Point CDF Combination

a. No Action

An assessment of “no action” is required by NEPA to determine whether existing conditions are adequate to deal with dredging demands. The Corps determined that if no further action occurred beyond what is currently available at WHN and WHS, the sites would eventually reach capacity and Port operations would be severely restricted or discontinued.

b. Dredged Material Reuse as a Construction Material

The Corps and EPA have developed a list of possible projects that allow dredged material to be used in a beneficial way. These options will be discussed in detail further in the report. For purposes of the DMMP evaluation, the Corps picked the production of lightweight aggregate (LWA) as the preferred beneficial use and analyzed the concept of using this material in quantities sufficient to offset the amount being sent to WHN. The Corps defines LWAs as “*either naturally occurring or manufactured materials that are being used in today’s construction industry in high performance construction masonry, asphalt pavement, structural concrete, and geotechnical applications (e.g. fill, road base and drainage systems).*” They cite as LWA’s primary advantage its ability to produce construction material with reduced weight but no reduction in structural soundness.

The Corps envisions a method whereby a LWA manufacturing plant would be built to process and prepare the material for use. The facility would be located, in theory, near WHN to allow dried dredged material to supply the plant’s needs at a rate of extraction equal to what would be deposited during a normal cycle. While WHN was being mined, WHS would be used for disposal and vice versa. As the Corps notes, if the amount being mined and extracted equaled the amount being deposited, this could hypothetically provide a perpetually active site. And while they did not discuss the impact this would have on DSWA’s expansion plans utilizing WHN, the Corps did assume that the amount dredged would be greater than that mined and processed consequently adding up to a site filled to capacity over time.

The Corps estimated that this alternative would have a total initial cost of \$79 million. This includes \$7.3 million for site preparation and \$72 million for plant construction. When assessing this alternative, the Corps concluded, “this method of reuse was deemed plausible for the future, albeit impractical at the current time.”

It is worth noting that pursuit of this option would also have to explore any impacts on the stability of the adjacent Cherry Island Landfill, which the WHN site “piggybacks” and identify any legal ramifications of altering the land-transfer agreement between DSWA and the Corps. Other beneficial use options not explored in the DMMP are discussed later in this report.

c. Biddles Point CDF

Biddles Point (See Figure 1) is an active 300-acre CDF owned by the Corps used as a dredging maintenance site for the C&D Canal two decades ago. It is located 13.5 miles from the Port on the north bank of the canal east of the St. George’s Bridge in New Castle County. This CDF could be used in tandem with WHS to provide approximately 50 years of capacity at current dredging rates (20 million cubic yards at an eight-month dredging cycle). During the C&D Canal deepening study, the Corps noted that the site is located above two aquifers that are the primary source of groundwater for local communities and that concerns have been raised about impacts on groundwater. Costs to use Biddles Point disposal area, including remediation for groundwater impacts, if necessary, have already been included in the costs of the DMMP.

Using generally accepted engineering techniques, the site could be expanded and dredged material could be pumped from WHS. This would require construction of a roughly four-mile pipeline along the CSX rail line parallel to Delaware State Route 9. The pipeline would require crossing highways, streets and tidal estuaries and relocating utility and sewer lines. Diesel-powered booster pumps would be required at approximately each mile of pipeline length.

Initial implementation costs were estimated at \$78 million, however, the DMMP notes that these costs may be significantly underestimated because real estate requirements have not been fully evaluated. The time it would take to assemble real estate and easement needs was not estimated, but the Corps acknowledged it could create significant project delays.

d. Killcohook/Biddles Point Combination

In an effort to address concerns raised by New Jersey officials over using Killcohook as a disposal site and the cost and institutional issues raised by Biddles Point, the Corps proposes a “swap.” Under this scenario, material dredged from Wilmington Harbor would be deposited in Killcohook cells #2 and #3 on a rotating basis when WHS is drying out. This would displace an equal amount of main channel material that would normally go to Killcohook. The displaced main channel material would be sent to Biddles Point. During the years when WHS is being used and the alternate site is not needed, main channel material would go to Killcohook #1 as usual. According to the Corps, New Jersey would have no net increase in dredged material from the exchange.

Under this alternative, WHS would run out of capacity in year 37, after which material would go to Biddles Point or Killcohook. Because the amounts of material from Wilmington Harbor and the main channel deepening are different and the size and configurations of the CDFs are different, the amounts of material and frequency of their use vary over the life of the project. According to the Corps, even though WHS would

no longer be used after it reached capacity, the total amount of material sent to Killcohook would not result in a net increase.

Pumping dredged material from the Port of Wilmington to Killcohook would require a temporarily submerged pipeline. Pumping to Biddles Point would require construction of a three-mile pipeline from the entrance of the C&D canal near Reedy Point. The pipeline would follow a route within the existing right of way along the canal access road with assistance from a booster pump station at Reedy Point. Most of the pipeline would be above ground and no other crossings would be required.

When the Corps conducted a benefit-cost analysis, the Killcohook/Biddles Point combination emerged as the best choice. They determined “the combination offers the greatest net benefits, the lowest average annual cost, and a favorable benefit-to-cost ratio when compared to the other alternatives.”¹¹⁷

Based on these findings, the Corps chose the Killcohook/Biddles Point combination as the recommended alternative for meeting Wilmington Harbor dredging needs. In addition to economic benefits, this alternative is expected to have minimal environmental impacts because of the use of existing CDFs and pipeline placement within an existing government-owned service road. No significant real estate needs are anticipated. Moreover, when the draft DMMP was written in 2003, the combination alternative was determined most likely to meet the 2009 implementation target – an important factor considering the shrinking window for action before WHN reaches its limit. However, two years have elapsed since the draft made this assertion.

The alternative is expected to cost approximately \$7.85 per cubic yard for disposal. Subsequent to the initial cost-benefit comparisons, an updated schedule was calculated with even more favorable results. Average annual benefits were recalculated to \$13,626,000 and average annual costs were calculated to be \$6,123,000 resulting in a benefit-cost ratio of 2.2.

Initial construction costs, calculated in 2003, including construction of the pipeline between Biddles Point and the entrance of the canal, site preparation, and site expansion, are approximately \$26,300,000 within an 18-month time period.¹¹⁸ The Corps estimates average annual costs over the 50-year life of the project at \$4.4 million/year.¹¹⁹

Initial costs of developing new disposal capacity associated with Federal navigation projects are shared between the Corps and the non-federal sponsor – here, the Port of Wilmington. Under the requirements of the Water Resources Development Act - federal legislation that authorizes Corps projects - the non-federal share would amount to approximately 35 percent of project costs.

Because the Port will use the Killcohook/Biddles Point combination for the dredging of non-federal berthing areas, the cost of creating capacity for this material has to be borne by the Port of Wilmington at 100 percent. The Corps estimates non-federal dredged material amounts to approximately 12.8 percent of the total material disposed of in each dredge

¹¹⁷ DMMP, p. 70

¹¹⁸ Ibid, p. 71

¹¹⁹ Ibid, p. 74

cycle. Therefore, of the total project costs of \$26,300,000, the non-federal share would be approximately \$3.4 million. This amount is subtracted from initial project costs and the remaining cost (approximately \$22.9 million) is shared at 65 percent federal/35 percent non-federal (this includes an additional 10 percent for long term repayment of navigation features). The federal share is approximately \$14.9 million and the non-federal share is \$11.4 million (\$3.4 plus \$8 million).

