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SUMMARY REPORT
FOR
STAFFORD PARK RENEWABLE ENERGY
BLOCK 25 LOTS 34.02, 39, & 40
STAFFORD TOWNSHIP, OCEAN COUNTY
NEW JERSEY

APPLICANT:
TOWNSHIP OF STAFFORD
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CERTIFICATE OF AUTHORIZATION NO. 24GA27923000

JULY 15, 2010


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I. INTRODUCTION

The Stafford Township landfill is located on a 77.834 acre parcel known as Block 25 Lot 39 in Stafford Township. The capped landfill occupies approximately 54 acres of the lot. The landfill operated from August 1970, when it registered with NJDEP, until December 31, 1983, when it ceased accepting waste. Closure activities for the landfill were completed and the as-built certification for the landfill closure was approved by NJDEP on June 18, 2009.

As part of the landfill closure, the waste excavated from the Old Stafford Township Landfill was relocated to the landfill for beneficial reuse to grade the landfill surface and a final cover system consisting of a 6-inch bedding layer/gas venting layer, 40 mil LLDPE geomembrane, 12-inch drainage layer, 6-inch fill, and 6-inch topsoil was installed at the site. A passive landfill gas venting system and ancillary drainage features were also completed during the closure construction to ensure proper drainage and stormwater management. Approximately 18 acres of the capped landfill is used by Ocean County for leaf composting.

Stafford Township through its designated Redeveloper, Walters Homes Inc. is proposing to beneficially utilize much of the remaining capped portion of the Stafford Township Landfill and the adjacent areas to develop a renewable energy project. The proposal is to generate approximately 6 Megawatts of solar power to provide energy to commercial and residential elements of the Stafford Park Redevelopment Project as well as existing Ocean County facilities located at Stafford Park.

The purpose of this report is outline the facilities necessary to accomplish the renewable energy project, their impact, and the infrastructure necessary to provide the solar generated electrical power to the ultimate users.

II. EXISTING CONDITIONS

The Stafford Township landfill is located on a 77.834 acre parcel known as Block 25 Lot 39 in Stafford Township. The capped landfill occupies approximately 54 acres of the lot. Approximately 18 acres of the capped landfill is used by Ocean County for leaf composting. The remaining capped landfill consists of grasses and drainage channels.

There are an additional 24 acres of land in Lot 39 which primarily consist of the stormwater basins for the landfill. There is a gravel access road around portions of the landfill. Approximately 4 acres of the 77.834 acre lot remains in its natural wooded condition.

The wetlands and buffers were previously approved for the entire Business Park site. The approved plan is titled, Topographic and Wetland Survey prepared by Thomas J. Ertle and Associates dated November 11, 2005 and last revised January 17, 2007. Approximately a two acre portion of the capped landfill is located in the wetlands buffer. No development is proposed in the wetlands buffers.

In order to deliver the solar generated electricity to the users, power lines will need to be constructed across Block 25 Lots 34.02 and 40. The power lines will be overhead high voltage lines generally running through existing wooded portions of Lots 34.02 and 40. There is a small wetlands buffer on lot 34.02 which will not be disturbed by the power lines.

All *Threatened and Endangered Species* issues were resolved for the entire site as part of the landfill closure approval.

III. SOLAR POWER

The construction of a solar energy system on the top of a capped landfill requires that the design and construction be sensitive to the impermeable landfill cap. In order to safely install the solar systems, no penetrations or excavations are proposed on the landfill cap. All proposed elements of the solar system above the landfill cap are designed to be placed on the existing cover material or within four inches of the existing surface.

Solar panels will be aligned along the east west axis to maximize solar energy. Each panel is approximately 3.3' by 5.5'. The panels are set on a raised metal frame called an array. Each array contains 24 panels. The arrays are set at a 30 degree angle to the horizontal axis. The arrays are 27.10 feet long. Because of the 30 degree angle, the horizontal projection of the depth of the array is only 14.46 feet when the panel length is actually 16.50 feet.

The most significant load on the solar array is the uplift forces from wind. Each metal frame has four legs which are bolted to the precast concrete ballasts. The ballasts are 14 feet long, 24 inches wide and 18 inches high. Two ballasts are required for each array, two legs are attached to each ballast. Each ballast weights 6, 300 pounds and is placed directly on top of the existing landfill surface. No excavation is proposed to set the ballast so as to protect the existing landfill cap.

The arrays are set in rows running east-west. There is a one foot separation in the east-west direction between arrays. In the north south direction, there is a separation of 20.17 feet to provide optimum sunlight to the successive panel. The arrays are set a minimum of 4 foot 3 inches above the existing landfill surface. The existing grass cover will remain under and around the arrays.

The solar panels create DC power. Within the array, the panels are interconnected. Each array is connected to an adjacent array with an overhead power line. The pole for the power line is attached to one of the ballasts for each array. A total of 54 arrays, 1296 solar panels are connected to an inverter. The inverter changes the DC power into AC power for transmission to the transformers.

