PART 2 of Petition

APPENDIX E WATER RESOURCES

E-1: POTABLE USE & WATER DISTRICT INFORMATION

CALPINE

EASTERN REGIONAL OFFICE
THE PILOT HOUSE, 2ND FLOOR
LEWIS WHARF
BOSTON, MASSACHUSETTS 02110
617.723.7200
617.723.7635 (MAIN FAX)

May 2, 2001

Town Board
Town of Wawayanda
POB 106
Slate Hill, NY 10973

Re: Water Supply Needs for Wawayanda Energy Center

Dear Town Board Members:

This will confirm that an affiliate company, Calpine Construction Finance Co., LLP is in the process of seeking approvals to develop a 540 MW electric generation facility at a site located along Dolsontown Road in the Town of Wawayanda. This letter represents Calpine's plans concerning water supply for the project.

From a water use perspective, this facility will be designed and engineered to be among the most efficient electric generation plants in the world. It will require (i)process water to operate the facility, and (ii)potable water for the facility's staff generally known as domestic water. As to the latter, based upon our design and engineering plans and data, our best estimate is that the facility will require no more than 5,000 gallons per day to meet the needs of domestic water use. As to process water, Calpine is still investigating its options. One option and promising source of meeting this need for process water is the utilization of treated effluent discharge from the City of Middletown through its Public Office of Treated Water (POTW) with whom we are presently negotiating. Should this negotiation with POTW be successful, Calpine will abandon and terminate its potential for the development of on-site wells.

We also fully understand that the Town of Wawayanda, (Town) as a party to a Stipulation of Settlement dated September 14, 1989 between the Town and the City of Middletown has obtained approvals from the State of New York to acquire water from the City of Middletown of up to 200,000 gallons per day upon the establishment of a water and sewer district. We understand that such district is in the final stages of its formation and that it is intended to be operational in the near future for the purpose of servicing those properties which are within such improvement district.

Accordingly, Calpine hereby agrees that it will use or utilize no more than five thousand (5,000) gpd from the Town's water source derived through its Stipulation of Settlement with the City of Middletown to meet its needs for a domestic water supply system. In addition, notwithstanding Calpine's discussions and on-going negotiations with POTW for process water and irrespective of the outcome of such negotiations, Calpine, for itself and for its successors and assigns, hereby waives its rights, if any, as a property owner, optionee or

otherwise within the contemplated special improvement district to be known as District No. 1, to have, obtain or use any additional water made available to the Town and the said District by reason of the aforesaid Stipulation of Settlement.

This is intended to be binding upon the Town and upon Calpine, its affiliates, successors and assigns.

Please acknowledge your understanding and assent to the foregoing by signing below.

Calpine Corporation

By:_____
Paul Barnett
Vice President – Asset Optimization

The undersigned hereby agrees to the foregoing.

Town of Wawayanda

By:_____
Thomas J. DeBlock
Supervisor

422.22

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Flanigan Square, 547 River Street, Troy, New York 12180

RECEIVED
OCT 10 2000
TECTONIC ENGINEERING

Antonia C. Novello, M.D., M.P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

October 4, 2000

Mr. Lawrence G. Biegel
NYS-DEC Region 3
21 South Putt Corners Road
New Paltz, NY 12561-1696

RE: WSA No. 9959
Wawayanda W.D. #1
Expansion from (C) Middletown
To Route 17M Area
(T) Wawayanda, Orange Co.

Dear Mr. Biegel:

We have reviewed the documents received on July 31, 20000 and discussed the project with staff of the Orange County Department of Health. We recommend:

X Approval of this application with the following conditions:

1. That each service connection will be metered and the total taking will be metered.

2. That no service connection will be made which would increase the maximum daily demand of the district beyond 200,000 gpd.

3. That any request, by the Town of Wawayanda for a boundary expansion of the Wawayanda W.D. #1 service area and/or an increased taking of water from the City of Middletown beyond 200,000 gpd, will include assurance that the Highlands Water Treatment Plant has been replaced by the City of Middletown and that new raw water transmission mains and a new storage tank have been constructed by the City of Middletown and/or assurance that the Town of Wawayanda will have an adequate source and/or a new source.

Sincerely,

Kenneth W. Caffrey, P.E.
Senior Sanitary Engineer
Bureau of Public Water Supply Protection

cc: TECTONIC Engineering Consultants, P.C. Attn: John V. Nosek, P.E.
Clark Paterson Associates, Attn.: Jacob Tawil, P.E.
Orange County Department of Health, Attn.: Lee Bergus, P.E.
NYSDOH, Attn.: Tim Vickerson, P.E.
DEC Albany, Attn.: Gordon Behn, P.E.

08/10/2001 09:51 FAX 8455345635 TECTONIC/CIVIL

WO 322,212

New York State Department of Environmental Conservation
Division of Water, Region 3
200 White Plains Road – 5th Floor, Tarrytown, New York 10591-5805
Phone: (914) 332-1835 • FAX: (914) 332-4670
Website: www.dec.state.ny.us

Environmental Conservation 30 Years
John P. Cahill
Commissioner

October 2, 2000

Mr Jeff Schiller
Tectonic Engineering Consultants, P.C.
70 Pleasant Hill Rd
Mountainville, NY 10953

RE: Approval of Plans and Specifications for Sewer Main Extension of Town of Wawayanda to Serve the Town of Wawayanda and Sewer District No. 1, in the Town of Wawayanda Orange County.

Dear Mr. Schiller:

This is to advise you that the plans and specifications for the above referenced project are being approved by this Department. This project consists of approximately; 2,750 linear feet of 8" PVC force main, 1 pump station, 4,100 linear feet of 12" PVC gravity sewer and 1,000 linear feet of 8" PVC gravity sewer, connected through 23 manholes to the existing sanitary sewer manhole as shown in the plans prepared by "Tectonic Engineering Consultants, P.C., consisting of sheets 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, and 12 of 12, last revised July 16, 1999.

By initiating the construction of the said project covered by the approval of the plans and specification, the applicant accepts and agrees to abide by and conform with the following:

(1) This approval is issued pursuant to SPDES Permit No. NY-0026328.

(2) That this approval letter shall be maintained on file by the applicant.

(3) That the approval is revocable or subject to modification or change pursuant to Article 17 of the Environmental Conservation Law.

(4) That any and all construction undertaken by the terms of the approval of plans shall be completely and wholly at the risk of the applicant.

(5) That the facilities shall be fully constructed and completed in compliance with plans as approved on October 2, 2000.

(6) That this office is to be notified when construction commences.

(7) That the engineer will forward the results of the leakage tests of the completed work to this department.

(8) That professional engineer supervising such construction shall certify to this Department in writing and to the applicant that the constructed facilities have been fully completed in accordance with the engineering report and the plans.

(9) That the leakage outward or the infiltration inward of the constructed sewer line shall not exceed 200 gallons per inch of the pipe diameter per mile per day for any section of the sewer system between manholes and including manholes.

(10) The approved project must be completed within five (5) years of the approval date at which time the approval will expire.

Enclosed please find one copy of the approved plans and the engineering report. Also, one copy of the approved plans is being sent to the Orange County Health Department.

Very truly yours,

Joseph Marcogliese, P.E.
Regional Water Engineer

Enclosure
cc: Orange County Health Department/ w Enclosure

E-2: STORM WATER PLANS AND CALCULATIONS

DRAFT

Wawayanda Energy Center

Article X Application

APPENDIX E

STORM WATER POLLUTION PREVENTION PLAN

DRAFT

TABLE OF CONTENTS

1 *PURPOSE*

The objective of this Construction Storm Water Pollution and Prevention Plan (SWPPP) is to demonstrate compliance with the State Pollutant Discharge Elimination System (SPDES) in consideration for issuance of a General Permit for storm water discharges associated with construction activity.

This SWPPP provides a detailed analysis of storm water runoff for existing and proposed site conditions. Also included are the soil erosion and sediment control measures that will be used during construction. All temporary and permanent erosion and sediment control facilities are designed in accordance with the New York Guidelines for Urban Erosion & Sediment Control (NYGUESC).

Wawayanda Energy Center will submit a Notice of Intent (NOI) Form and the SWPPP to the town of Wawayanda in order to demonstrate compliance with the SPDES program and receive coverage under a General Construction Activity Storm Water Permit. After final stabilization has been achieved, a Notice of Termination (NOT) Form will be submitted.

2 *BACKGROUND INFORMATION*

2.1 *Project*

The site of the proposed Wawayanda Energy Center (WEC) Project is located within the Town of Wawayanda in Orange County, New York. The project includes the construction and operation of a 540-megawatt natural gas, combined cycle power generation facility. Primary structures of the facility include a switchyard, turbine building, cooling towers, heat recovery steam generator, stack, and water treatment building. Site grading of approximately 22 acres will be required. This will improve site drainage by diverting storm water first through a new system of catch basins and then into a storm water detention pond.

2.2 *Site Description*

The WEC property contains just over 25 acres, and is situated within the Light Industrial Zoning of Wawayanda. The site is bounded to the south by Dolsontown Road, to the east by an abandoned railroad easement, to the north by electric transmission lines, the 36 MW Shoemaker combustion turbine, an electrical substation, city of Middletown sewer easements and the Middletown POTW, and to the west by open land generally extending to Route 17. The site is proximate to the Interstate 84 (I-84)/Route 17 interchange, providing ready access from I-84 to the site from Route 17M to Dolsontown Road. The project's access drive will extend off of Dolsontown Road.

Present grade within the WEC site is flat along the southern portion adjacent to the drainage ditch. Along the western portion the slopes are mild. The average slope through this section is about 7%. The site slopes down from west to east between Elevations 500 and 446 feet. The current site usage is agricultural and undeveloped. With the exception of a house and two small buildings at the southern end of the site and overhead electric transmission lines located at the northern end, the property does not contain any above ground structures.

Due to its agricultural use, the site does not include indigenous vegetation. A portion of the site includes hydric soils and other evidence of wetland characteristics and is considered a wetland under the U.S. Army Corps of Engineers (ACOE) definition. No state-mapped wetlands exist on the site, nor is the site located within a mapped floodplain. The site contains a small pond area and a drainage ditch that is an unnamed tributary to the Monhagen Brook. The site is outside the nearest Wild, Scenic and Recreational River Zone and there are no known water wells on-site. Due to the agricultural use of the site, exceptional natural communities or protected species are unlikely to exist. A wetland delineation of the site was conducted. Drawing WAWA-1-DW-SPI-735-001 depicts the existing site conditions as surveyed by John Nelting, Land Surveyor, in May 2000.

2.3 Subsurface Conditions

The Site Soils located in the area of the proposed power plant are listed below:

Symbol	Soil Name	Hydrologic Soil Group
ErB	Erie gravelly silt loam	C
MdB	Mardin gravelly silt loam	C
HoB	Hoosic gravelly sandy loam	A
Wd	Wayland silt loam	D

Mardin gravelly silt loam, MdB, using the US Department of Agriculture Soil Conservation Service Soil Survey of Orange County, New York (1981), is characterized as deep (greater than 5 feet thick) and has a dense fragipan in the subsoil. Permeability is moderate in the surface and upper part of the soil and is slow in the fragipan and substratum. The water table in this soil is perched above the fragipan in the early spring and in other excessively wet periods. Seasonal wetness and slow permeability in fragipan limit the uses of the Mardin soil.

The eastern half of the site consists of Wayland and Erie silt loam and Hoosic gravelly sandy loam. The majority of the eastern half consists of the Wayland silt loam, which is a deep, poorly drained soil. The Wayland soil is commonly subject to flooding in the springtime and the water table is at or near the surface for prolonged periods unless the soil is drained. The on-site drainage ditch that serves as a tributary of Monhagen Brook and the on-site wetlands are located within the Wayland soil. The Hoosic soil is located to the west of the Wayland soil and comprises approximately one quarter of the eastern half of the site. The Hoosic soil is a deep, well-drained soil with a high content of sand and gravel. This soils lies outside of the area of disturbance.

The site soils were derived from glacial till, glacial outwash deposits and/or alluvial deposits that underlie the site. The Mardin soil, where the building footprint is proposed to be located, was formed from glacial till deposits derived from sandstone, shale and/or slate. This glacial till has a variable texture (e.g., clay, silt-clay, boulder clay) and variable thickness ranging from 3 to 150 feet. The eastern portion of the site (or just to the east of the site) is underlain by lacustrine silt and clay that was deposited in proglacial lakes. This silt/clay is laminated and has a variable thickness ranging up to 300 feet.