An analysis of the DMMP done by Gahagan & Bryant Associates, an engineering firm used as a consultant to the Port, shows the Port's share is greater than 35 percent because the area would be used to receive berth material and the federal government would not pay for the percentage of the improvements necessary to receive that material. The Port would be asked to contribute about 44 percent. The federal government would then contribute 56 percent.

An environmental assessment was conducted in accordance with the requirements of NEPA and the Endangered Species Act and the Corps concluded the preferred alternative would not endanger the continued existence of any species or the critical habitat of any fish, wildlife or plant. It also concluded that the proposed project would not cause significant environmental impacts and therefore an Environmental Impact Statement was not required. A Section 404 (b)(1) evaluation required by the federal Clean Water Act also was prepared for the DMMP. The Corps acknowledges that a 401 Water Quality Certificate will be obtained from DNREC and NJDEP prior to project implementation and that the plan complies with and can be implemented consistent with Coastal Zone Management Program of the State of Delaware and New Jersey.

D. OPTIONS FOR ADDRESSING DREDGED MATERIAL DISPOSAL SITE CAPACITY LIMITS

As previously noted, the DMMP is still in draft form and has not been officially released by the Corps or endorsed by affected stakeholders. Since it was first circulated in 2003, many of the stakeholders have taken a closer look at their piece of the dredging puzzle and have proposed options that address the looming capacity shortage.

The issue of when disposal sites will actually reach their capacity limits is still unresolved. The key site in question is WHN, which is nearing capacity soon. The Corps' revised date of 2009 assumes the dikes can be raised one more time to accommodate an additional dredge cycle. However, tests on the structural integrity of the site could reveal limited expansion is not feasible and the Corps would have to scramble to maintain its dredging obligations.

The 2009 timetable could converge well with the projected 18 months needed to implement its preferred alternative in the DMMP, but this does not take into account the planning and preparation that would precede it. In order to buy more time and added flexibility, one option that has been proposed is to extend the life of WHN through more aggressive management techniques.

1. Extend the Capacity of WHN

In the summer of 2004, the engineering firm of Gahagan & Bryant Associates prepared an evaluation of the sites used for its dredged material disposal for the Port of Wilmington.¹²⁰ Their examination revealed that several plausible scenarios could be developed to extend the life of WHN through a more aggressive approach towards dewatering and consolidating of the filled material. The report proposes more efficient dewatering and consolidation by following the Corps' guideline for a three-foot lift (the height of the new material deposited on top of old fill that has been dried and consolidated). According to the report, thicker lifts of material have been shown to be difficult to dewater and consolidate completely, thereby reducing ultimate capacity. The report notes that typical ditching equipment used at disposal sites cannot cut deeply enough to effectively dewater material thicker than three feet. WHN has not been adequately dewatered between cycles because of a spillway that is too high and is keeping water on site. This wetter material results in reduced capacity.

a. 3-Cycle Scenario – Extend to 2015

Gahagan & Bryant premise a 3-dredge cycle scenario on the basis of placing fill at the recommended thickness so that it can be efficiently dried and consolidated. They suggest that only one cycle should be placed in WHN when alternating away from WHS. Under this scenario, WHS would be used for three cycles in sequence before switching to the WHN for one cycle, and so on.

This would differ from the current alternating schedule used by the Corps. As was noted previously, dredging is conducted every eight months, alternating between the two sites to allow for dewatering and consolidating operations during periods of non-use. The Corps has been routinely alternating between the two sites every three to four cycles.

Under this scenario, WHN would be filled in March 2010, requiring a new site by November 2012. If the dikes can be raised three feet, a new site would not be needed until July 2015.

Under current disposal area usage plans, the Corps estimate of when a new site is required essentially agrees with the Gahagan & Bryant projections.

b. 4-Cycle Scenario – Extend to 2018

Similar to the 3-cycle scenario, WHS would be used for four cycles in sequence before switching to WHN for one cycle, and so on. Under this scenario, the lift thickness would total 5.1 feet, exceeding the guideline of three feet. As a result, this option would be used when more aggressive dewatering and consolidation efforts between cycles are found to be effective in significantly consolidating WHN. Otherwise, the 3-cycle scenario is preferred to avoid over stressing WHS.

¹²⁰ Gahagan & Bryant Associates, *Preliminary Evaluation of Existing Sites*, 2004

Under this scenario WHN would be filled in July 2011, requiring a new site by November 2014. If the dikes can be raised three feet, a new site would not be needed until March 2018.

c. 3-Cycle/Split WHS Combination Scenario – Extend to 2015/2016

The Gahagan & Bryant report also constructs a scenario identical to the 3-cycle scenario that extends WHN to 2010, but if at that time an alternate site is not available, then the WHS could be split into two 110-acre cells, which would each be roughly the size of WHN. As previously noted, two sites are needed to alternate between dredge cycles. Splitting WHN into two cells could serve that purpose on a temporary basis if engineering and management requirements proved feasible. The report notes that one benefit of splitting the site into two smaller cells is that the perimeter trench, which is easier to create than interior ditches, is more effective in removing water over a smaller site.

Under this scenario WHN would be filled in March 2010, requiring a new site by November 2012. If the dikes can be raised three feet, then a new site would not be needed until March 2016 or July 2015, depending on the number of cycles put into the split cells.

Under all the above scenarios, the impact on DSWA's plans to take over WHN for its expansion was not evaluated by the Corps. Current assumptions are that DSWA would take back the property after it reached capacity in 2009. But as Gahagan & Bryant found in its evaluation, WHN would not be adequately dewatered and consolidated for use at that time. Additional management would be required to prepare the site for further DSWA use. It seems reasonable then that if the scenarios explored by Gahagan & Bryant were to be followed, DSWA could take over a site closer to being ready for use than under current plans. DSWA in return would have to allow the Corps to continue its use of the site for a while longer.

2. Split WHS into Two Cells in 2009

The scenarios above are proposed to buy time until a true solution can be found. The combination scenario assumes that WHS can be split into two cells and alternated between dredge cycles, which raises the question if it can be done temporarily, then why not permanently and use the two split cells as the alternating disposal sites?

As attractive as this may appear on the surface, it has serious limitations that fail to address the long-term continuous dredging needs of Wilmington Harbor. WHS in its entirety currently can accommodate roughly 15 dredge cycles before it reaches capacity. Splitting WHS into two cells would require additional dike building and each time the dikes are raised the effective disposal area gets a little smaller. This shrinking capacity combined with accelerated filling would significantly limit the availability of its use and eliminate the flexibility offered by its combination with another site.

Extending WHS into the Delaware River and splitting it into two cells was in fact reviewed as an option through several rounds of the DMMP, but rejected because it was the most costly option (more than \$100 million), raised significant institutional issues and only provided approximately 20 years of additional capacity.

Further on in the report we examine proposals to expand WHN by using stabilized sewage sludge as construction material.

3. Beneficial Use

Dredged material is increasingly being viewed as a resource, not a waste byproduct. Throughout the country, dredged material is used for a variety of purposes and as a result disposal in a containment area is avoided. Although one of the key benefits is to avoid disposal in facilities with limited capacity, beneficial uses are not cost competitive with existing containment facilities in our area. In situations where other benefits can be attributed to a beneficial use, such as environmental restoration or economic development, additional federal funds might be contributed and the economics improve. Where disposal sites are extremely limited such as in the NY/NJ Harbor area, beneficial use becomes more competitive, especially for non-federal disposal. Nonetheless, when reviewing disposal alternatives it is useful to evaluate some of the applications.