The inverters are set on concrete pads which are 4.5 feet wide and 15 feet long. The pad contains an electrical cabinet and two power poles. One pole is for the DC power into the inverter and one is for the AC power out of the inverter. AC power will be connected from inverter to inverter overhead until it reaches the transformers. In some locations, intermediate poles will be required. A total of 6 intermediate poles are shown on the landfill cap and will be set on precast concrete pads which are 4 foot by 4 foot. No penetrations or excavations are proposed on the landfill cap.

In order to generate 6 megawatts of power, 1,026 arrays are required. The total number of solar panels required is 24,624. There are nineteen inverters required to handle the 1,026 arrays. The entire solar field will be contained within a fence with several access gates. Fencing is required since live power is dangerous.

All of the components of the solar energy system on the landfill have little to no required maintenance. There are no additional access roads proposed within the solar field. Mowing of the landfill grasses will still be required as part of the post closure operations for the landfill.

The proposed solar field fence will enclose approximately 30 acres. The capped portion of the landfill is approximately 95% of the fenced solar field area. The panels have a total horizontal projection of 9.24 acres.

Electrical transformers will be pad mounted outside of the limit of the landfill. The two transformer locations will occupy an additional 0.08 acres. Both transformer locations are also fenced. Grounding will be performed outside of the limits of the landfill cap.

The transformers increase the voltage of the AC power for transmission to the ultimate users. Higher voltages are required to reduce losses in the transmission lines. The electricity will be sent to the existing Ocean County buildings on the northeastern side of the landfill located on Block 25 Lot 37 and several County buildings along Haywood Road. The electricity will also be used by the commercial buildings in Stafford Park as well as possible future residential uses.

IV. DESIGN CONSIDERATIONS

A. Vegetation

1. Transmission Lines

There are two transmission lines proposed with the solar power system. The first line carries power to the County facilities on Block 25 Lot 37 and Haywood Road. No natural vegetation is proposed to be removed to supply power to the County. The transmission lines would run overhead to the southwest corner of lot 37 and then underground along the existing fence line to the County buildings.

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The second transmission line runs from the transformers on the southerly side of the landfill to the existing commercial portion of Stafford Park. The majority of this transmission line route is currently wooded. The route generally follows the common property line with the State Forest. The clearing limit for this transmission line has been held 10 feet away from the property line to prevent any disturbance of the State Forest.

The transmission line also bends around the wetlands buffer on Block 25 Lot 34.02. Clearing of trees is required on lots 34.02, 39 and 40 for the transmission line. The width of the clearing is proposed to be 40 feet. The total area of clearing is approximately 4.5 acres. Most of the area along the route of the transmission line will be part of the fire break required for the construction of residential uses on lot 34.02.

Once the transmission lines are constructed, the exposed areas will be seeded with Pinelands grasses. No access roads will remain once construction has been completed.

2. Uncapped Portion of the Landfill Lot

Only minimal disturbance is proposed on the uncapped portion of the landfill, Lot 39. The solar energy facilities required in this area consist of the transformers, switch gear, one inverter, and approximately 16 solar arrays. All of this equipment will be located on areas already cleared of trees. The total area of grasses removed for these facilities is approximately 0.10 acres.

3. Capped Portion of the Landfill Lot

The capped portion of the landfill, Lot 39, will support the majority of the solar arrays. The solar energy facilities required in this area consist of the 1,010 arrays, 18 inverters, and 6 pads for electric poles. All of this equipment will be located on grass areas. No new access roads will be constructed on the capped landfill.

No penetrations or excavations are proposed on the landfill cap. All proposed elements of the solar system above the landfill cap are designed to be placed on the existing cover material or within four inches of the existing surface. In order to minimize any erosion on the drip lines of the arrays, a 4 inch wide by 4 inch deep stone drip line is proposed.

Any grass area on the landfill disturbed by construction will be reseeded at the completion of construction in accordance with the seeding schedule approved for the landfill cap. There will be vegetation lost due to the precast concrete structures placed on the landfill cap and the stone drip line. The total area of grasses lost as a result of the solar facilities is approximately 1.55 acres.

B. Stormwater Management

1. Transmission Lines

There are two transmission lines proposed with the solar power system. The first line carries power to the County facilities on Block 25 Lot 37 and Haywood Road. No natural vegetation is proposed to be removed to supply power to the County. There is no increase in the runoff coefficient CN and therefore no impact on stormwater.

The second transmission line runs from the transformers on the southerly side of the landfill to the existing commercial portion of Stafford Park. The majority of this transmission line route is currently wooded. The route will require the removal of approximately 40 feet of woods and stabilization of the soils with grasses. The runoff coefficient CN will increase from 55 to 61 along this route.

There is no increase in volume due to new impervious surfaces however there is an increase in volume due to the ground cover. The following is a calculation of the increase in volume.

2 Year Volume Increase CN 55 to 61

$$0.53'' - 0.31'' = 0.22''$$

10 Year Volume Increase CN 55 to 61

$$1.62'' - 1.19'' = 0.43''$$

100 Year Volume Increase CN 55 to 61

$$4.38'' - 3.63'' = 0.75''$$

The power line route has various topographic conditions. There is no location for a centralized stormwater management system. The proposed stormwater management system consists of a 1 foot deep depression between each set of poles. If the grade is sloping parallel to the pole line, the depression is located near the lower pole. If the grade is sloping perpendicular to the pole line, the depression is located on the low side of the clearing.