The depth of bedrock is greater than 100 feet below the surface. This is based on available information. Bedrock is not likely to be encountered during any excavations. The seasonal wetness of the on-site soils will be factored into the design and construction of the structures/buildings to ensure the stability of slopes, trenches, excavations and structures.

2.4 Climate

The climate of Orange County is classified as humid continental. Most weather systems travelling through the northeastern United States will affect the county, including those travelling through the St. Lawrence Valley, the middle latitudes of the country, and parallel to the eastern seaboard. Thus, temperature, humidity, winds, and other atmospheric conditions normally undergo significant changes within a few days. The average daily minimum and maximum temperatures are 39 and 57 degrees Fahrenheit, respectively. Temperatures of 90 degrees or higher generally occur 8 to 12 days a year, between the months of June and August. Last frost generally occurs between May 10 and 15, signifying the start of a freeze-free season that lasts approximately 160 days. Average monthly precipitation ranges from 2.3 inches in February to 3.8 inches in June. Total annual precipitation ranges from 35 to 38 inches per year. The site is well above not only the 100-year flood plane, but the 500-year plane as well.

2.5 Runoff Coefficients

The Rational runoff coefficient for each sub-area was determined using Runoff coefficients for Rational formula, from USDOT, FHWA, FHWA-SA-96-078, HEC-22, Urban Drainage Design Manual. This table is available in Attachment A, Design Calculation WAWA-1-DC-SDS-CE-001.

Several characteristics of the site, such as its vegetation, gradient, and the excessively drained soil conditions, weighed heavily in the selection of specific Rational runoff coefficients.

2.6 Curve Number

The curve number was determined using Urban Hydrology for Small Watersheds, TR No. 55, June 1986.

The soil group letter and cover conditions determined the selection of specific curve number.

2.7 Receiving Waters

Most site runoff enters an unnamed tributary to Monhegan Brook. Ultimately, all of the site runoff discharges into to Monhegan Brook. This will continue during and after site development.

3 STORM WATER MANAGEMENT

An analysis of storm water runoff conditions (pre-development, post-development, and post-development bypass) was completed for the Wawayanda Energy Center, as required by Appendix D, General Permit for Construction Activities Storm Water Management

Guidelines for New Development of the SPDES General Permit for Storm Water Discharges from Construction Activities.

3.1 Peak Flow Attenuation

3.1.1 Pre-development Conditions

Although the property itself is only 25 acres, the area of disturbance is only 22 acres. Currently, all runoff from the site enters the existing drainage ditch. A delineation of watershed boundaries and critical flow path for the pre-development condition is available on drawing WAWA-1-SK-SPI-735-001. Detailed results are available in Design Calculation WAWA-1-DC-SDS-CE-001, and are summarized in Tables 3-1 and 3-2. (Refer also to drawing WAWA-1-DW-SPI-735-001 for existing topography.)

3.1.2 Post-development Conditions

The proposed conditions are shown on drawing WAWA-1-DW-SPI-735-002. The majority of the ground surface is kept close to a 1 percent slope in order to maximize drainage time and increase total infiltration while still providing positive drainage. Final grade was designed to divert nearly all rainfall within the site into a storm water detention pond via a new system of catch basins and smooth-lined polyethylene (SLPE) storm water pipes. The pond is required in order to trap sediment during construction, control 'first flush' runoff, and to attenuate peak flows entering the existing drainage ditch. The pond discharges through a 30-inch reinforced concrete pipe (RCP) barrel into the existing drainage ditch. Results are summarized in Tables 3-1. All of the new drainage areas and flow paths for the post-development conditions are shown on drawing WAWA-1-SK-SPI-735-002.

3.1.3 Construction Conditions

During construction, the worst-case scenario would be to assume that the entire site is stripped of topsoil and that rough grading is complete. All areas would drain toward the site with the exception of the access driveway and part of the plant roadway. The detention basin will be used as a sediment basin during construction. All of the drainage areas and flow paths during this stage of construction are expected to be similar to those after development. Areas 1 through 31, including critical flow paths, will be identical, except for cover conditions. The critical path for this area also is shown on drawing WAWA-1-SK-SPI-735-002.

3.1.4 *Comparison between Pre-development and Post-development*

Before and after site development, all runoff ultimately will leave the site by the existing on-site tributary/drainage ditch. Table 3-1 compares peak flow rates, in cubic feet per second (cfs).

TABLE 3-1: PEAK FLOW (CFS)

	Predevelopment	Post-development Onsite Bypass	Basin Outflow	Post-development Peak Discharge
2-yr Storm	30.47	23.98	4.25	28.23
10-yr Storm	73.56	53.54	13.30	66.84
25-yr Storm	97.53	69.24	18.31	87.55
50-yr Storm	109.80	77.20	20.84	98.04
100-yr Storm	122.22	85.21	23.31	108.52

Table 3-1 shows that the peak flow through the proposed storm water management facilities for the 2, 10, 25, 50, and 100-year storms will remain below pre-development levels, both during and after site development.

3.2 *100-Year Flood Plains*

No state-mapped wetlands exist on the site, nor is the site located within a mapped floodplain. The site includes a small ponded area and a drainage ditch that is an unnamed tributary to the Monhagen Brook. None of this site is within the 100-year floodplain of the Monhagen Brook or its unnamed tributary.

The Project site is well above both the 100 and 500-year flood plains. Thus, there will be no encroachment into the special flood hazard area. Recommended buffers will be maintained.

3.3 *Runoff Conveyance Systems*

It was determined that a system of catch basins and SLPE storm water pipes will serve the needs of Wawayanda Energy Center. It will be optimized to the new site layout in addition to providing water quality treatment. Due to layout restrictions, much of the runoff will require pipes in order to flow from the eastern perimeter of the site back toward its center. From here, runoff will be conveyed to the detention pond. This detention basin will use extended detention as a method of 'first flush' treatment. The system is designed to convey the entire flow from a 100-year storm. A StormCAD model of this system also may be found in WAWA-1-DC-SDS-CE-001, along with plan and profile views.

3.4 *Stream Corridor and Wetlands Management*

There is an existing tributary and wetlands within the site. Land clearing and grading will occur within the wetland. No stream crossings are proposed.

3.5 *Water Quality Management Guidelines*

3.5.1 *Control of 'First Flush'*

All runoff contains various amounts and types of pollutants. These may include sediment, thermal stress, nutrients, oxygen-demanding organics, toxic substances, and pathogens. Common sources include pavement degradation, motor vehicles, atmospheric fallout, vegetation, and construction runoff. Most of these pollutants are flushed from impervious surfaces (pavement, roofs) during the first half-inch of runoff. This is referred to as the 'first flush' runoff.

Appendix D of the SPDES permit recommends that infiltration, retention, extended detention, and/or various storm water management adjuncts be used to treat the 'first flush' runoff, preferably in that respective order. Wawayanda Energy Center will use extended detention to improve storm water quality.

The pond will provide for the storage of well over one inch of runoff for each impervious acre after development. A conservative 'first flush' analysis may consider not just impervious areas, but all areas for which the land surface has been changed from predevelopment conditions. Runoff from lawn areas, for example, may contain leftover nutrients from fertilizers. The first half-inch of runoff from the 16.28 acres draining into the pond will be treated through extended detention. In all cases, the first half-inch of runoff will be treated, and it will take over 24 hours for the pond to empty completely. Smaller storms, such as those producing only up to about 0.4 inches per acre of runoff volume, will take over six hours for the pond to empty.

3.5.2 *Control of Thermal Discharges*

Impervious surfaces, such as asphalt and roofs, may store large quantities of heat. This heat can be transferred to storm water runoff through conduction. Additional heat contained in storm water runoff can then elevate temperatures within nearby streams. Bodies of water containing cold-water fisheries are of primary concern. Storm water discharges should be consistent with the thermal criteria found in Part 704 of the Water Quality Regulations, Title 6, Chapter X, New York State Codes, Rules and Regulations.

The site watershed currently contains no impervious acres. This will be increased to 5.55 acres after development. However, storm water runoff from 5.35 of these acres will be routed through the detention pond. The only runoff from impervious areas that will remain untreated will be from portions of the existing road and the proposed plant roadway. Extended detention will provide thermal benefits to storm water runoff. The pond will eliminate or minimize any thermal impact on the Monhegan Brook.

4 *SITE CONSTRUCTION PLAN*

4.1 *Construction Activities*

Construction of Wawayanda Energy Center will require soil-disturbing activities, including utility installation, rough grading, excavation, fill, and final grading. Bedrock is well below project design elevations and will not be encountered. Thus, no mechanical removal or blasting of bedrock is anticipated. Several erosion and sediment controls will

be implemented in order to minimize the effects of storm water runoff both during and after construction.

In addition to the various buildings, plant equipment, a road also will be constructed. The road will have one entrance from Dolsontown Road.

4.2 Erosion and Sediment Controls

The contractor will employ several temporary methods to provide erosion and sediment control during construction. These will include silt fencing, storm water inlet protection, swales and waterways, temporary and permanent seeding and mulching (Section 4.4), construction entrances, riprap erosion protection, and a sediment pond. Erosion and sediment control features were designed using Reducing the Impacts of Stormwater Runoff from New Development and in accordance with the NYGUESC.

4.2.1 Silt Fencing and Inlet Protection

Silt fences will be installed wherever the grade slopes (or can be expected to slope at any time during the Project) away from the property line. Most of the perimeter of the site will utilize silt fencing. It also will be used along the downslope side of the temporary soil stockpiles.

Storm water inlet protection will be used to filter sediment from water, and will consist of straw bales placed around any active catch basins or inlets. This measure will be used after installing a new system of catch basins prior to final grade stabilization. Inlet protection will remain until the corresponding tributary area is stabilized.

Drawing WAWA-1-DW-SPI-735-008 demonstrates all silt fence and inlet protection locations, with details available on drawings WAWA-1-DW-SPI-735-009 and WAWA-1-DW-SPI-735-010.

4.2.2 Permanent Drainage Channels

Locations of these permanent drainage channels are shown on drawing WAWA-1-DW-SDS-735-002, with details available on drawing WAWA-1-DW-SPI-735-010. Calculations and standards used to size the channels are available in Attachment B, Erosion and Sediment Controls Design Calculation (WAWA-1-DC-SDS-CE-002).

4.2.3 Construction Entrances and Dust Control

Temporary construction entrances will be used to provide a buffer zone between the disturbed site and the surrounding properties. The stone surface will prevent tracking of site soils onto adjacent roadways wherever traffic enters or leaves the construction site. The anticipated locations of these temporary access points are shown on drawings WAWA-1-DW-SPI-735-008- and 014 and with details available on drawing WAWA-1-DW-SPI-735-009. Temporary construction entrances will provide dust control at all access points. During dry weather conditions, the construction supervisor will direct additional dust control activities as needed. If spray adhesives are necessary, dilution and application rates will be similar to those in Section 5A of the NYGUESC.

4.2.4 Riprap Outlet Protection

Drawing WAWA-1-DW-SPI-735-004 contains riprap locations. More detail is available on WAWA-1-DW-SPI-735-004. Apron sizing was calculated as shown in WAWA-1-DC-SDS-CE-002.

4.2.5 Sediment Basin

The sediment basin will be located in the northeast corner of the main plant the site, and will be converted into the permanent detention pond after final stabilization. The basin location is shown on drawing -008. All sides have 4:1 slopes, sloping from Elevation 458 feet down to Elevation 450 feet. The temporary outlet structure is shown on drawing -009. It will consist of a perforated, 36-inch diameter corrugated metal riser, and will include an anti-vortex device and a trash rack. It will connect to a temporary 18-inch diameter, CMP barrel will be attached to the proposed detention basin outlet structure. The basin outlet structure will be connected to a 30-inch diameter RCP barrel that will convey the outflow to the existing drainage ditch/tributary of Monhagen Brook.

Part III.D.2.b.1 of the SPDES General Permit for Storm Water Discharges from Construction Activities states that a sediment pond should provide 3600 cubic feet (cf) of storage per acre drained. For a drainage area of 16.28 acres, 58,608 cf is recommended. The actual volume of the pond is 157,687 cf at elevation 453.62 feet (the service spillway elevation). The NYGUESC recommends sediment storage capacity equal to 33 cubic yards (cy) per acre drained, or in this case 538 cy total. Sediment clean out will occur at Elevation 451.07 feet, the invert of the lowest outlet orifice is set at the same elevation, 451.07. Calculations for the size and shape of the basin, as well as its outlet structure, may be found in WAWA-1-DC-SDS-CE-002.