Key criteria for determining beneficial use applications are the sediment characteristics and the contaminant profile of the material. Testing methods are readily available to determine the level of contaminants in dredged material and whether it is suitable for beneficial use. Sediment characteristics, primarily grain size, determine the types of applications suitable for use. As was noted in the DMMP, the possible use of dredged material for construction purposes was reviewed. Beneficial use as proposed was determined to be too expensive and impractical at current time because it would have required building a LWA manufacturing plant to process and prepare the material. However, there are other applications that have recently been examined that might provide feasible options in combination with other disposal alternatives.

State environmental and transportation agencies in our region have for many years been exploring processes and programs to promote beneficial use in a manner that gains public acceptance. The Pennsylvania Department of Environmental Protection has proposed a revision of its “Clean Fill” rules with its so-called “Safe Fill” regulations that outline a process for analyzing dredged material and its safety for use. The key objective of the new regulation is to define qualifying dredged material so that it can be more widely used. Even though the regulations have not been finalized, they are being followed by PADEP.

Delaware’s 2001 Statewide Dredging Policy,¹²¹ developed to better define dredging parameters and processes, characterizes beneficial use in the following manner:

Beneficial use of dredged materials includes a wide variety of options for utilizing dredged material for some productive purpose. Dredged material is potentially a manageable soil resource with beneficial uses that could be incorporated into project plans and goals. Additionally, by using the dredged material for some constructive purpose, it keeps clean fill from being placed into upland disposal facilities where it may mix with contaminated material, thereby rendering it unusable. Use of valuable coastal land for constructing new confined disposal facilities can also be reduced.

¹²¹ DNREC, Statewide Dredging Policy Framework, http://www.dnrec.state.de.us/dnrec2000/Divisions/Soil/dcmp/DE%20Statewide%20Dredging%20Policubi%20yards_2001.pdf

DNREC's Solid and Hazardous Waste Management Branch reviews requests for beneficial use applications and grants approval through a beneficial use designation. This process is used to determine the potential environmental impact and not all beneficial use is deemed to be environmentally beneficial. In situations where contaminants could impair aquatic life or pose a health risk to humans, the benefits of finding an alternate disposal method are not viewed as outweighing the risks. Most common environmental concerns arise when metal and organic compounds with varying levels of toxicity are detected. These compounds often contaminate sediments in areas that have experienced decades of industrial activity.

A key contaminant of concern is polychlorinated biphenyls (PCBs). The EPA has identified PCBs as a possible human carcinogen and advisories have been posted in the Delaware River to limit fish consumption because of concentrations in fish tissue. While PCB production was banned in the 1970s, its toxic legacy can be found in surface and ground water sediments. Dredged material with high levels of PCBs risks discharges into surface and ground water. In response to a Court ruling that Total Maximum Daily Loads (TMDL) be established, EPA charged the Delaware River Basin Commission to develop TMDLs as required by the federal Clean Water Act. Determining what is an acceptable load level of PCBs and how sources are limited has proven to be a challenge. It is estimated it will take years to resolve. Whatever agreement is reached, these standards will have a significant impact on how dredged material can be used.

The Corps and EPA have developed a list of possible beneficial use projects that are shown below to give a range of possible uses of material:

- Habitat restoration/enhancement (wetland, upland, island, and aquatic sites);
- Beach replenishment;
- Aquaculture;
- Parks and recreation;
- Agriculture, forestry, and horticulture;
- Strip mine reclamation and landfill cover for solid waste management;
- Shoreline stabilization and erosion control (fills, artificial reefs, submerged berms);
- Construction and industrial use;
- Material transfer (fill, dikes, parking lots, and roads).

Numerous demonstration projects have occurred throughout the region and one major beneficial use project got underway last year. The Delaware River Port Authority funded and undertook a mine reclamation project in Tamaqua, Pennsylvania where dredged material is trucked in from the Fort Mifflin Confined Disposal Facility (CDF). This project, permitted by PADEP in March 2004, could ultimately handle ten million cubic yards of material. Initial disposal costs for only 54,000 cubic yards of material have averaged almost \$40 per cubic yard.

The Philadelphia Regional Port Authority has recently explored other beneficial use options in an effort to identify viable alternatives for dredge disposal for commercial berths

on the Delaware River.¹²² Capacity for non-federal operations is managed by Weeks Marine, Inc. at its disposal facility located in Gloucester County, New Jersey – the only commercial disposal facility on the Delaware River. The report, prepared by Gahagan & Bryant Associates, was developed in response to concerns about projected capacity at the site in 20 years, the lack of readily available alternatives, and rising costs for environmental compliance and improvements at the facility that have pushed disposal into the range of \$15 to \$20 per cubic yard. Cost concerns and uncertainties related to NJDEP regulation of the site moved PRPA to search for disposal alternatives. The key criteria for the project was to find a site or combination of sites or approaches that could provide capacity for 460,000 cubic yards per year of dredged material for a minimum of ten years. This capacity requirement reflects an increase in dredging from the 286,000 cubic yards for existing facilities to the higher volume associated with the proposed main channel deepening to 45 feet.

The report examined properties near the Delaware River that could serve as confined disposal facilities and found there were no locations in Pennsylvania available for development. Finding no sites, the report focus shifted to possible beneficial use alternatives. The beneficial uses evaluated were:

- Abandoned Mine Reclamation. Abandoned mines located 80 miles north of Philadelphia were examined and determined to have the capacity to handle non-federal dredging needs.
- Brownfield Reclamation. Several projects, such as the expansion of the southern end of the Port of Philadelphia (Packer Avenue Marine Terminal), were reviewed.
- Landfill Day Cover. Landfills were identified in the region, but more than one landfill would be required to meet dredging volume needs.
- Abandoned Quarry Reclamation. Sites within 15 miles of Philadelphia were identified as being able to accommodate volume needs.

The report concluded that the use of the existing Fort Mifflin CDF as a transfer and dewatering station combined with a beneficial use project to reclaim abandoned mines in Schuylkill County, Pennsylvania presented the best option. The use of Fort Mifflin as a dewatering transfer station with an existing rail line to transport the material, in combination with a substantial federal cost share, made the project feasible. It was estimated that total loading, transport and unloading costs for this project would be \$20 per cubic yard in addition to the dredging cost. The Corps is currently in the process of constructing the transfer facility with completion scheduled for September 2005. The facility will be capable of transferring 500,000 cubic yards of dredged material from the Fort Mifflin site on an annual basis.

4. Environmentally Beneficial Use

As has been noted in the preceding section, beneficial use is not cost competitive with a CDF except when other values such as environmental restoration are added into the calculation. Other factors that influence the practicality of beneficial use applications are the availability of sites for dredged material disposal. The Corps' DMMP and the survey

¹²² Gahagan & Bryant Associates for Philadelphia Regional Port Authority, *Analysis of Viable Alternatives for Dredged Material Disposal*, April 2004.

of site availability by the PRPA showed that there are few new sites available and those that were considered have significant institutional, environmental and fiscal limitations. Other competing port areas such as Baltimore and New York are also experiencing these problems and they are looking to innovative environmental restoration projects to meet their needs. In fact, Baltimore will lose the use of its main disposal site, Hart Miller Island, in 2007 and released a DMMP for public comment in early February.

One such project is Poplar Island (See Figures 3 and 4) located approximately 30 miles southeast of Baltimore Harbor in the Chesapeake Bay. The Corps and other Federal, State, and local stakeholders are involved in the Poplar Island Restoration Project, which will create a 1,110-acre island from federal channel maintenance dredged material. Remnants of the original island, which suffered loss of land mass due to erosion, ship traffic, significant weather events and sea-level rise, will form the foundation of the restoration project that will return the island to its 1850s' configuration.