Each depression would have a minimum 600 cubic foot capacity. The required capacity for the increase in volume in the 100 year storm is 313 cubic feet per span between poles ($4.38'' - 3.63'' = 0.75''/12' * 40' * 125'$). The infiltration storage capacity proposed of 600 cubic feet is almost twice the increase in flow from the 100 year storm. This low impact technique will infiltrate the increase runoff along the entire transmission line route.

2. Uncapped Portion of the Landfill Lot

BASIN D

The majority of the improvements on the uncapped portion of the landfill are in the Basin D drainage area. The solar energy facilities in this area consist of the transformers, switch gear, one inverter, and approximately 16 solar arrays. All of this equipment will be located on areas already cleared of trees.

Basin D has an infiltration volume of 454,787 cubic feet. The required infiltration volume for the capped landfill for the increase in impervious cover in the 10 year storm was 325,046. With the solar fields, the volume increases to 325,791 CF, well below the available capacity. In the 100 year storm, with the solar field improvements, the rate of discharge increases by 0.01 CFS from 1.63 to 1.64 CFS where 7.71 CFS is allowed.

The solar improvements on the uncapped portion of the land have no impact on the approved stormwater management Basin D. The calculations are below:

Increase in Impervious cover

• Ballasts	33 @ 285 SF each	924 SF
• Inverters	1 @ 68 SF	68 SF
• Transformer/switch	4 @ 184 SF each	736 SF
	<u>TOTAL</u>	<u>1728 SF</u>

10 Year Volume Increase

$$5.17"/12" * 1728 = 745 \text{ CF}$$

100 Year Volume Increase

$$8.96"/12" * 1728 = 1290 \text{ CF}$$

$$10 \text{ Year Volume Required for Landfill} = 325,046 \text{ CF}$$

$$10 \text{ Year Volume Required for Landfill \& Solar} = 325,046 + 745 = 325,791 \text{ CF}$$

$$10 \text{ Year Volume Provided for Landfill} = 454,787 \text{ CF}$$

$$10 \text{ Year Rate Approved for Landfill} = 0 \text{ CFS}$$

$$10 \text{ Year Rate Proposed for Landfill \& Solar} = 0 \text{ CFS}$$

100 Year Rate Approved for Landfill = 1.63 CFS

100 Year Rate Proposed for Landfill & Solar = 1.64 CFS

100 Year Rate Allowable = 7.71 CFS

BASIN C

The only improvement on the uncapped portion of the landfill that drains to Basin C is one transformer. This equipment will be located on an area already cleared of trees.

Basin C has an infiltration volume of 665,228 cubic feet. The required infiltration volume for the increase in impervious cover in the 10 year storm was 492,073 CF. With the transformer, the volume increases to 492,153 CF, well below the available capacity. In the 100 year storm, with the solar field improvements, the rate of discharge remains at zero.

The solar improvements on the uncapped portion of the land have no impact on the approved stormwater management Basin C. The calculations are below:

Increase in Impervious cover

- Transformer/switch 1 @ 184 SF each 184 SF

10 Year Volume Increase

$$5.17"/12" * 184 = 80 \text{ CF}$$

100 Year Volume Increase

$$8.96"/12" * 184 = 138 \text{ CF}$$

10 Year Volume Required for Landfill = 492,073 CF

10 Year Volume Required for Landfill & Solar = 492,073 + 80 = 492,153 CF

10 Year Volume Provided for Landfill = 665,228 CF

10 Year Rate Approved for Landfill = 0 CFS

10 Year Rate Proposed for Landfill & Solar = 0 CFS

100 Year Rate Approved for Landfill = 0 CFS

100 Year Rate Proposed for Landfill & Solar = 0 CFS

3. Capped Portion of the Landfill Lot

The capped portion of the landfill was designed and approved as impervious cover. The runoff coefficient used for the capped portion of the landfill was a CN of 98. The solar improvements on the capped portion of the landfill have no impact on the approved stormwater management systems.

C. Outside Agency Approvals

The following approvals are required for this project.

1. Township Site Plan for the construction of the solar facilities and the electric transmission lines.
2. The Pinelands Commission
3. The Ocean County Soil Conservation District for the disturbance of more than 5,000 SF.
4. The NJDEP Solid Waste for a modification of the Post Closure Maintenance Plan.

D. Visual Impact

The solar field is located on the landfill. The adjacent land uses consist of the County Maintenance Facility, the State Forest, and a future residential lot. The solar field is not visible from any adjacent roads. The residential lot is buffered from the solar field by an existing 10 to 12 foot high berm. When the residential site is developed, trees will be added to the berm.

V. SUMMARY

The Stafford Township landfill site is well suited for renewable energy generation. The site was previously disturbed and the capped landfill already addresses the stormwater impacts. This site complies with the Pinelands CMP for the development of renewable energy in the Regional Growth Area of the Pinelands.