In accordance with Section 5 of the NYGUESC, the outlet barrel was designed to convey the peak runoff from a 10-year storm for the worst cover conditions. Typically, the principal spillway is designed for 0.2 cfs per acre drained, with total capacity of the principal and emergency spillways able to discharge the peak runoff from the 10-year storm. The principal spillway will pass 7.40 cfs. The basin will be formed almost entirely by excavation and the construction of an earthen embankment. It follows that the barrel will require anti-seep collars due to the presence of the embankment.

It should be noted that both during and after site development, the pond will attenuate peak flows during the 2, 10, and 100-year storms to below pre-development levels (Section 3.1). Design guidelines require that the emergency spillway be capable of passing the entire pond inflow during a 10-year storm with no regard for peak flow attenuation.

The 36-inch riser is recommended in order to accommodate the 30-inch barrel. The perforations in the riser were designed in accordance with the NYGUESC. The sediment basin will take over 72 hours to dewater. A baffle shall be installed in the sediment basin to increase the flow length from the basin intake structure to the basin outlet structure. This will aid the settlement of sediment from the runoff. Upon completion of construction and stabilization of the site, the sediment basin will be converted to a detention basin. The temporary riser and baffle will be removed during the conversion of the basin.

The basin design satisfies both temporary and permanent flow and volume requirements. Because the permanent pond is a detention pond, the permanent outlet structure is designed to extend detention. This assists in capturing the "first flush" volume (Section 3.5.1) during post-development conditions.

4.4 Vegetative Measures

Following construction of the Project, topsoil will be reapplied to the site in areas where vegetation is to be established. Final stabilization, including preparation, grading, seeding, and mulching, shall be as follows:

4.4.1 Site Preparation

The existing erosion and sediment controls will be maintained to ensure their effectiveness during final stabilization. Any additional controls that may be necessary will be installed.

Rough and final grading will be completed, allowing for the depth of topsoil to be added.

All compact, slowly permeable, medium and fine textured subsoil areas, if any, will be scarified. This will be done at approximately right angles to the slope direction in areas that are steeper than 5 percent, such as the pond and the earth berm.

Refuse, woody plant parts, stones over 3 inches in diameter, and any other litter will be removed from the subsoil.

4.4.2 Application and Grading of Topsoil

Topsoil will be distributed to a uniform depth of six inches over the area. It will not be placed when it is partly frozen, muddy, or on frozen slopes or over ice, snow, or standing water puddles. Any topsoil placed and graded on slopes steeper than 5 percent will be promptly fertilized, seeded, mulched, and stabilized.

Topsoil should be relatively free of 1 1/2-inch and larger stones, trash, and noxious weeds. Any undesirable stones or other debris will be removed.

Prior to seeding, compacted or crusted soil surfaces will be loosened to a depth of at least two inches by disking, raking, or other suitable methods.

4.4.3 Seeding and Mulching

Seeding and mulching will involve liming and fertilizing the soil, sowing seed, applying mulch, and occasionally anchoring the mulch. Ideally, seeding will occur between March 21 and May 20, or between August 25 to October 15. Seeding procedure will vary between the earth berm, sediment pond, temporary drainage channels, and permanent pond. For the remainder of the site, permanent seeding and mulching guidelines are as follows:

- The soil should be limed to a pH of 6.5, and fertilized with 850 pounds of 5-10-10 or equivalent per acre (20 pounds per 1000 square feet). Lime and fertilizer should be incorporated throughout the topsoil.

- Seed the soil to a depth of 1/8 to 1/4 inch. Use a cultipacker type seeder if possible. If seed is to be broadcast, cultipack or roll after seeding. If hydroseeded, lime and fertilizer may be applied through the seeder and rolling is not practical.

- The seed mixture should be as follows:

		lbs./sq. ft	lbs./acre
65%	fine fescue	2.6-3.3	114-143
15%	perennial ryegrass	0.6-0.7	26-33
20%	Kentucky bluegrass blend	0.8-1.0	35-44
		4.0-5.0	175-220

- To improve disease resistance, more than one species of Kentucky bluegrass should be used.

- Straw mulch will be applied at a rate of 2 tons per acre (90 to 100 pounds, or 2-3 bales, per 1000 square feet), to a depth such that at least 90 percent of the surface is covered.

The earth berm and the slopes of the sediment/detention basin will be seeded and stabilized immediately upon completion. The earth berm will use the permanent seeding and mulching procedure. The sediment basin will be temporarily seeded, mulched and stabilized using the following procedure. The basin should be limed to a pH of 6.5, and fertilized with at least 50 pounds of N, P, and K per acre (1.0 – 1.25 pounds per 1,000 square feet). Straw mulch will be applied at a rate of 2 tons per acre (90 to 100 pounds, or 2-3 bales, per 1000 square feet), to a depth such that at least 90 percent of the surface is covered. In each case, the mulch will be anchored with biodegradable jute netting.

For the temporary seeding, the seed mixture should be as follows:

		lbs./sq. ft	lbs./acre
45%	Kentucky bluegrass	0.6	25
35%	creeping red fescue	0.5	20
20%	perennial ryegrass	0.2	10
		1.30	55

Drainage channel 1 willed be sodded and stabilized immediately upon completion. Drainage channels 2 and 3 will be permanently seeded and stabilized immediately upon their completion. Jute netting will be used to anchor the permanent seeded swales.

After the site is at least 70 percent stabilized, all of the erosion and sediment controls will be removed. The sediment basin will be converted into the detention basin, and seeded in accordance with the permanent seeding procedure.

4.4.4 Trees

Existing trees shall be disturbed as little as possible during construction. Trees planted on site upon completion of construction, shall be planted in accordance with the NYGUESC.

4.5 Construction Sequence

A. Erosion and sedimentation controls must be constructed, stabilized and functional before general site disturbance within the tributary area to those controls commence, as follows:

1. Install stabilized construction entrance.

2. Install vegetated diversion Swale 1 and level spreader outlets upland from the area to be disturbed around the area of the proposed power plant.

3. Install filter fabric fence along the down gradient perimeter of the soil stockpile area, around the perimeter of the proposed power plant area, along the down-gradient side of the site access driveway and plant roadway, and perimeter of the proposed sediment basin area.

4. Install and immediately stabilize the sediment basin, Swale 2, Inlet 17, the 48 inch RCP, Endwall #32, the Basin Outlet Structure and riprap apron at Endwall #34.

B. Rough grade site to subgrade elevations. Excavate and remove unsuitable material. Backfill with suitable material, place fill material in uniform layers and compact each layer to establish subgrade elevations.

C. Excavate for structure foundations for power plant.

1. Stockpile excavated material on the temporary soil stockpile as shown on the plan. Sow temporary seed and/or mulch the soil stockpile.

2. Excess material not incorporated back into the work will be disposed of in a spoil area east of the main plant site.

3. The contractor will be responsible to design and construct a temporary excavation support and protection system for the power plant foundation excavations in compliance with OSHA Regulations, Standards- 29 CFR, PART 1926, Safety and Health Regulations for Construction, Subpart p - EXCAVATIONS.

4. Any water that accumulates in the open excavation(s) shall be completely removed by pumping. The pump discharge hose shall have a sediment filter bag attached to its effluent end. The flow rate of the dewatering pump shall not to exceed 50% of the maximum flow rate indicated on the bag label. Place the sediment filter bag over straw laid on a stabilized area. Distribute straw at the rate of 1 bale per 30 square feet.

D. Construct structure foundations for power plant.

E. Backfill and compact soils to subgrade elevations around foundation walls of the power plant structures/buildings.

F. Construct underground utility lines and appurtenant manholes. Underground piping and manholes may be constructed concurrent with the construction of the power plant structure/buildings and access road.

1. Limit daily trench excavation to the length of pipe placement and backfilling that can be completed the same day unless pressure testing requires that the trench remains open for a longer period until testing is complete.

2. The contractor will be responsible to design and construct a temporary excavation support and protection system for the power plant foundation excavations in compliance with OSHA Regulations, Standards- 29 CFR, PART 1926, Safety and Health Regulations for Construction, Subpart p - EXCAVATIONS.

3. Water that accumulates in the open trench will be completely removed by pumping. The pump discharge hose shall have a sediment filter bag attached to its effluent end. The flow rate of the dewatering pump shall not to exceed 50% of the maximum flow rate indicated on the bag label. Place the sediment filter bag over straw laid on a stabilized area. Distribute straw at the rate of 1 bale per 30 square feet.

4. On the day following the pipe placement and trench backfilling, the disturbed area will be graded to final contours and appropriate temporary erosion and sedimentation pollution control measures/facilities will be installed. Seeding and mulching of all disturbed areas will be done at the end of each week.

5. Straw bale drop inlet protection shall be installed at all newly installed inlets.

G. Construct power plant structures/buildings.

H. Place topsoil cover in disturbed area surrounding power plant structures/buildings to a six (6) inch depth.

I. Form roadbed for access driveway and plant roadway to the established subgrade elevations.

J. Construct access driveway and plant roadway proposed typical pavement (see detail).

K. Grade access driveway and plant roadway shoulders, and permanently seed and mulch disturbed areas on driveway/roadway shoulders.

L. After final site stabilization has been achieved, all remaining temporary erosion and sediment pollution control facilities will be removed. Sediment basin shall be converted to permanent detention basin. Install riprap aprons at Endwalls 32 and 36. Areas disturbed during removal of the controls shall be stabilized immediately.

M. Should any measures contained within this plan prove incapable of adequately removing sediment from on-site flows prior to discharge or of stabilizing the surfaces involved, additional measures must be immediately implemented by the contractor to eliminate all such problems.

N. The New York Soil and Water Conservation District must approve any changes to this construction sequence due to conditions that develop during construction.

4.6 Controls and Maintenance

The Owner's construction supervisor or his designated agent, in conjunction with the Contractor, will regularly inspect the project's erosion and sedimentation controls during the entire active construction stages until the site is completely stabilized. Control measures will be inspected at least once a week and after each rainfall event that produces runoff. Measures will be inspected daily during prolonged rainfall periods. The Contractor will be responsible for the installation, operation, maintenance, and removal of all erosion and sedimentation controls. All other controls will be inspected on the same schedule. All sediment removed from the controls will be disposed onsite near the soil stockpile.

- The Rock Construction Entrance shall be maintained by adding or replacing the coarse aggregate if the entrance becomes clogged with sediments.

- Silt fences shall be re-anchored, repaired, or replaced as necessary. Sediment that has been trapped by the silt fence shall be removed as required when bulging is evident. It is recommended that this occur before the accumulation has reached one-third the above ground height of the fence.

- Temporary Inlet Protection shall be maintained as required during the life of the Project. Sediment shall be removed and the bales replaced as required.

- The Sediment Basin shall be maintained by removing sediment when it reaches the cleanout elevation. The cleanout stake shall be maintained in the trap to clearly indicate the sediment levels.

- Final stabilization will be repaired as necessary. Depending on site conditions, it may be necessary to irrigate, fertilize, overseed, or reestablish planting in order to provide permanent vegetation for adequate erosion control. If necessary, an additional 10-10-10-analysis fertilizer at the rate of ten pounds per 1000 square feet may be applied.

- Stabilization measures shall be initiated no more than 14 days after the construction activity in a particular area has temporarily or permanently ceased, unless activity will resume less than 21 days after activity ceased or the 14th day is precluded by snow, in which case measures shall be initiated as soon as practicable.

All required temporary erosion and sedimentation controls will remain in place and be maintained until the area they protect has been stabilized. Stabilization for this project will consist of seeding and mulching disturbed areas, equipment installation, or paving. After areas stabilized by vegetative cover are established, denoted by 70% uniform

vegetative cover, modification of the sediment basin to the permanent basin shall commence.

4.7 Inspections

A signed copy of this Plan and any supporting materials must be maintained at the project site from the date of project initiation to the date of final stabilization. All records and supporting documents will be compiled in an orderly manner and maintained for a period of three years following final site stabilization.

The generation of reports, as part of the construction process and inspection or amendment procedures, provides accurate records that can be used to evaluate the effectiveness of this Plan and document the compliance of the Plan. Changes in design or construction of the storm water management system are documented and included with the Plan to facilitate Plan review or evaluation. The following forms have been developed to assist the Construction Manager with record keeping activities:

- Record of Plan Amendments
- Construction Activity Record
- Erosion and Sedimentation Controls Inspection Form

Plan amendments will be documented on the form in the front of this Plan and on the drawings. A record of construction activities will be maintained in Attachment C of this Plan. Completed inspection and maintenance forms will be kept in Attachment D of this Plan.