A lack of environmentally acceptable disposal sites, a reliance on overboard disposal in the Bay and rising dredged material disposal costs led to a coordinated effort to find innovative alternatives. Over a 20-year period, 38 million cubic yards of dredged material will be used to rebuild the site. Scott Johnson, the Corps' project manager for the site says that project costs are approximately \$10 per cubic yard; however, additional offsets may make comparisons with conventional disposal costs unreliable. Nonetheless, when compared with the \$7.85 per cubic yard cost of the DMMP preferred alternative for WHN, this alternative is worth consideration.

Eventually, more than 1,000 acres of upland and wetland habitat will be created and 125 acres of existing water bird and bald eagle nesting habitat will be enhanced. The project will recreate an 800-acre shallow water cove that is expected to allow for the recolonization of an equal acreage of submerged aquatic vegetation.

According to the U.S. Fish and Wildlife Service, islands of this type in the Chesapeake Bay support nesting snowy egrets, common egrets, double-crested cormorants, terns, green herons, great blue herons, black ducks, and bald eagle. Diamondback terrapins nest in the high marshes and beaches, and river otters fish from the island shores.

Poplar Island has been so successful and the need for additional capacity so great, that the Corps is currently completing a planning study for another island restoration – James Island at the mouth of the Choptank River in the northern end of the Bay.

The Poplar Island Restoration Project represents a partial solution to the dredged material problem while supporting habitat restoration objectives. For this reason, the project has gained an unprecedented level of approval from the entire Chesapeake Bay community.

Whether Poplar Island can serve as model for beneficial use projects in the Delaware River needs further study. The Delaware River and Bay is a different estuary system than the Chesapeake Bay. Tidal currents, shoaling and river flow rates, and the configuration of beaches and shallow areas are significantly different. Project manager Johnson notes that dike building and restoration has occurred in water depths of four-to-eight feet and studies show that depths of 10- to-12 feet become economically difficult.

Closer to home, the history of Pea Patch Island, located in the upper reach of the Delaware Estuary, suggests further study might prove useful. In the late 1700s, Pea Patch Island was a mud bank and later formed into an island so substantial that in 1814 Fort Delaware was built on it to guard river access to New Castle, Wilmington, and Philadelphia. In the early 1900s, the Army Corps of Engineers doubled its size by placing dredged material from the river channel on the north end of the island. It is now managed as a State Park for historical and environmental purposes.

According to DNREC's Division of Soil and Water Conservation herons, egrets, and ibises began nesting on the northern part of the island in the 1950s and 1960s. Over time, small heronries abandoned the mainland in Delaware and New Jersey and populated the island. Although it has experienced a decline in the last decade, the island's heronry remains the largest north of Florida on the east coast.

The Corps restored the island's original footprint, however erosion of the heronry portion of the island is still occurring on the south end. The Corps tried to stabilize the erosion by installing rip rap, but additional restoration could help assure the island's stability and protect its historical and environmental resources.

Over the decades that the Delaware River has been used for shipping, a number of small islands and shoals have eroded or have been removed for navigational purposes. Captain Mike Linton of the Pilots Association for the Bay and River Delaware told us that east of the channel directly off of the mouth of the Christina River is what is known as "Cherry Island Flats." This two-to-three feet deep shoal is what remains of a small island well-known to area boaters and ship captains in the early part of the last century. Historical maps and records indicate a number of islands and sand bars existed years ago. Additional research might reveal sites that could be restored with significant benefits for area wild and aquatic life.

The prospects of an environmental restoration project the size of Poplar Island being developed to manage Wilmington Harbor's near-term dredge disposal needs is out of the question. However, the lessons learned from Poplar Island and the unintended benefits demonstrated on Pea Patch Island suggest opportunities are available for environmental restoration projects that could be address some of the disposal needs out into the future.

As will be discussed later, environmental restoration and beach replenishment projects have been chosen as disposal applications for part of Delaware's allocation of dredged material coming from the proposed Main Channel Deepening.

5. Move the Port

In our assessment of disposal alternatives and the impending capacity shortage, the focus has been on meeting the basics needs of the Port, which as stated at the beginning, is to provide the Port of Wilmington with adequate clearance from the river bottom for ships to dock. Without this essential condition, the Port ceases to meet its customers' needs and they will go elsewhere. It is clear that public officials will not let the situation reach that crisis state, but from a public policy perspective it should not make any difference how that basic condition is achieved, as long as the public interest is served by efficient and effective use of public resources.

A limited examination of the short-term and long-term needs of the Port suggests that continual dredging of the Wilmington Harbor is neither the most cost-effective nor the most efficient means of maintaining the Port's competitive status. The feasible alternatives that were evaluated in the DMMP require costly fixes that solve the problem for only four or five decades. Once those options are maximized, a new round of disposal alternatives will have to come under review to meet future needs. All require removing river bottom sediment and disposing of it through a variety of means. If, however, the requirement to dredge sediment is removed, so is the requirement to dispose of it.

As simple as this proposition may sound, it is only worth consideration if the option to avoid dredging exists. The Port of Wilmington, unlike other ports in the region, has that option. In fact, it is an option that has at different times been considered, but abandoned for a variety of reasons, most of which involved short-term considerations that did not adequately assess the long-term implications of dredging in perpetuity.

The option, simply stated, is to relocate the main berths that are currently in Wilmington Harbor out to the Delaware River and discontinue dredging the Harbor. The Christina River would shoal to its natural depth of about 25 feet (MLLW)¹²³ and the berths at Wilmington Harbor could no longer be used for ships with drafts more than 22 feet. Relocation would allow the berths to benefit from the 40 foot depths provided by the Delaware River's main channel that is regularly maintained by the Corps for navigation purposes. As noted earlier, the Port currently has one berth situated on the river – the roll-on/roll-off berth for automobiles. This berth accommodates ships with a 36-foot draw and never has to be dredged.

While a full technical, fiscal and environmental examination of this option is beyond the scope of this report, a cursory review illustrates the benefits that might accrue. Even the DMMP listed "Relocate Port to the River" as a possible option early in the screening process (see Table 7), however, it was dropped from consideration because of anticipated "institutional" barriers such as lack of significant fiscal resources necessary to conduct such relocation. Interviews with Port representatives, Corps officials and technical experts indicate such a move is feasible if adequate resources can be assembled.

The costs associated with relocation would be considerable. Costs for the 800-foot long auto berth were approximately \$22 million. It is estimated that approximately 5,000 feet of wharf would be required to replace the berth capacity at the existing harbor. Interviews with Port officials indicate that the auto berth costs are still relevant, which would put relocation costs in the \$100 million range. If the berths were to be relocated, it is likely the oil operation currently located close to the mouth of the Christina River would be the first to move out to the Delaware and costs would be lower because of existing usable infrastructure – primarily pipelines.

In order to replace the capacity that would be relocated, the existing supporting infrastructure would have to be reconfigured. This would be an additional cost. Currently, most of the Port's infrastructure for refrigerated cargo is concentrated in Wilmington Harbor adjoining berths #2, #3 and #4 where container ships are offloaded

¹²³ DMMP, p.60

and perishable goods are transported to refrigerated warehouses. Distances from offloading points to storage destinations are short, requiring little transfer time. Locating the berths on the Delaware River would require relocating or rebuilding the crane and transfer systems currently in place in the Harbor.