DRAFT

ATTACHMENT A

DESIGN CALCULATION WAWA-1-DC-SDS-CE-001

DRAFT

ATTACHMENT B

DESIGN CALCULATION WAWA-1-DC-SDS-CE-002

DRAFT

ATTACHMENT C

DRAFT

CONSTRUCTION ACTIVITIES RECORD

PROJECT INFORMATION		
PROJECT NAME:	PROJECT NUMBER:	
GENERAL CONTRACTOR		
NAME:		
ADDRESS:		
CITY:	STATE:	ZIP:
PROJECT SUPERINTENDENT:	PHONE:	
SITE WORK CONTRACTOR		
NAME:		
ADDRESS:		
CITY:	STATE:	ZIP:
PROJECT SUPERINTENDENT:	PHONE:	
DESCRIPTION OF CONSTRUCTION ACTIVITIES		

DRAFT

ATTACHMENT D

DRAFT

INSPECTION FORM

PROJECT INFORMATION			
PROJECT NAME:		PROJECT NUMBER:	
GENERAL CONTRACTOR			
NAME:			
ADDRESS:			
CITY:		STATE:	ZIP:
PROJECT SUPERINTENDENT:		PHONE:	
SITE WORK CONTRACTOR			
NAME:			
ADDRESS:			
CITY:		STATE:	ZIP:
PROJECT SUPERINTENDENT:		PHONE:	
SITE CONDITIONS			
TODAYS DATE:	TODAYS TEMPERATURE:	DATE OF LAST RAINFALL:	
CURRENT WEATHER CONDITIONS:			
DESCRIPTION OF INSPECTED EROSION CONTROL DEVICES:			

PARSONS

CALCULATION COVER SHEET

CLIENT	Calpine
PROJECT	Wawayanda Energy Center
SUBJECT	STORMWATER MANAGEMENT
JOB NUMBER	537162
WBS NUMBER	00108
CALCULATION NO.:	WAWA-1-DC-SDS-CE-001
PAGE 1 OF	10

DESCRIPTION/PURPOSE

Design a system to collect site runoff and a storm water management pond capable of reducing the peak flow after development to a level less than or equal to that before development.

METHOD OF ANALYSIS

Rational Method for collection system design and TR55 for pre-development analysis.

REFERENCES

1. *PondPack*, Version 7.0, Haestad Methods, Waterbury, CT.
2. *StormCAD*, Version 3.0, Haestad Methods, Waterbury, CT.
3. *New York Guidelines for Urban Erosion & Sediment Control*, Empire State Chapter, Soil and Water Conservation Society, 1997.
4. *Urban Hydrology for Small Watersheds*, TR No. 55, June 1986.
5. *Rainfall Frequency Atlas of the United States*, Technical Paper No. 40, May 1961.
6. *Rainfall Intensity Curves for Orange County, New York*, sent by Tectonic Engineering Consultants P.C. on 2/23/2001.
7. *Urban Drainage Design Manual*, US DOT, FHA, FHWA-SA-96-078, HEC-22.
8. *Soil Survey of Orange County, New York*, US Department of Agriculture Soil Conservation Service, 1981.
9. *Reducing the Impacts of Stormwater Runoff from New Development*, New York State Department of Environmental Conservation, 1993.
10. *Design Charts for Open-Channel Flow*, USDOT, FHA, Washington, DC, 1977.

REV	DATE	DESCRIPTION	PAGES REVISED	PAGES ADDED	PAGES DELETED	BY/DATE	REV/DATE	LDE/DATE
3								
2	8/20/01	Added 25 and 50-yr storms	2-5,7-10	Appendix pp added	NA	JAWinterhalter 8/20/01	WAnundson 8/20/01	JAWinterhalter 8/20/01
1	7/1/01	Basin relocated	2,3,4,6,9, 10	NA	NA	JAWinterhalter 7/18/01	WAnundson 7/23/01	DGGallino 7/23/01
0	4/18/01	ORIGINAL ISSUE	NA	NA	NA	NLGreenway 4/18/01	JAWinterhalter 4/23/01	DGGallino 4/24/01

PARSONS

CALCULATION COVER SHEET

CLIENT	Calpine		
PROJECT	Wawayanda Energy Center		
SUBJECT	STORMWATER MANAGEMENT		
JOB NUMBER	537162	WBS NUMBER	00108
CALCULATION NO.:	WAWA-1-DC-SDS-CE-001	PAGE 2 OF	10

REFERENCES (continued)

11. Design WAWA-1-LI-040-0001 & WAWA-1-LI-040-0002, "Wawayanda Energy Center, Preliminary Scoping Statement Under Article X of the NY State Public Service Law, July 2000 (Includes revised stipulations, October 25, 2000). *(Rev. 2 based upon Stipulation 50, Jan. 31 2001.)*
12. WAWA-1-LI-024-0001, Zoning, Chapter 195, April 1998, Code of the Town of Wawayanda.
13. WAWA-1-LI-024-0002, Subdivision of Land, Chapter 162, February 1997, Code of the Town of Wawayanda.

ASSUMPTIONS

None require later confirmation.

CONCLUSIONS OR RESULTS

The post-development storm water collection and management system was analyzed and found to attenuate peak flows below the corresponding pre-development levels. 'First flush' runoff was controlled.

Revision 1 Description:

The storm water basin was relocated to minimize disturbance in the wetlands. It was moved to the northeast corner of the immediate plant site. The relocated pond was raised one foot in elevation to accommodate discharge to the existing grade in that area. The volume of the pond is at least as large as the original pond, contour for contour, so the storms will not be rerouted. Also, the total storm sewer pipe length increased so the peak pond inflow hydrographs will be reduced slightly.

Revision 2 Description:

The stipulations revised January 31, 2001 require that the 2, 10, 25, 50, and 100-year return rainfall events be evaluated. The calculation previously evaluated the 2, 10, and 100-year events. None of the earlier conclusions have changed. The pond and discharge structures attenuate the peak flows from the 25 and 50- year events.

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Attachment 4 – Post-development Analysis

4a	Post-development drainage area to basin	
	Runoff Curve Number Data	1 p
	Time of Concentration Calculation	2 pp
	Basin Volume Analysis	1 pp
	Basin Outfall Structure Geometry	3 pp
	Outfall Structure Data	1 p
	Hydrographs (2-yr, 10-yr, *25-yr, 50-yr*, 100-yr)	10 pp R2
	Basin Summary (2-yr, 10-yr, *25-yr, 50-yr*, 100-yr)	5 pp R2
	Basin Routing Summary (2-yr, 10-yr, *25-yr, 50-yr*, 100-yr)	5 pp R2
4b	On-site Post-development Bypass	
	Runoff Curve Number Data	1 p
	Time of Concentration Calculation	3 pp
	Hydrographs (2-yr, 10-yr, *25-yr, 50-yr*, 100-yr)	10 pp R2

Attachment 5 – First Flush Analysis

First flush storage capacity data	1 p
Storage-Elevation Routing Summary	1 p
Volume-Elevation vs Time data	3 pp
One inch storm hydrographs	2 pp
Basin Routing Summary (one-inch storm)	1 p
Storage-Elevation Routing Summary	1 p
Volume-Elevation vs Time data	3 pp

Attachment 6 – Emergency Spillway Calculation

Emergency Spillway Calculation	1 p R 1

Attachment 7 – Permanent Swales Analysis

Swale 1	
Drainage Area Map (USGS Quadrangle)	1 p
Drainage Area Analysis	2 pp R1
Flowmaster data analysis sheet	2 pp R1
Swale 2 & 3	
Drainage Area Analysis	1 p
FlowMaster data analysis sheet - Swale 2	3 pp
FlowMaster data analysis sheet - Swale 3	2 pp
Exhibit 7-1, Mannings "n"	1 p

Attachment 8 – Riprap Apron Design

Riprap Apron Design	2 pp

Sketches

WAWA-1-SK-SPI-735-001, Pre-development Conditions	
WAWA-1-SK-SPI-735-002, Post-development Conditions,	Rev. 1

STORMWATER DRAINAGE DESIGN CRITERIA

1. Use modified Rational Method to design the storm water collection system.
2. Rational runoff coefficient for impervious surfaces (pavement and concrete), gravel, and grass.
3. Size storm sewer to carry 100-year peak runoff (10-year minimum required). Use 5 minutes for minimum time of concentration. Reference 11, revised stipulation 43 (frequency). *Stipulation 50, Jan. 31, 2001.* R2
4. Storm sewer materials: Smooth lined polyethylene pipe. RCP pipe and endwalls will be used where the pipes enter and exit the detention basin.
5. The storm water management basin shall be sized to reduce post-development peak runoff to less than or equal to the pre-development peak flows. Reference 11, 16.4.2. Control "first flush" runoff. Reference 3, Appendix G, 3, A.
6. Use SCS-TR-55 Graphical Peak Discharge Method to design the Stormwater Detention Basin.
7. Comparisons shall be made between pre-development, post-development runoff to the basin and post-development bypass runoff for 2, 10, *25, 50,* and 100-year rainfalls. Reference 11, 16.4.2. *R2*
8. The times of concentration shall be calculated using methods specified in "Urban Hydrology for Small Watersheds," TR No. 55, June 1986.
9. The SCS Runoff Curve Number shall be calculated using methods specified in "Urban Hydrology for Small Watersheds," TR No. 55, June 1986. Reference 11, 16.4.2.
10. The rainfall Intensity/Duration/Frequency chart shall be generated from "Rainfall Intensity Curves for Orange County, New York. Reference 6.

STORMWATER DRAINAGE CALCULATIONS

1. General Approach:

   Design the site grading to have a minimum slope of 1%. Using the final cover shown on the General Arrangement, determine the tributary area to each inlet. Design the storm sewer to have a minimum pipe slope of 0.003 ft./ft. to minimize the trench depth.

2. Site Soils:

Symbol	Soil Name	Hydrologic Soil Group
ErB	Erie gravelly silt loam	C
MdB	Mardin gravelly silt loam	C
Wd	Wayland silt loam	D

1. Rational Runoff Coefficients:

   The site cover conditions will be:

Grass	C = 0.35
Gravel	C = 0.60
Impervious (Pavement, Roofs)	C = 0.90

   Source: (Reference 7) USDOT, FHA, FHWA-SA-96-078, HEC-22, "Urban Drainage Design Manual"

2. Inlet Tributary Data:

   See Attachment 2.

3. Time of Concentration and Rainfall Intensity:

   Use a minimum t_c = 5 minutes. Using 5 minutes will produce a larger, more conservative flow.

   The 100-year Intensity-Duration curves were entered in StormCad.

4. See Attachment 2 for the results of the StormCad design of the storm sewer system.

   Table of Contents:

Outlet O-32, Inlets 1 to 18	100-yr. design
Outlet O-32, Inlets 17 to 31	100-yr. Design
Outlet O-34, Basin Outlet	2-yr. Design, 100-yr. Design
Outlet O-36, Driveway Culvert	2-yr. Design, 100-yr. Design

5. Permanent Channel Design:

   See Attachment 7 for calculations and Flowmaster output.

6. Rock Outlet Protection for Outlets:

   Design rock outlet protection in accordance with New York Guidelines for Urban Erosion and Sedimentation Control, Rock Outlet Protection.

   These criteria were intended for outlets where the downstream flow is channelized or flat with no definite channel. Endwall 32 outlets to a detention basin. See Attachment 8 for design calculations.

Outlet	Pipe Dia. (in.)	Velocity (fps)	La(ft.)	W1(ft.)	W2(ft.)	Riprap	D(in.)
O-32	42 R1	8.9R1	10	12	16	D50 – 6 in	14
O-34	30	6.27	10	8	12	D50 - 6 in	14
O-36	24	4.82	10	6	10	D50 - 6 in	14
O-38	30	10.03	25	8	18	D50 - 9 in	20

APPROACH

Pre-Development Analysis

1. Calculate/determine on-site tributary area at Point of Interest, CN (curve number), and time of concentration for the existing site at specified point of interest.
2. Determine the peak runoff for the 2, 10, *25, 50*, and 100-year rainfalls. R2

Post-Development Analysis

1. Design preliminary grading plan.
2. Develop model of pipes, inlets, and outlets in StormCAD.
3. Size the pipes to convey a 100-year storm.
4. Calculate/determine tributary area to basin and on-site area bypassing basin, CN (curve number), and times of concentration for the proposed site.
5. Determine the peak flow to the basin, as well as the bypass flow.
6. Size the detention basin.

Storm Water Detention Pond Design

1. Ensure that post-development peak flow (water entering the nearby stream) is less than pre-development peak flow for 2, 10, *25, 50*, and 100-year storms. R2
2. Determine the maximum allowable pond outflow such that the total water entering the stream will remain below pre-development levels. This includes pond outflow and any on-site bypass flow.
3. Model pond design using PondPack to obtain actual peak pond outflow. Determine actual peak flow through existing storm water system using StormCAD.
4. In addition to peak flow attenuation, consider additional design constraints such as principle and emergency spillway design and "first flush" runoff volume.