There is also the question of where the berths would be located and what land is available for staging and unloading. As we have noted, there is no land for expansion at the Port, however, if WHS were no longer used as a CDF, more than 300 acres would become available for conversion to Port property. WHS would require extensive dewatering and preparation for conversion. The issue of where to put the dredged material from the Harbor while this is being done arises, but some of the alternatives suggested in this report could be used on a temporary basis for that purpose. In addition, the land at the former Pigeon Point Landfill might be available as well.¹²⁴ More extensive evaluation is required.

When assessing the general estimate of \$100 million for relocation, it is most useful to compare it to the costs of the DMMP-preferred Killcohook/Biddles Point Combination alternative. As stated earlier, initial construction costs, including construction of the pipeline between Biddles Point and the entrance of the canal and site preparation, are approximately \$26,300,000. Average annual costs over the 50 year life of the project are estimated at \$4.4 million/year. Simple arithmetic shows that total costs for the preferred alternative totals more than \$246 million with the bulk of the expense coming from annual costs. If the allocation of costs used in the DMMP is followed, the non-federal costs over the life of the project will be more than \$78 million. The federal share will be more than \$167 million. By comparison, the non-federal share for moving the berths to the River would cost approximately \$25 million if total project costs were \$100 million.

When evaluated over 50 years, it appears to make more sense to make the initial investment in relocation and relieve both the Corps and the Port from any further dredging requirement. However, the Corps traditionally has not evaluated the relocation of a port as part of solving a disposal problem. In fact, Corps policy based upon congressional authorizations for projects under the Water Resources Development Act generally does not address this possibility. Because the Corps has responsibility for dredging the channel to the Harbor, authorization for funds for conventional national navigation projects is fairly routine. The authorization for new projects, such as proposed in the DMMP, generally proceeds without controversy, particularly given the established need and favorable benefit-cost calculation. A project that departs from standard planning guidelines used by the Corps, particularly one that requires projecting the comparative savings over an extended period of time has higher institutional hurdles to clear.

In times of tight federal budgets this becomes even more difficult even if calculations prove that in the years ahead significant savings could be achieved. The Bush Administration has opposed WRDA over the past four years because of the high costs associated with so many projects. The key criteria for establishing the value of such a project is to demonstrate the benefit to national economic development.

If the relocation option were determined to be in the best interests of the Port and State, the Governor would need to enlist the aid of Delaware's congressional delegation to have the

¹²⁴ Duffield Associates, *Conceptual Evaluation: Partnering Opportunities for the City of Wilmington*, June 2004, p. 7

project authorized in an upcoming WRDA and funds added in annual appropriations. Given the lag that occurs when projects are first proposed to the time funds are authorized and appropriated, a decision should be made soon to pursue this route. In the meantime, some of the proposals that extend the life of WHN for a few extra years should be seriously considered.

Before the congressional authorization process is initiated however, the current Corps process involving the DMMP should be pursued to its conclusion, recognizing that WHN could reach capacity within four years. As previously noted, the DMMP has not been officially released. One of the concerns cited for the delay was New Jersey's opposition to Delaware's dredged material being deposited in their state. The relocation plan resolves that problem. The Corps should be engaged by the appropriate state agencies, DNREC and DelDOT, and a written request made to consider the relocation option as part of a revised DMMP. The Corps should be instructed to consider all comparative costs over the life span of the preferred alternative including the cost of relocation.

E. DISPOSAL SITES AND MAIN CHANNEL DEEPENING

When examining the options for dredged material disposal in the region, it becomes readily apparent that the shadow of the proposed main channel deepening looms over available sites. For the purposes of this report, the impact of the proposed deepening on options for dredged material placement for Wilmington Harbor was reviewed. An evaluation of the merits of the deepening was beyond the scope of this report.

The USACE has proposed deepening the main channel for the Delaware River from its current depth of 40 feet to 45 feet. Currently the largest oil tankers serving Philadelphia-area ports have sailing drafts of 55 feet. After lightering in the lower Delaware Bay, these tankers continue upriver to the refineries with sailing drafts within the 40 foot channel constraint. A deeper main channel depth would allow these same ships to lighter less before navigating upriver. Some container and dry bulk vessels will see an increase in size, but these vessel classes are smaller than the oil tankers. The project is not without controversy and several roadblocks must be cleared before deepening can proceed.

The project has not yet received full congressional appropriation and Delaware has a permit pending that addresses environmental concerns ranging from meeting water quality standards to protecting aquaculture. In 2003 DNREC conducted a public hearing on the project with the applicant – the USACE - and issued a report in December of that year.¹²⁵ The hearing officer's report found that the applicant has not met the requirements of the permit, but if the deficiencies raised were adequately addressed, it could be approved. According to the Corps, it has not formally received a request from DNREC for action. The Corps is awaiting action on how to proceed.

In addition to Delaware's outstanding permit, a number of regional issues remain to be resolved including where the dredge spoils will go.

¹²⁵ Hearing Officer Report to the Secretary of DNREC, Delaware Main Channel Deepening Project Permit Application, December 2003.
http://www.dnrec.state.de.us/dnrec2000/admin/news/specialreports/december2003_ho_report_1103.pdf

It is estimated that deepening the 103-mile channel would require dredging 26.5 million cubic yards of material. Delaware’s portion would be allocated as follows:

Table 8 -- Portion of MCD Dredge Material Deposited in Delaware

2.5 million cubic yards	Kelly Island wetland restoration (60 acres)
306,000 cubic yards	Port Mahon beach replenishment
1.7 million cubic yards	Broadkill Beach replenishment
340,000 cubic yards	Reedy Point South CDF
3.4 million cubic yards	Killcohook CDF
8,246,000 cubic yards	TOTAL

As can be see from the chart above, most of the dredged material would go to beneficial use projects, namely beach replenishment and wetland restoration. The remainder would be deposited in Corps-operated CDFs. Reedy Point is located in New Castle County Delaware, however, Killcohook is located on the New Jersey side of the river even though it is technically in New Castle County, Delaware. In addition to Killcohook, most of the remaining dredged material from the deepening project would be deposited in New Jersey.

The disposal sites for the deepening have been identified in project documents and do not directly compete for capacity with disposal sites designated for dredging Wilmington Harbor. In its preferred alternative in the DMMP, the Corps states unequivocally that the needs of Wilmington Harbor can be accommodated in the Killcohook CDF. However, New Jersey government officials have expressed opposition to having a disproportionately large amount of the deepening material deposited in their state, particularly since Pennsylvania would gain the most benefit from the project. In fact, New Jersey officials have demanded that Pennsylvania take about half of the amount slated to go to New Jersey. This concern was one of the main reasons former New Jersey Governor McGreevey refused to support the deepening until the allocation issue was resolved. Current Acting Governor Codey has not taken a position on the deepening and a powerful block of southern New Jersey lawmakers have staked out their opposition.

In an effort to reach an agreement between Pennsylvania and New Jersey, Pennsylvania Governor Rendell sent Governor McGreevy a letter in September 2004 calling for formation of a “bi-state working group that would focus on aggressively resolving outstanding issues to the mutual satisfaction of both of our states.” The letter further stated, “As we discussed, we are working on a plan that could result in Pennsylvania taking a majority of the dredged material.” No action was taken on this proposal before Governor McGreevey left office in November 2004, however, Governor Rendell has renewed his request with Acting Governor Codey. Discussions aimed at addressing the allocation issue and project benefits for New Jersey have been initiated between the two offices.

While there is no direct competition for disposal site space between the deepening and dredging for the Port of Wilmington, concerns expressed by New Jersey officials related to the deepening compound their concerns about the USACE proposal to pump material to Killcohook. New Jersey Department of Environmental Protection Commissioner Bradley Campbell told us that consideration of plans to dispose of Wilmington Harbor dredge at Killcohook could only be viewed in the larger context of the deepening and other federal navigation projects. Such a comprehensive tri-state overview has not been initiated. Rich Dewan, the former NJDEP official in charge of dredging issues for the Department was

equally direct. He said, [Delaware] “needs to throw out the old thinking and look for innovative ways” to find “tangible, mutual benefits for both states.”

In light of these and other comments we heard, it is unlikely New Jersey would entertain a proposal to pump to Killcohook without a global allocation agreement reached on the deepening project. In addition, Secretary Hughes’ decision in early February 2005 to deny oil giant BP’s application to site a liquefied natural gas terminal pier in the Delaware River has likely made it even more difficult to reach an accommodation with New Jersey on the use of Killcohook. The permit denial drew an impassioned response from a New Jersey lawmaker who called for retaliation against Delaware-based credit card companies. “It’s payback time. We need to exact some Jersey justice on these characters who think nothing about meddling in our affairs,” Assemblyman John Burzichelli, D-Gloucester, said.¹²⁶ Interviews with New Jersey political observers indicate that the Assemblyman’s response was representative of many office-holders in southern New Jersey. One interviewee said opposition to the exchange would be a convenient form of “payback” that would have a direct relationship with activities relating to the River, unlike credit cards. Another individual sardonically scoffed, “ It would be very entertaining to see Delaware ask for help on this.”

Nonetheless, as representatives of the Governors of New Jersey and Pennsylvania meet to discuss allocation and project benefit issues, Delaware officials should ask to be kept apprised of the progress of the talks and any agreements that might be proposed that would impact the State.

¹²⁶ The News Journal, *N.J. lawmaker urges retaliation on Del*, February 9, 2005

IV. WILMINGTON SEWAGE SLUDGE

Another significant issue that confronts New Castle County and the demand for shrinking landfill capacity is the disposal of sewage sludge. It arises from the 60,000 tons of sludge generated annually by the wastewater treatment system that serves the City of Wilmington and parts of the County.

Sewage sludge, or biosolids, is the solid material that remains after municipal wastewater treatment processing. The City of Wilmington's Waste Water Treatment Plant (WWTP) processes up to 70 million gallons of wastewater per day, which originates from homes, businesses, industries, and storm sewers. It is important to note that while the City owns and operates the plant, New Castle County generates approximately 70 percent of the treated wastewater, with the remainder generated by the City itself. The treatment process, which includes primary, secondary and tertiary treatments, has no dedicated facility for sludge disposal in New Castle County. This has required the City to find alternate means of disposal.

Since May 1993, VFL Technologies has operated a biosolids treatment facility under contract with the City's WWTP operator, USFilter. VFL has overall responsibility for managing sludge disposal from the WWTP and converts the plant's sewage sludge into a usable product.

VFL says that it has explored a number of disposal alternatives for the sewage sludge but has found a depressed market for other applications, which include use as a soil additive or fertilizer. The authors examined other communities where sludge is processed and found essentially no market for treated sludge. For example, the City of Philadelphia processes its sludge for use as a pathogen-free form of compost at a cost of \$140 per ton. It is unable to sell it or even give away large enough quantities to avoid additional disposal arrangements. If the City of Wilmington had to dispose of its sludge in the CIL, it would have to pay a tipping fee ranging from the Differential Disposal Fee Program (DDFP) rate of approximately \$48 per ton to the set rate of \$61.50 per ton.

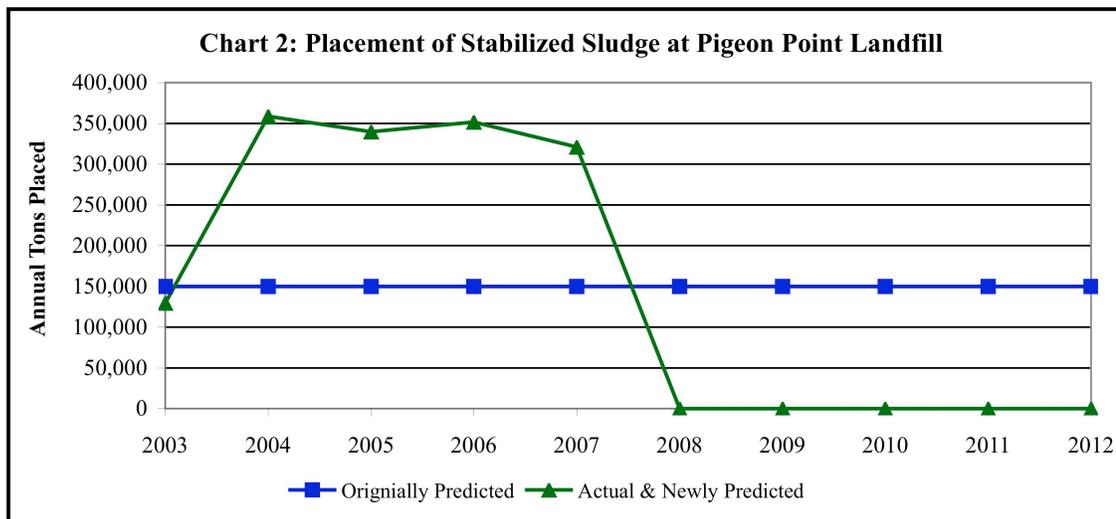
Using a proprietary formula, VFL annually combines the 60,000 tons of sludge with coal-burning power plant fly ash and other materials, including alkaline reagents. The result is what is called "stabilized sludge." Fly ash is blended with sewage sludge to "stabilize" the material by raising its temperature and pH, and drying it. The material is approved by DNREC for specific beneficial uses.

The regional utility Delmarva Power contracts with VFL to take all of the fly ash (approximately 100,000 tons per year) from its coal power plant in Edgemoor, New Castle County. Even though Delmarva Power has limited on-site capacity for disposal of its fly ash, it would run out of space in less than a year if it had to dispose of all of its ash in its landfill. Thus, the City's contract with VFL to stabilize the sludge takes care of two waste streams. This has allowed both the City and Delmarva Power to dispose of its waste in an economical and environmentally acceptable manner.

To date, VFL has found projects for all of the stabilized sludge produced, including daily landfill cover at Cherry Island Landfill and dike construction at Wilmington Harbor North. Since January 2003, stabilized sludge has been utilized in a cap enhancement project at the former Pigeon Point Landfill (See Figure 2) to promote better drainage and reduce leachate

production. Regrading the landfill surface is being done under a sedimentation and erosion control plan originally developed by Schnabel Engineering for DSWA and sanctioned by the Division of Soil and Water Conservation. A “distribution and marketing” permit from the Division of Water Resources covers use of the VFL materials incorporating biosolids. Permit DM-009/95B defines its permitted uses and distribution, however, the non-biosolids portion of the stabilized sludge is approved for use separately through a “beneficial use determination” (BUD) issued by DNREC’s Solid and Hazardous Waste Management Branch.