RUNOFF CALCULATIONS

Pre-Development Analysis

General

The total area of the permanent facilities of the proposed Wawayanda Energy Center is approximately 21.1 acres. This site is located in the middle of Orange County. This area is within the Hudson Mohawk Lowland. The project site is nearly level to gently sloping (3%) in the central portion of the site. This section of the site contains wetlands and an unnamed tributary to Monhegan Brook. The building footprint is proposed to be located on the western portion of the site. The ground on this portion of the site is gently to moderately sloping from 5 to 16 percent. The site currently contains a house and the land is otherwise undeveloped, with existing agricultural use. The site does not contain indigenous vegetation. Pre-existing conditions were assumed for this analysis. The cover was assumed to be grassland/meadow for soil group C/D.

Results

Table 1 summarizes the results for the pre-development conditions:

TABLE 1: PRE-DEVELOPMENT PEAK FLOW (CFS)

2-year storm	10-year storm	25-year storm R2	50-year storm R2	100-year storm
30.47	73.56	97.53	109.80	122.22

PondPack hydrographs are shown in Attachment 3 for on-site tributary area to the Point of Interest. Results are presented for all three storms (2, 10, *25*, 50, and 100-year). R2

Post-Development Analysis

General

The developed site will contain a system of catch basins and storm water pipes. The proposed grading will divert virtually all rainfall within the site (28 sub-areas) into a storm water detention pond via the new storm water system. However, most of the area along the south side of the proposed road and gas metering area will bypass the basin.

The first objective of the post-development analysis was to determine the new peak flow that will flow to the proposed basin. The second goal was to determine the on-site peak flow that bypasses the basin. However, after site development, the existing drainage ditch will receive water from the pond outlet as well as direct runoff from on-site bypass area. It was necessary to determine the peak flow from the onsite bypass area. The allowable outflow for the proposed detention basin was determined. The detention basin was sized accordingly.

Results

The new network of catch basins and storm water piping was entered into StormCAD. The areas, Rational runoff coefficients, and times of concentration were entered into the program for the new drainage areas created by the proposed grading. A summary of this data is shown in Attachment 2. Times of concentration were assumed to be 5 minutes. Refer to Sketch WAWA-1-SK-SPI 735-002 for all drainage subareas.

Using the above information, StormCAD helped size the piping in order to provide a network capable of handling post-development runoff in the event of a 100-year storm. The PondPack Version 7.0 computer program was used to produce SCS TR-55 runoff hydrographs and to analyze the flow characteristics through the detention pond during 2, 10, *25, 50,* and 100-year storms. R2 The Critical storm duration was calculated for each design storm. This corresponded to the maximum required pond volume and peak outflow. The pond inflow was a weighted composite of the discharge from the new storm water system and the runoff from the area immediately surrounding (and including) the pond. The peak pond outflow was calculated for each design storm based upon the pond inflow, pond geometry, and riser design. Results are shown in Table 2:

TABLE 2: POST-DEVELOPMENT PEAK FLOW (CFS)

	2-year storm	10-year storm	25-year storm R2	50-year storm R2	100-year storm
Pond Inflow (from area around pond and new storm water system)	37.71	66.14	80.26	87.28	94.29
Pond Outflow	4.25	13.30	18.31	20.84	23.31
On-site Bypass Area	23.98	53.54	69.24	77.20	85.21

The StormCAD data for the proposed storm sewer is shown in Attachment 2. This includes plans, profiles, and reports for the three design storms. Results are shown in Attachment 4 for the basin routing and on-site bypass flows for 2, 10, *25, 50,* and 100-year rainstorms. R2

Construction Analysis

It is important to consider how the pre-development peak runoff compares to not only the post-development peak flow, but also the peak runoff during construction as well. The construction phase can alter the drainage characteristics of the site significantly. The time of concentration generally decreases while the cover conditions may get worse. Erosion and sedimentation controls shall be installed prior to construction to deal with these conditions during construction.

This will include a sediment pond and two temporary drainage channels. During construction, the 16.28 acres of the site will drain into the sediment pond via the temporary drainage channels. The assumption is that all areas within the site will slope roughly in the direction of the sediment pond at approximately 0.5 percent slope. It is assumed to travel from the northeast corner of the site, at one half percent grade, until it reaches the grassed waterway. At this point it continues flowing within the channel until reaching the pond.

The New York Guidelines for Urban Erosion & Sediment Control were used to size the sediment basin (due to the lack of storm water pipes leading into the pond during the construction phase). This program computed the peak pond inflow and corresponding peak outflow. During construction, the use of the pond as a sediment basin will preclude its use as a detention basin. Results are available in WAWA-1-DC-SDS-CE-002.

STORMWATER MANAGEMENT POND DESIGN

Flow Attenuation

In order to minimize the impact on the surrounding area, it was important that the peak flow during and after site development remained less than or equal to the pre-development peak flow. Table 3 summarizes the peak flow before and after site development:

TABLE 3: PEAK FLOW (CFS)

	Predevelopment	Post-development Onsite Bypass	Basin Outflow	Post-development Peak Discharge
2-yr Storm	30.47	23.98	4.25	28.23
10-yr Storm	73.56	53.54	13.30	66.84
25-yr Storm	97.53	69.24	18.31	87.55
50-yr Storm	109.80	77.20	20.84	98.04
100-yr Storm	122.22	85.21	23.31	108.52

For each design storm, the peak flow into the existing storm water system will remain below pre-development levels. The storm water pond will provide the necessary peak flow attenuation.

Pond Service Discharge Structure:

The proposed outlet structure will consist of a inlet box, with a two (2) inch circular orifice, two rectangular weirs, a grated top and trash racks. It will connect to a 30-inch diameter, reinforced concrete pipe that will convey the outflow towards the existing drainage ditch. The top of grate is at Elevation 455.37 feet *R1*. The two (2) inch orifice is at elevation 449.43 *R1*. The rectangular weirs are at elevation 452.00, 3.5 feet wide and 1 ft - 8 in. height *R1*.

Emergency Spillway:

The pond will have an earthen emergency spillway. The spillway elevation is at 455.62 *R*1. It can safely pass 100-year inflow over the spillway with one (1) foot of freeboard. The spillway is 140 feet long and 14 feet wide.

Control Of 'First Flush'

Most pollutants are flushed from impervious surfaces (pavement, roofs) during the first half-inch of rainfall. This is referred to as the 'first flush' runoff. From 70 to 95 percent of storm water contaminants can be removed by controlling the 'first flush' runoff through infiltration practices. For a dry basin, extended detention will be used and designed in accordance with NYGUESC. Two conditions must be meet to achieve this. First, the first one-half inch of runoff from the contributory drainage area to the basin should be extended over a 24-hour detention period. This was achieved by multiplying ½-inch by 16.28 acres. Using PondPack the required storage capacity required was 0.678 acre-feet. The surface elevation corresponding to this storage capacity is 451.63 *R1* feet. Dewatering results are available in Attachment 5. Infiltration could not be used to treat the "first flush" runoff due to the low permeability of the site soils.

The second condition requires the stormwater runoff volume generated from a one-inch storm should be released over a 24-hour detention period. PondPack was used to generate this storm and route it through the basin. The corresponding maximum water level elevation is 450.93 R1 feet for this one-inch storm event. Dewatering results, inflow hydrograph and the basin routing are in Attachment 5.

ATTACHMENT 1

RAINFALL INFORMATION

TECTONIC ENGINEERING CONSULTANTS P.C. TELEFAX TRANSMISSION

☒ 70 Pleasant Hill Road, Mountainville, NY 10953, Phone: 845-534-5959, Fax: 845-534-5999

☐ 2570 Route 9W, Cornwall, NY 12518, Phone: 845-534-3450, Fax: 845-534-3556

☐ 145 Mt. Vernon Avenue, Mount Vernon, NY 10550, Phone: 914-663-8668, Fax: 914-663-8662

☐ 557 Blooming Grove Turnpike, New Windsor, NY 12553, Phone: 845-561-3798, Fax: 845-561-4371

☐ 12 Cornell Road, Latham, NY 12110, Phone: 518-783-1630, Fax: 518-783-1544

☐ 4 West Main Street, Northborough, MA 01532, Phone: 508-393-7411, Fax: 508-393-4740

☐ 9100 Centre Pointe Drive, Suite 100, West Chester, OH 45069, Phone: 513-942-9530, Fax: 513-942-9531

☐ 804 Moorefield Park Drive, Suite 100, Richmond, VA 23236, Phone: 804-330-7203, Fax: 804-330-7213

☐ 1344 Silas Deane Highway, Suite 500, Rocky Hill, CT 06067, Phone: 860-563-2341, Fax: 860-257-4882

COMPANY: Parsons FAX #: 610-855-3398

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Comments: Rainfall curves as requested

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ENGINEERS SURVEYORS CONSTRUCTION MANAGERS

TECTONIC
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8/11

RAINFALL INTENSITY CURVES
FOR
ORANGE COUNTY, NEW YORK

STORM DURATIONS - 5 MINUTES TO 120 MINUTES
RETURN PERIODS - 2 YEARS TO 100 YEARS

CONSULTING ENGINEERS

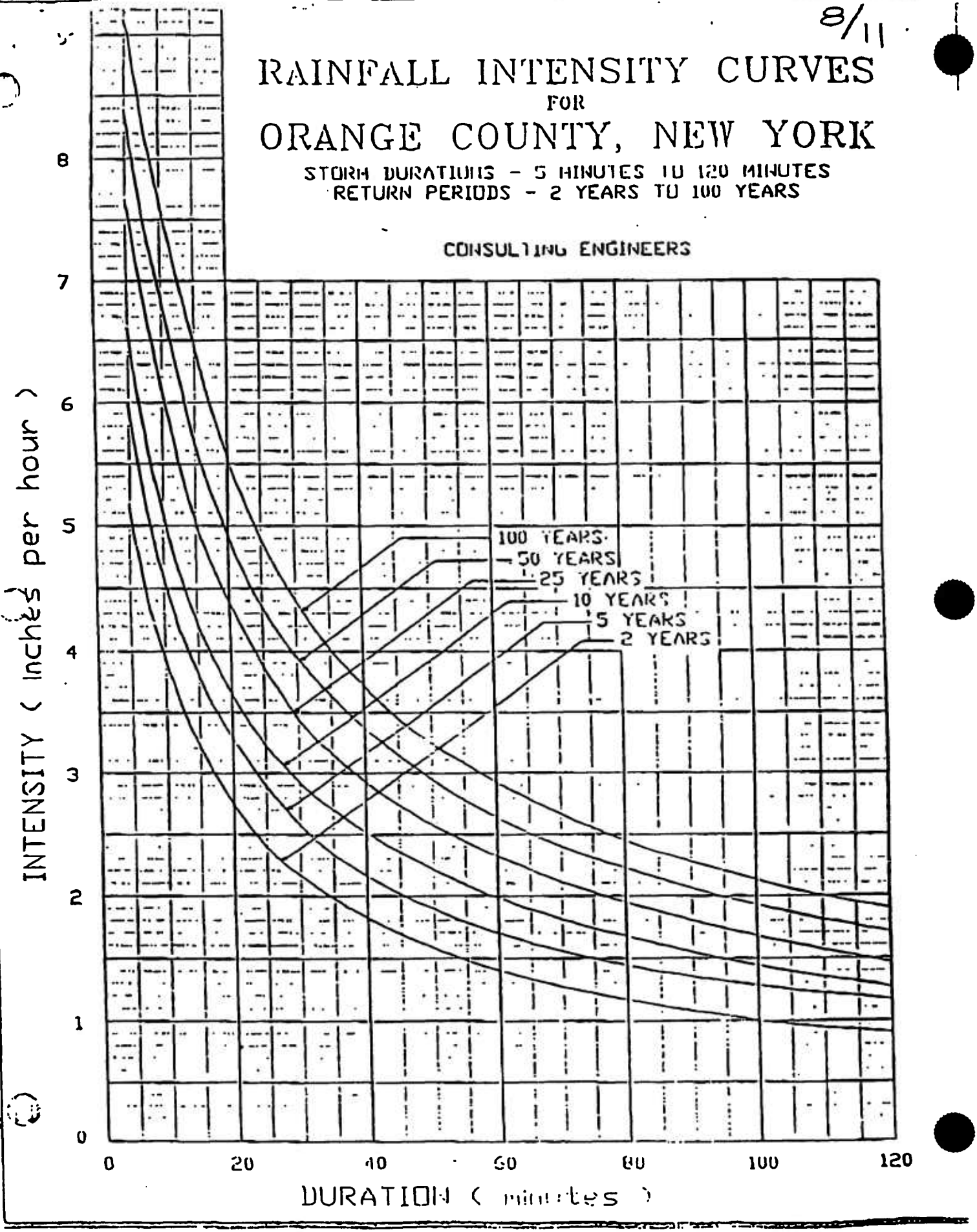


Table B. 24 Hour Rainfall Amounts (inches) for New York State Counties for use with SCS TR-55 (Continued)