The regrading plan at Pigeon Point called for approximately 1.5 million tons of stabilized sludge material to be used as bulk fill over a period of nine to ten years¹²⁷ at approximately 150,000 tons per year. However, over the past two years stabilized sludge placement has occurred at a much higher rate. This is due in part to the fact that VFL was previously applying significant quantities of stabilized sludge as daily cover at Cherry Island Landfill, but was forced to stop this practice because waste haulers had complained that the material’s consistency inhibited vehicle traffic and local citizen groups complained about odors at the landfill. (As discussed earlier, odors were associated with the sludge mixture, although studies indicated its contribution to the problem appears to be insignificant). Since the daily cover option was no longer available, VFL accelerated placement at Pigeon Point. As is discussed below, the addition of more than 200,000 tons of out-of-state coal ash and alkaline reagent also contributed to the higher placement rate. Chart 2 illustrates the original placement plan over ten years versus the accelerated placement of the past two years and (potentially) that for the remainder of the project.



In the twelve months between September 2004 and August 2005, VFL delivered more than 362,000 tons of stabilized sludge to Pigeon Point Landfill, more than double the annual placement amount originally planned.¹²⁸ If fill rates were to continue at this level, this use would be available for only an additional two to three years. VFL representative, Jody Bacher, told us that efforts were underway to find alternative uses for the stabilized sludge so that the amounts going to Pigeon Point could be reduced.

¹²⁷ Duffield Associates, *Conceptual Evaluation: Partnering Opportunities for the City of Wilmington*, June 2004, p. 5

¹²⁸ DSWA memorandums, *Stabilized Sludge Delivered to CIL and PPLF by VFL, Calendar Year 2003 and Calendar Year 2004*

Of the 362,000 tons of stabilized sludge being used at Pigeon Point, approximately 200,000 tons represents materials that come from out-of-state – primarily from regional power and cement plants. In effect, the amount from outside Delaware far exceeds the total originally planned for Pigeon Point. VFL says that multiple sources of fly ash are needed for its blend with sewage sludge because when plants go down for maintenance, sufficient quantities of ash are unavailable from Edgemoor as a single source. DSWA disputes this fact, stating that ash can be stockpiled at Delmarva Power, VFL or even DSWA.

As for Delmarva Power's fly ash, in 1989 the utility signed a twenty-year agreement with DSWA to landfill up to 1.44 million wet tons of this by-product. After 20 years, the agreement operates on a year-to-year basis up to 30 years, at which point, if the 1.44 million wet tons has not been reached, the agreement terminates. Use of the fly ash in stabilized sludge for daily cover and/or construction purposes does not count toward the 1.44 million tons in the agreement.

If for some reason, VFL decided to no longer use Edgemoor fly ash in its stabilized sludge blend, the fly ash would go straight to CIL where Delmarva Power would be faced with higher disposal costs.

Because of the level of uncertainty surrounding renewed use of stabilized sludge as landfill daily cover, even with the proposed expansion of Cherry Island Landfill, the City decided to examine alternative means of disposal.

A. OPPORTUNITIES FOR THE PORT

In June 2004, the City of Wilmington Department of Public Works had Duffield Associates prepare an evaluation to examine opportunities to beneficially use stabilized sludge and dredged material for Port needs.¹²⁹ The document was intended primarily to address sludge disposal needs for the City; however, the report makes the case that this objective can be combined to serve a variety of interests, such as:

- The Port's need for dredged material disposal capacity and room to expand;
- DSWA's need for expansion into WHN and its ongoing responsibility for Pigeon Point Landfill
- The Corps' responsibility to maintain navigable waters and Wilmington Harbor.

Duffield Associates previously provided engineering expertise for dike construction demonstration projects at WHN and this experience led them in their report to propose using stabilized sludge as a construction material for expanding WHN. This contrasts with the Corps' DMMP where expansion was eliminated as an option because of stability and cost concerns. These concerns related to the site's location on soft soils and previously placed dredged material.

Normally, disposal area expansions occur using material from the site itself to raise dikes, which leaves room for additional capacity. The Duffield report argues that because of the

¹²⁹ Duffield Associates, *Conceptual Evaluation: Partnering Opportunities for the Port of Wilmington*, June 2004

unique site stability issues and desired staging characteristics, stabilized sludge could be more efficiently used to expand the site than dredged materials by placing it on the exterior and on top of existing dikes and that large counterberms could also be built with the material to stabilize the site and allow for significant vertical expansion. The report adds that the use of stabilized sludge will make WHN more viable for DSWA's expansion plans.

The report also proposes to utilize the Pigeon Point Landfill as an area for Port expansion (See Figure 2). A roadway to provide access to the northern part of the landfill would be necessary and could be built using stabilized sludge as bulk fill material. This approach could potentially expand the Port from its existing size by 23 percent over ten years and add 100 acres. Another benefit to the proposal noted by the report is that redeveloping the landfill for Port expansion would relieve DSWA of site maintenance costs.

As noted in the earlier section on the DMMP, the beneficial use of dredged material from WHN was regarded as impractical because of its high moisture content and the costs of drying and processing. The Duffield report suggests exploring several options that might make the material more usable. One option is to blend the material, like VFL does with sludge, to make a dry product. This could be stockpiled more easily or used for construction purposes.

The report concludes that there is the potential for use of more than four million cubic yards of stabilized sludge at WHN and Pigeon Point representing 20 years of disposal capacity for the City. In addition, if each site expands, there is the possibility of as much as an additional 20 years capacity. They estimate that large-scale counterberm construction could extend capacity to 2024 at costs "an order of magnitude lower" than previously identified solutions. They acknowledge that significant engineering evaluation is required for this idea.

The approaches offered by the Duffield report reflect the need to creatively incorporate the disposal needs of material such as sewage sludge into solutions being designed to address the Port's expansion and dredging requirements. A comprehensive approach to the Port, Pigeon Point and WHS has the potential to not only increase the size of the Port, but also make the ultimate conversion of WHS to usable Port land more efficient without limiting storage volumes within WHS.

V. RECOMMENDATIONS FOR SOLID WASTE/ DREDGED MATERIAL LANDFILL CAPACITY LIMITS

As has been stated throughout the report, the clock is ticking on important decisions relating to landfill capacity. Each decision will have an impact on capacity, whether to expand or constrict it. Options such as Cherry Island Landfill expansion, mandatory recycling, siting a new landfill, examining other in-state or out-of-state waste management options (including waste-to-energy), and relocating berths at the Port represent some of the choices available for dealing with capacity issues. The following recommendations are not intended to resolve all of the public policy questions underlying them, but to set in motion a coordinated and collaborative process to arrive at decisions that best serve the public interest.

These recommendations represent the views of the project authors and do not necessarily reflect the views of DNREC management and staff or individuals interviewed for the report.

A. DNREC

1. Either as lead agency or under the auspices of the Governor's office, develop a decision tree portraying the sequencing of decisions that must be made to determine:
 - a) When DSWA needs to start using landfill capacity made available by transfer of WHN to optimize Cherry Island Landfill expansion plans if landfill expansion is approved;
 - b) When the Corps can transfer WHN and in what condition, i.e. dewatered, reconstructed and ready for use by DSWA or "as is;"
 - c) When the Corps needs to complete its DMMP with updated analysis, choose preferred alternative, secure authorization and implement choice in order to maintain Port viability; and
 - d) When the City must find an alternative means of disposing of stabilized sludge currently used to regrade Pigeon Point.
2. Either as lead agency or under the auspices of the Governor's office, convene a meeting of DSWA, the Port, the City of Wilmington, the USACE, DEDO and DELDOT to reach consensus on decision tree and assign tasks to resolve outstanding issues. Develop process to include stakeholder involvement.
3. Initiate contact with appropriate New Jersey officials to review dredged material allocation issues involving main channel dredging, proposed Killcohook/Biddles Point DMMP disposal plan and main channel deepening project. In addition, request inclusion in discussions between New Jersey and Pennsylvania over allocation issues.
4. Appropriate adequate funding to initiate a study of potential environmentally beneficial restoration projects in the Delaware River and Bay using dredged material.

5. Require as a specific condition relating to approval of the permit to expand the Cherry Island Landfill that DSWA complete an updated Solid Waste Management Plan, including but not limited to items listed in recommendation #1 below, and hold public hearings on the plan within a year of permit issuance. Under ideal conditions, the issues examined in a new plan should precede permit approval.
6. Review DSWA's stabilized sludge plan and application rate at Pigeon Point Landfill to determine if it meets original project criteria and site stability requirements. Currently, three divisions within DNREC have some form of involvement with and/or oversight of activities at Pigeon Point Landfill. These activities should be coordinated for purposes of this review.

B. DSWA

1. Revise and update Statewide Solid Waste Management Plan (independent of or in response to permitting recommendation #5 above) and solicit public comment about landfill alternatives. The plan should examine in detail:
 - Alternatives to landfilling, both in-state and out-of-state, including, but not limited to, waste-to-energy;
 - Comparative cost/ton of various alternatives;
 - Impacts of alternatives on DSWA's ability to meet its responsibilities under Title 7 Delaware Code, Chapter 64, which created the Authority;
 - Comparative human health, environmental and community welfare impacts of alternatives;
 - Combinations of options to avoid landfilling at current rates, such as Chester, PA WTE, out-of-state/downstate shipments, recycling and alternative technologies;
 - Recycling issues not addressed in proposed legislation, such as commercial MSW;
 - Comparative community impacts of alternatives, including assessment of public/community attitudes about location and visual statement made by Cherry Island Landfill; and
 - Market incentives to reduce solid waste flow to landfills, such as "pay-as-you-throw."
2. Follow RPAC and SB 225 recommendations to pursue goal of 30 percent recycling rate for residential MSW and SB 225's goal of 50 percent recycling of commercial MSW. Conduct study of commercial waste stream in order to optimize recycling and landfill capacity extension.
3. Conduct a thorough review of potentially available landfill sites in New Castle County, including southern New Castle County and south of the C&D canal.
4. Review decision to discontinue use of stabilized sludge as daily landfill cover.

C. The Port of Wilmington and U.S. Army Corps of Engineers

1. The Corps should be engaged to conclude its process involving the DMMP, recognizing that WHN could reach capacity within four years. The Port and appropriate state agencies should communicate a sense of urgency to the Corps and submit a written request to have the relocation option considered as part of a revised DMMP, as well as piping dredged material directly to the Killcohook CDF. The Corps should be requested to consider all comparative costs over the life span of the preferred alternative including the cost of relocation.
2. Concurrently, the Port and other appropriate stakeholders should embark on an evaluation of the feasibility of moving the berths at Wilmington Harbor to the Delaware River.
3. Perform technical and economic evaluation of alternatives proposed in reports by Gahagan & Bryant Associates and Duffield Associates to extend the capacity of WHN past 2009.

D. General Assembly

1. Fund recycling programs and grants significantly like other states do.
2. Legislation to allow unclaimed bottle deposit funds to be used to support recycling.

FIGURES

McCABE & ASSOCIATES
ENVIRONMENTAL CONSULTING

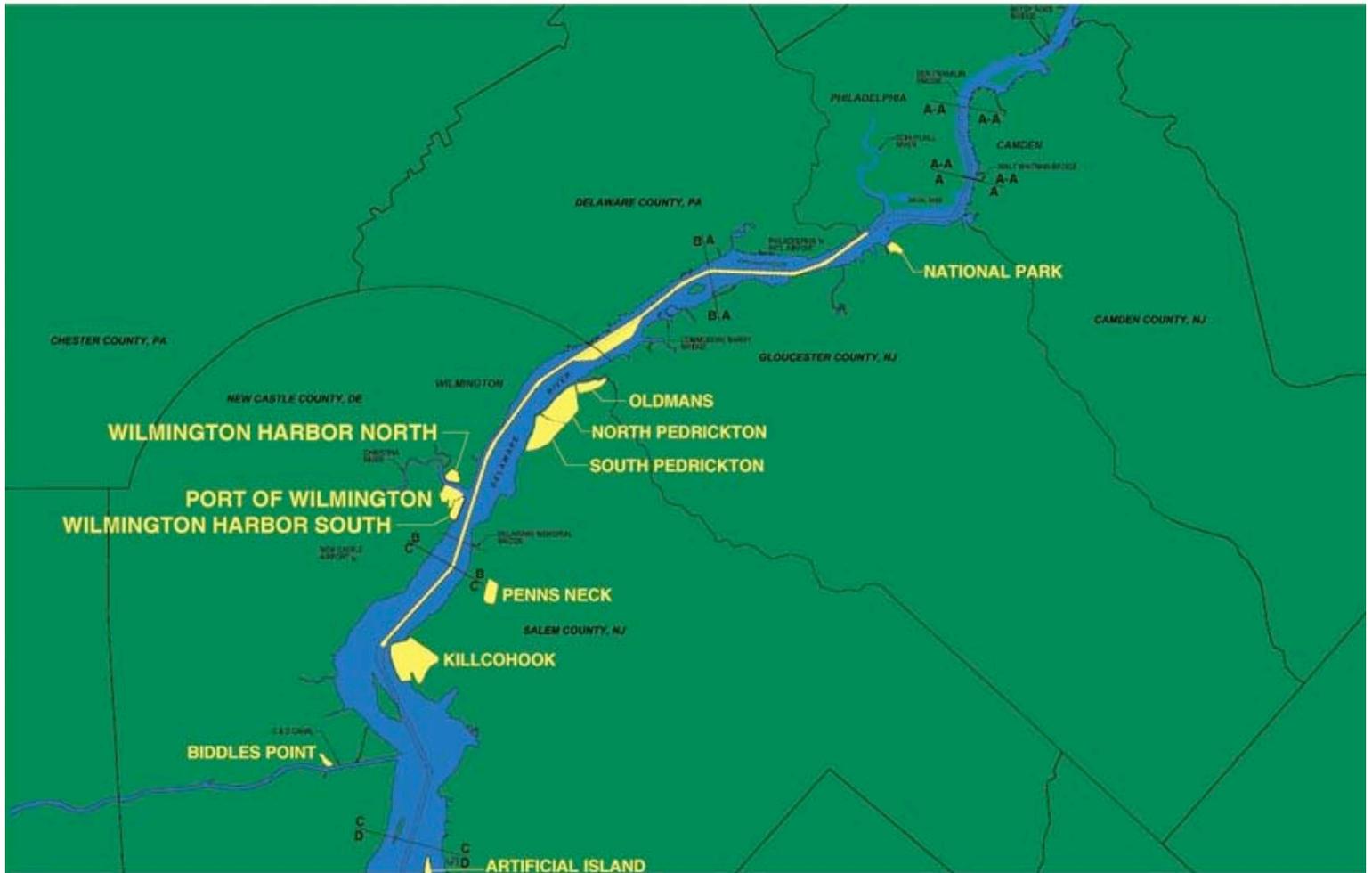


Figure 1
Courtesy of Gahagan & Bryant / USACE

(See Attachment 1 for full-size figure)



Figure 2
(See Attachment 2 for full-size figure)



Figure 3: Poplar Island before beneficial reuse



Figure 4: Poplar Island after beneficial reuse

Photos courtesy of US
Army Corps of Engineers