County	Design Flood Frequency or Return Period (Years)						
	1	2	5	10	25	50	100
Kings	2.7	3.5	4.5	5.0	6.0	7.0	7.5
Lewis	2.3	2.5	3.1	3.6	4.2	4.5	4.8
Livingston	2.2	2.5	3.2	3.7	4.2	4.7	4.9
Madison	2.3	2.6	3.3	3.8	4.6	4.9	5.1
Monroe	2.2	2.5	3.1	3.6	4.1	4.6	4.8
Montgomery	2.4	2.7	3.4	3.9	4.7	5.0	5.6
Nassau	2.7	3.5	4.5	5.0	6.0	7.0	7.5
New York	2.7	3.5	4.5	5.0	6.0	6.5	7.5
Niagara	2.1	2.5	3.0	3.5	4.0	4.5	4.7
Oneida	2.3	2.5	3.2	3.8	4.5	4.8	5.0
Onondaga	2.2	2.6	3.2	3.8	4.5	4.8	5.0
Ontario	2.2	2.5	3.2	3.7	4.3	4.7	4.9
Orange	2.9	3.5	4.5	5.5	6.5	7.0	7.5
Orleans	2.1	2.5	3.0	3.5	4.0	4.5	4.8
Oswego	2.2	2.5	3.1	3.6	4.3	4.6	4.8
Otsego	2.4	2.8	3.4	4.0	4.8	5.0	5.6
Putnam	2.7	3.5	4.5	5.0	6.0	7.0	7.5
Queens	2.7	3.5	4.5	5.0	6.0	7.0	7.5
Rensselaer	2.4	2.7	3.5	4.3	4.9	5.5	5.9
Richmond	2.7	3.5	4.5	5.0	6.0	7.0	7.5
Rockland	2.7	3.5	4.5	5.0	6.0	7.0	7.5
Saratoga	2.3	2.6	3.4	3.9	4.7	5.0	5.5
Schenectady	2.4	2.8	3.5	4.0	4.8	5.2	5.7

Table 3-1. Runoff coefficients for Rational formula.[14]

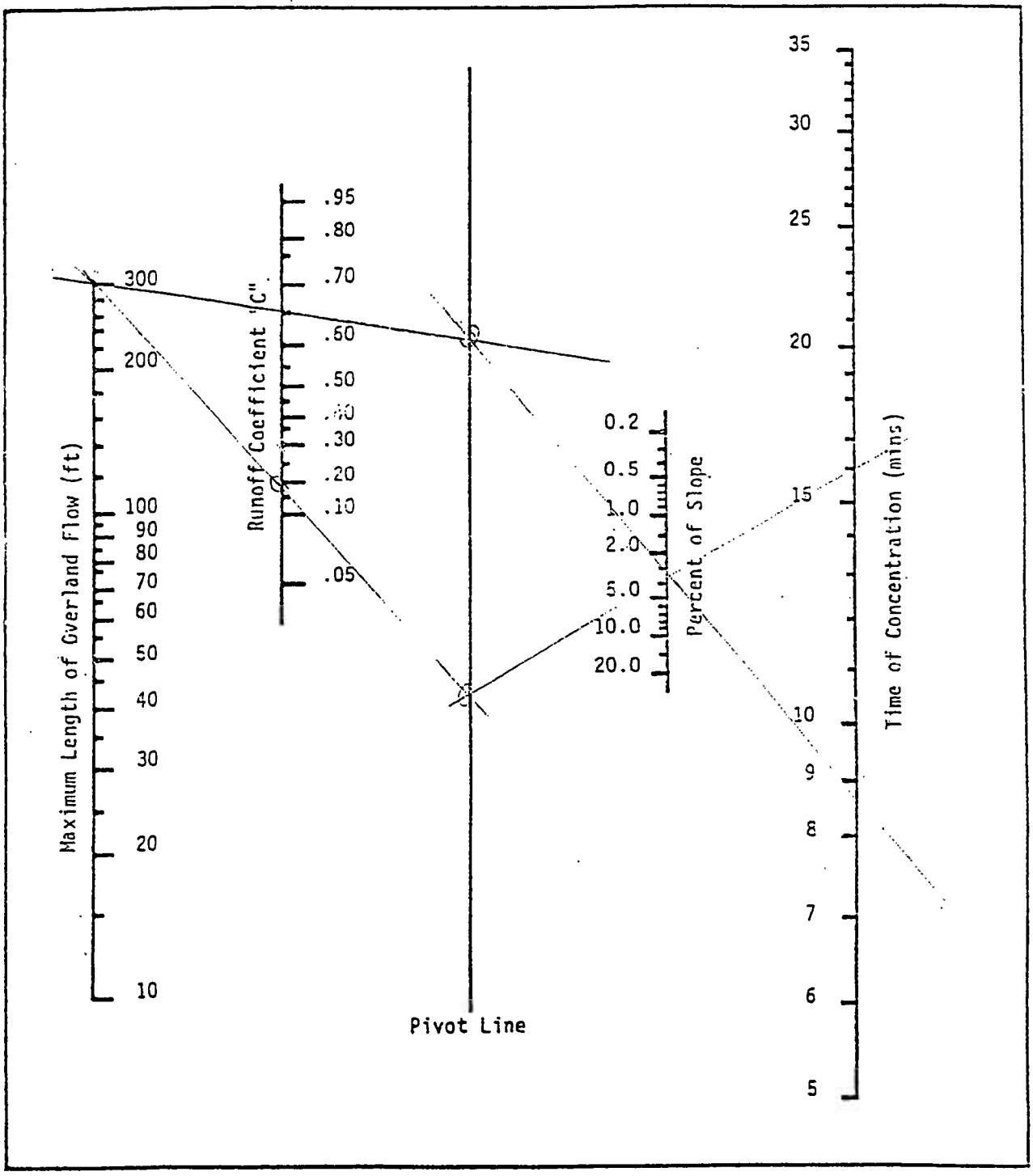
Type of Drainage Area	Runoff Coefficient, C*	
Business:		
Downtown areas	0.70 - 0.95	
Neighborhood areas	0.50 - 0.70	
Residential:		
Single-family areas	0.30 - 0.50	
Multi-units, detached	0.40 - 0.60	
Multi-units, attached	0.60 - 0.75	
Suburban	0.25 - 0.40	
Apartment dwelling areas	0.50 - 0.70	
Industrial:		
Light areas	0.50 - 0.80	} Gravel ≈ 0.60
Heavy areas	0.60 - 0.90	
Parks, cemeteries	0.10 - 0.25	
Playgrounds	0.20 - 0.40	
Railroad yard areas	0.20 - 0.40	
Unimproved areas	0.10 - 0.30	
Lawns:		
Sandy soil, flat, 2%	0.05 - 0.10	} Grass Areas ≈ 0.35
Sandy soil, average, 2 - 7%	0.10 - 0.15	
Sandy soil, steep, 7%	0.15 - 0.20	
Heavy soil, flat, 2%	0.13 - 0.17	
Heavy soil, average 2 - 7%	0.18 - 0.22	
Heavy soil, steep, 7%	0.25 - 0.35	
Streets:		
Asphaltic	0.70 - 0.95 ←	Blacktop ≈ 0.90
Concrete	0.80 - 0.95 ←	Concrete ≈ 0.90
Brick	0.70 - 0.85	
Drives and walks	0.75 - 0.85	
Roofs	0.75 - 0.95 ←	Roofs ≈ 0.90

=> * Higher values are usually appropriate for steeply sloped areas and longer return periods because infiltration and other losses have a proportionally smaller effect on runoff in these cases.

USDOT, FHA, FHWA-SA-96-078, HEC-22, "URBAN DRAINAGE DESIGN MANUAL"

TIME OF CONCENTRATION NOMOGRAPH

(for use with the Rational Method)



ATTACHMENT 2

STORM SEWER SYSTEM ANALYSIS

C:/forms/inlets

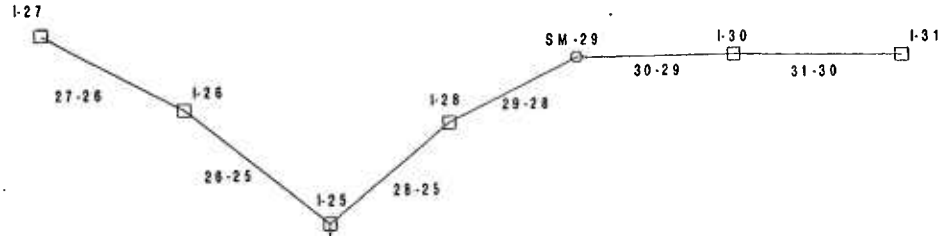
Job Name: Wawayanda
Job Number: 537162/00108

INLET NUMBER	AREA ACRES	"C"	IMP. AREA	STONE AREA	LAWN AREA
1	0.76	0.458553	0.1	0.11	0.55
2	0.44	0.640909	0.06	0.38	
3	0.45	0.64	0.06	0.39	
4	1.29	0.486047	0.13	0.85	
5	0.62	0.653226	0.11	0.51	
6	1.27	0.744094	0.61	0.66	
7					
8	0.62	0.614516	0.03	0.59	
9	0.59	0.615254	0.03	0.56	
10	0.07	0.642857	0.01	0.06	
11	0.31	0.774194	0.18	0.13	
12	0.35	0.754286	0.18	0.17	
13	0.44	0.688636	0.13	0.31	
14	0.41	0.768293	0.23	0.18	
15	0.49	0.697959	0.16	0.33	
16	0.12	0.8	0.08	0.04	
17	0.15	0.84	0.12	0.03	
18	0.28	0.814286	0.2	0.08	
19	0.3	0.88	0.28	0.02	
20	0.54	0.855556	0.46	0.08	
21	0.38	0.852632	0.32	0.06	
22	0.22	0.804545	0.15	0.07	
23					
24	0.39	0.769231	0.22	0.17	
25	0.25	0.756	0.13	0.12	
26	0.43	0.676744	0.11	0.32	
27	1.51	0.641722	0.21	1.3	

28	0.13	0.669231	0.03	0.1	
29					
30	0.5	0.834	0.39	0.11	
31	0.45	0.826667	0.34	0.11	

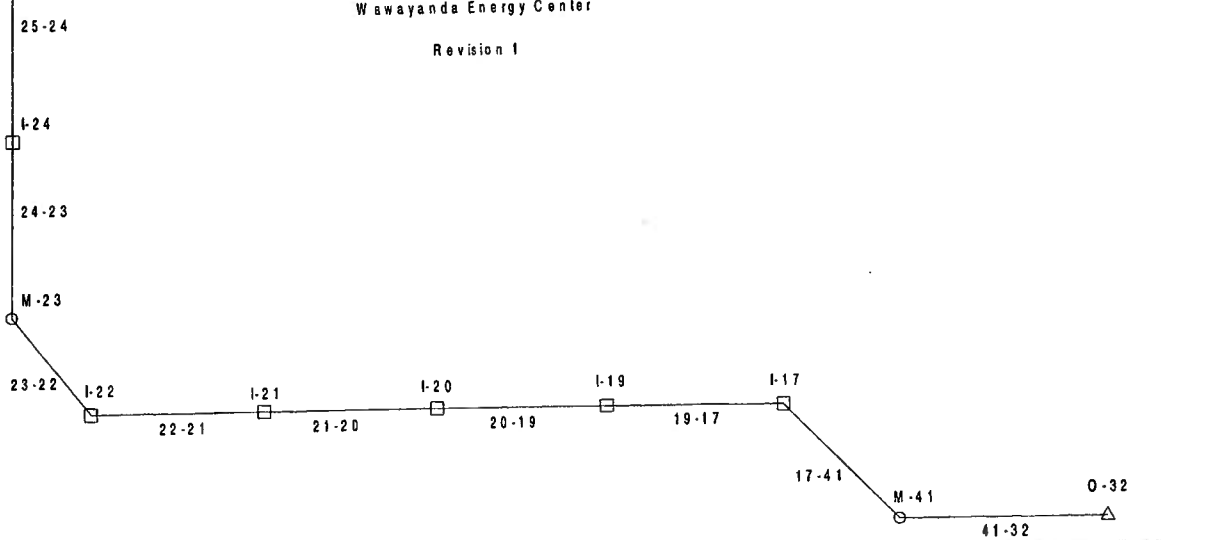
Rev. 1
100-yr

Scenario: Base



Wawayanda Energy Center

Revision 1



Rev. 1

*** Information: Subsurface analysis iterations: 3
*** Information: Convergence was achieved.

*** Information: 27-26 Hydraulic jump formed.
*** Information: 27-26 Critical depth assumed upstream.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
I-17	Generic Inlet	Generic Default 100%	1.16	0.00	100.0	0.00	0.00
I-19	Generic Inlet	Generic Default 100%	2.42	0.00	100.0	0.00	0.00
I-20	Generic Inlet	Generic Default 100%	4.26	0.00	100.0	0.00	0.00
I-21	Generic Inlet	Generic Default 100%	2.96	0.00	100.0	0.00	0.00
I-22	Generic Inlet	Generic Default 100%	1.61	0.00	100.0	0.00	0.00
I-24	Generic Inlet	Generic Default 100%	2.75	0.00	100.0	0.00	0.00
I-25	Generic Inlet	Generic Default 100%	1.74	0.00	100.0	0.00	0.00
I-28	Generic Inlet	Generic Default 100%	0.80	0.00	100.0	0.00	0.00
I-30	Generic Inlet	Generic Default 100%	3.81	0.00	100.0	0.00	0.00
I-31	Generic Inlet	Generic Default 100%	3.43	0.00	100.0	0.00	0.00
I-26	Generic Inlet	Generic Default 100%	2.68	0.00	100.0	0.00	0.00
I-27	Generic Inlet	Generic Default 100%	8.86	0.00	100.0	0.00	0.00

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-32

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
41-32	1	42 inch	Circular	340.00	78.96	8.93	455.50	453.43
17-41	1	42 inch	Circular	100.00	79.18	8.23	456.03	455.50
19-17	1	36 inch	Circular	130.00	31.88	4.51	456.28	456.03
20-19	1	36 inch	Circular	100.00	30.08	4.26	456.46	456.28
21-20	1	30 inch	Circular	120.00	26.50	5.40	456.88	456.46
22-21	1	30 inch	Circular	95.00	24.01	4.89	457.16	456.88
23-22	1	30 inch	Circular	33.00	22.58	4.60	457.25	457.16
24-23	1	30 inch	Circular	145.00	22.95	4.68	457.63	457.25
25-24	1	30 inch	Circular	108.00	20.60	4.20	457.87	457.63
28-25	1	18 inch	Circular	108.00	7.86	4.45	458.47	457.87
26-25	1	24 inch	Circular	70.00	11.43	3.64	458.02	457.87
29-28	1	18 inch	Circular	23.00	7.09	4.01	458.58	458.47
27-26	1	18 inch	Circular	110.00	8.86	5.55	465.15	458.02
30-29	1	18 inch	Circular	55.00	7.14	4.04	458.83	458.58
31-30	1	15 inch	Circular	70.00	3.43	2.79	459.03	458.83

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)

Rev. 1

O-32	78.27	455.50	453.43	453.43
M-41	78.96	460.00	455.50	455.50
I-17	79.18	458.90	456.03	456.03
I-19	31.88	458.90	456.28	456.28
I-20	30.08	459.40	456.46	456.46
I-21	26.50	459.40	456.88	456.88
I-22	24.01	459.00	457.16	457.16
M-23	22.58	459.40	457.25	457.25
I-24	22.95	458.95	457.63	457.63
I-25	20.60	459.20	457.87	457.87
I-28	7.86	459.05	458.47	458.47
I-26	11.43	458.40	458.02	458.02
SM-29	7.09	459.70	458.58	458.58
I-27	8.86	470.70	465.15	465.15
I-30	7.14	459.45	458.83	458.83
I-31	3.43	459.45	459.03	459.03

**** Calculation Completed: 07/17/01 04:21:40 PM

Scenario: Base

Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Area (acres)	Inlet C	Inlet CA (acres)	System Contributing Area (acres)	Local Rational Flow (cfs)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Description
31-30	I-31	I-30	70.00	0.45	0.83	0.37	0.37	3.43	15 inch	4.57	2.79	455.57	455.22	0.005000	
30-29	I-30	SM-29	55.00	0.50	0.83	0.42	0.79	3.81	18 inch	7.49	4.04	455.22	454.94	0.005091	
27-26	I-27	I-26	110.00	1.51	0.64	0.97	0.97	8.86	18 inch	30.48	5.55	464.00	454.74	0.084182	
29-28	SM-29	I-28	23.00				0.79		18 inch	7.59	4.01	454.94	454.82	0.005217	
26-25	I-26	I-25	70.00	0.43	0.68	0.29	1.26	2.68	24 inch	14.05	3.64	454.74	454.51	0.003286	
28-25	I-28	I-25	108.00	0.13	0.67	0.09	0.88	0.80	18 inch	7.43	4.45	454.82	454.28	0.005000	
25-24	I-25	I-24	108.00	0.25	0.76	0.19	2.32	1.74	30 inch	25.65	4.20	454.51	454.15	0.003333	
24-23	I-24	M-23	145.00	0.39	0.77	0.30	2.62	2.75	30 inch	25.30	4.68	454.15	453.68	0.003241	
23-22	M-23	I-22	33.00				2.62		30 inch	25.65	4.60	453.68	453.57	0.003333	
22-21	I-22	I-21	95.00	0.22	0.80	0.18	2.80	1.61	30 inch	25.79	4.89	453.57	453.25	0.003368	
21-20	I-21	I-20	120.00	0.38	0.85	0.32	3.12	2.96	30 inch	25.33	5.40	453.25	452.86	0.003250	
20-19	I-20	I-19	100.00	0.54	0.86	0.46	3.59	4.26	36 inch	41.51	4.26	452.86	452.53	0.003300	
19-17	I-19	I-17	130.00	0.30	0.88	0.26	3.85	2.42	36 inch	41.55	4.51	452.53	452.10	0.003308	
17-41	I-17	M-41	100.00	0.15	0.84	0.13	3.98	1.16	42 inch	62.61	8.23	452.10	451.77	0.003300	
41-32	M-41	O-32	340.00				3.98		42 inch	62.55	8.93	451.77	450.65	0.003294	

Rev. 1

Scenario: Base

Pipe Report

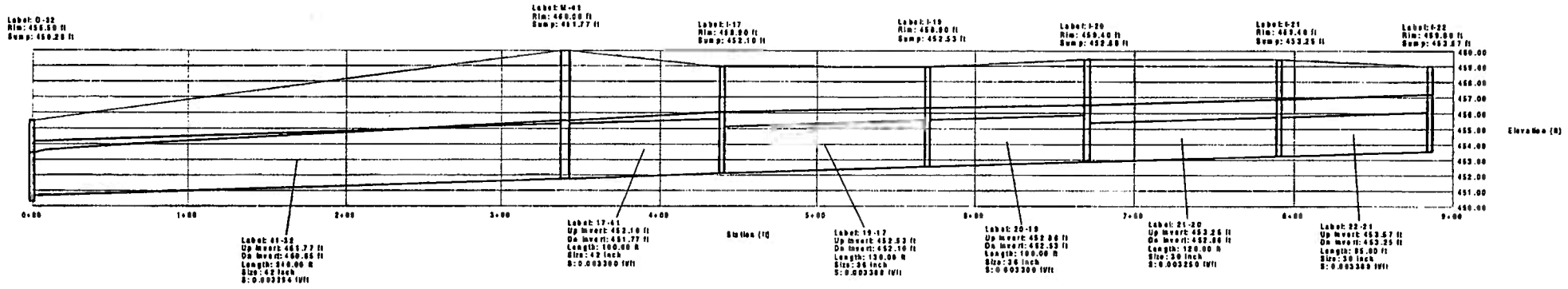
Length (ft)	Constructed Slope (ft/ft)	Section Size	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)
70.00	0.005000	15 inch	455.57	455.22
55.00	0.005091	18 inch	455.22	454.94
110.00	0.084182	18 inch	464.00	454.74
23.00	0.005217	18 inch	454.94	454.82
70.00	0.003286	24 inch	454.74	454.51
108.00	0.005000	18 inch	454.82	454.28
108.00	0.003333	30 inch	454.51	454.15
145.00	0.003241	30 inch	454.15	453.68
33.00	0.003333	30 inch	453.68	453.57
95.00	0.003368	30 inch	453.57	453.25
120.00	0.003250	30 inch	453.25	452.86
100.00	0.003300	36 inch	452.86	452.53
130.00	0.003308	36 inch	452.53	452.10
100.00	0.003300	42 inch	452.10	451.77
340.00	0.003294	42 inch	451.77	450.65

Rev. 1

 Parsons Energy & Chemicals Group Inc. 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

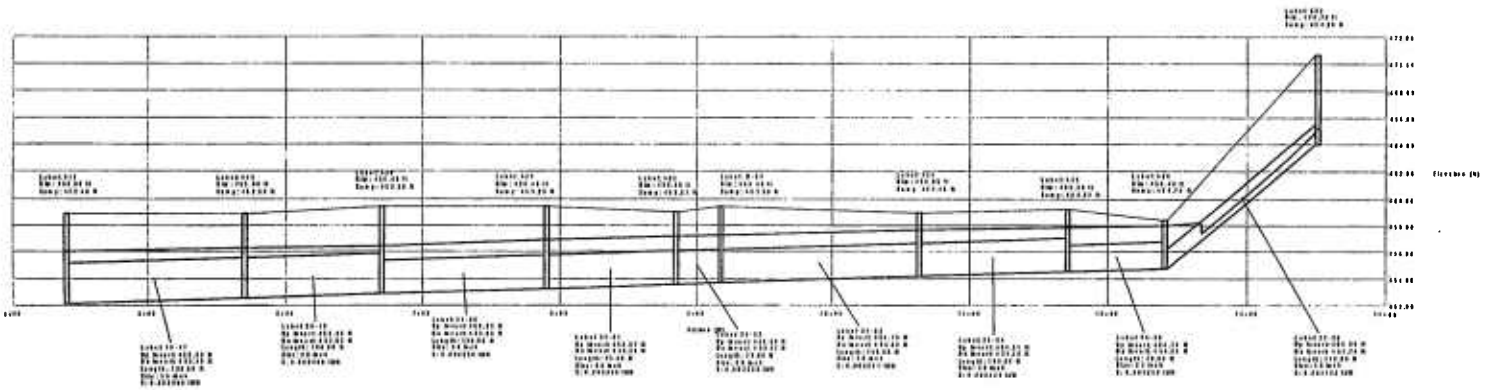
Rev. 1

Profile
Scenario: Base

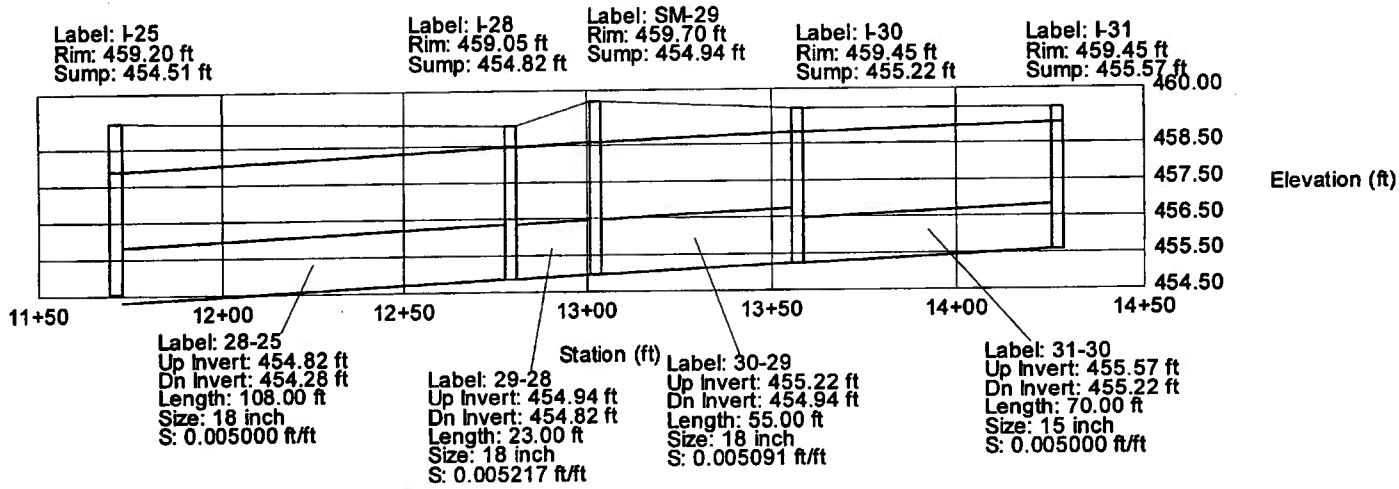


Rev-1

Profile
Scenario: Base



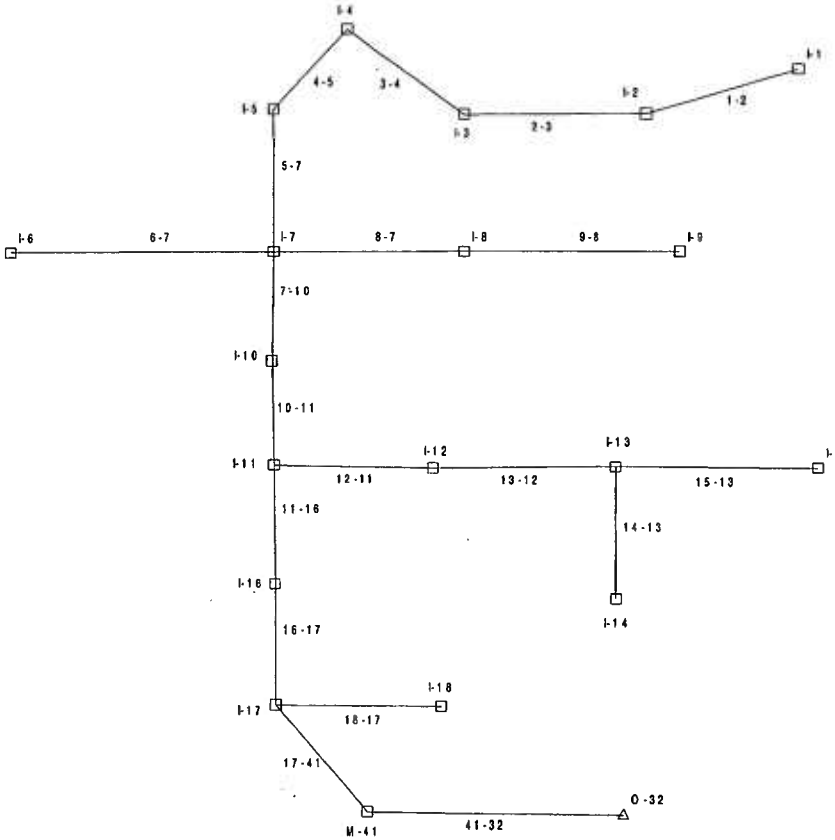
Profile
Scenario: Base



Rev. 1

Rev. 1
100-yr

Scenario: Base



Wawayanda Energy Center

Revision 1

Rev. 1

*** Information: Subsurface analysis iterations: 5
*** Information: Convergence was achieved.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
M-41	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
I-17	Generic Inlet	Generic Default 100%	1.16	0.00	100.0	0.00	0.00
I-16	Generic Inlet	Generic Default 100%	0.88	0.00	100.0	0.00	0.00
I-11	Generic Inlet	Generic Default 100%	2.19	0.00	100.0	0.00	0.00
I-10	Generic Inlet	Generic Default 100%	0.41	0.00	100.0	0.00	0.00
I-12	Generic Inlet	Generic Default 100%	2.41	0.00	100.0	0.00	0.00
I-13	Generic Inlet	Generic Default 100%	2.78	0.00	100.0	0.00	0.00
I-15	Generic Inlet	Generic Default 100%	3.15	0.00	100.0	0.00	0.00
I-14	Generic Inlet	Generic Default 100%	2.90	0.00	100.0	0.00	0.00
I-18	Generic Inlet	Generic Default 100%	2.08	0.00	100.0	0.00	0.00
I-7	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
I-5	Generic Inlet	Generic Default 100%	3.70	0.00	100.0	0.00	0.00
I-4	Generic Inlet	Generic Default 100%	5.80	0.00	100.0	0.00	0.00
I-3	Generic Inlet	Generic Default 100%	2.64	0.00	100.0	0.00	0.00
I-2	Generic Inlet	Generic Default 100%	2.58	0.00	100.0	0.00	0.00
I-1	Generic Inlet	Generic Default 100%	3.21	0.00	100.0	0.00	0.00
I-6	Generic Inlet	Generic Default 100%	8.62	0.00	100.0	0.00	0.00
I-8	Generic Inlet	Generic Default 100%	3.47	0.00	100.0	0.00	0.00
I-9	Generic Inlet	Generic Default 100%	3.36	0.00	100.0	0.00	0.0

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-32

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
41-32	1	42 inch	Circular	390.00	78.95	8.93	455.79	453.43
17-41	1	42 inch	Circular	100.00	79.26	8.24	456.32	455.79
18-17	1	15 inch	Circular	50.00	2.08	1.70	456.36	456.32
16-17	1	36 inch	Circular	66.00	43.48	6.15	456.56	456.32
11-16	1	36 inch	Circular	59.00	42.91	6.07	456.77	456.56
10-11	1	36 inch	Circular	104.00	31.10	4.40	456.96	456.77
12-11	1	24 inch	Circular	40.00	10.65	3.39	456.84	456.77
7-10	1	36 inch	Circular	68.00	30.98	4.38	457.09	456.96
13-12	1	24 inch	Circular	190.00	8.67	2.76	457.08	456.84
6-7	1	24 inch	Circular	75.00	8.62	2.74	457.18	457.09
5-7	1	24 inch	Circular	164.00	16.91	5.38	457.87	457.09
8-7	1	18 inch	Circular	111.00	6.62	3.75	457.46	457.09
14-13	1	15 inch	Circular	80.00	2.90	2.36	457.22	457.08
15-13	1	15 inch	Circular	92.00	3.15	2.56	457.27	457.08
4-5	1	24 inch	Circular	72.00	13.54	4.52	458.02	457.87
9-8	1	15 inch	Circular	165.00	3.36	2.73	457.84	457.46
3-4	1	24 inch	Circular	110.00	8.15	3.53	458.04	458.02

Rev. 1

2-3	1	18 inch	Circular	168.00	5.71	4.38	458.63	458.04
1-2	1	15 inch	Circular	110.00	3.21	3.78	458.98	458.63

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)
O-32	77.84	455.50	453.43	453.43
M-41	78.95	460.00	455.79	455.79
I-17	79.26	458.90	456.32	456.32
I-18	2.08	459.00	456.36	456.36
I-16	43.48	459.60	456.56	456.56
I-11	42.91	459.45	456.77	456.77
I-10	31.10	459.80	456.96	456.96
I-12	10.65	459.00	456.84	456.84
I-7	30.98	461.00	457.09	457.09
I-13	8.67	458.70	457.08	457.08
I-6	8.62	458.20	457.18	457.18
I-5	16.91	470.00	457.87	457.87
I-8	6.62	463.70	457.46	457.46
I-14	2.90	458.80	457.22	457.22
I-15	3.15	458.30	457.27	457.27
I-4	13.54	463.00	458.02	458.02
I-9	3.36	463.70	457.84	457.84
I-3	8.15	463.80	458.04	458.04
I-2	5.71	463.80	458.63	458.63
I-1	3.21	462.75	458.98	458.98

**** Calculation Completed: 07/17/01 03:44:23 PM

Scenario: Base

Combined Pipe/Node Report

Upstream Node	Downstream Node	Length (ft)	Area (acres)	Inlet C	Inlet CA (acres)	System Contributing Area (acres)	Local Rational Flow (cfs)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Description
I-1	I-2	110.00	0.76	0.46	0.35	0.35	3.21	15 inch	4.95	3.78	458.25	457.70	0.005000	
I-2	I-3	168.00	0.44	0.64	0.28	0.63	2.58	18 inch	8.05	4.38	457.70	456.86	0.005000	
I-3	I-4	110.00	0.45	0.64	0.29	0.92	2.64	24 inch	17.33	3.53	456.86	456.31	0.005000	
I-9	I-8	165.00	0.59	0.62	0.37	0.37	3.36	15 inch	4.96	2.73	455.57	454.74	0.005030	
I-4	I-5	72.00	1.29	0.49	0.63	1.55	5.80	24 inch	26.78	4.52	456.31	455.45	0.011944	
I-15	I-13	92.00	0.49	0.70	0.34	0.34	3.15	15 inch	4.00	2.56	453.57	453.27	0.003261	
I-14	I-13	80.00	0.41	0.77	0.32	0.32	2.90	15 inch	3.99	2.36	453.54	453.28	0.003250	
I-8	I-7	111.00	0.62	0.61	0.38	0.74	3.47	18 inch	13.92	3.75	454.74	453.08	0.014955	
I-5	I-7	164.00	0.62	0.65	0.40	1.95	3.70	24 inch	29.46	5.38	455.45	453.08	0.014451	
I-6	I-7	75.00	1.27	0.74	0.94	0.94	8.62	24 inch	14.15	2.74	453.33	453.08	0.003333	
I-13	I-12	190.00	0.44	0.69	0.30	0.96	2.78	24 inch	14.11	2.76	453.28	452.65	0.003316	
I-7	I-10	68.00	0.00	0.00	0.00	3.64	0.00	36 inch	41.10	4.38	453.08	452.86	0.003235	
I-12	I-11	40.00	0.35	0.75	0.26	1.22	2.41	24 inch	14.50	3.39	452.65	452.51	0.003500	
I-10	I-11	104.00	0.07	0.64	0.04	3.68	0.41	36 inch	41.92	4.40	452.86	452.51	0.003365	
I-11	I-16	59.00	0.31	0.77	0.24	5.15	2.19	36 inch	41.00	6.07	452.51	452.32	0.003220	
I-16	I-17	66.00	0.12	0.80	0.10	5.24	0.88	36 inch	41.72	6.15	452.32	452.10	0.003333	
I-18	I-17	50.00	0.28	0.81	0.23	0.23	2.08	15 inch	4.08	1.70	452.27	452.10	0.003400	
I-17	M-41	100.00	0.15	0.84	0.13	5.60	1.16	42 inch	62.61	8.24	452.10	451.77	0.003300	
M-41	O-32	390.00	0.00	0.00	0.00	5.60	0.00	42 inch	58.41	8.93	451.77	450.65	0.002872	

Rev. 1

Rev. 1

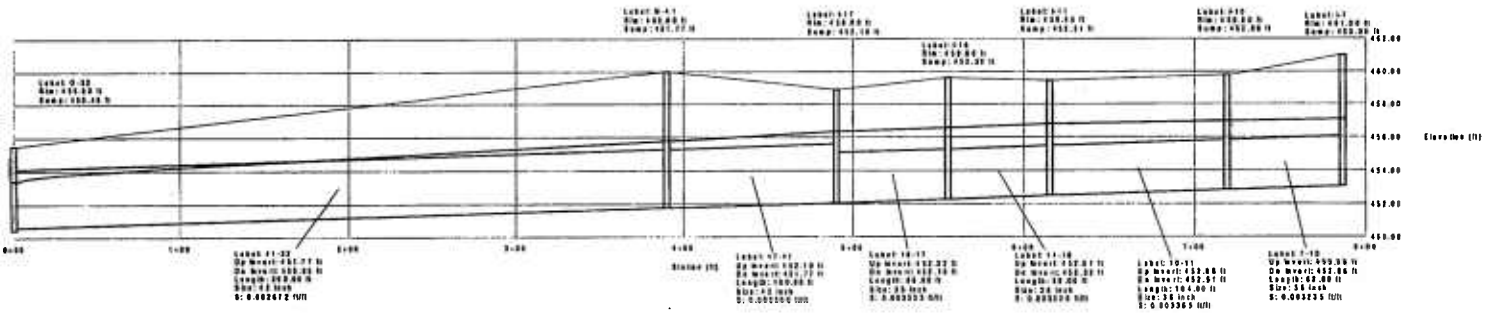
Scenario: Base

Pipe Report

Length (ft)	Constructed Slope (ft/ft)	Section Size	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)
110.00	0.005000	15 inch	458.25	457.70
168.00	0.005000	18 inch	457.70	456.86
110.00	0.005000	24 inch	456.86	456.31
165.00	0.005030	15 inch	455.57	454.74
72.00	0.011944	24 inch	456.31	455.45
92.00	0.003261	15 inch	453.57	453.27
80.00	0.003250	15 inch	453.54	453.28
111.00	0.014955	18 inch	454.74	453.08
164.00	0.014451	24 inch	455.45	453.08
75.00	0.003333	24 inch	453.33	453.08
190.00	0.003316	24 inch	453.28	452.65
68.00	0.003235	36 inch	453.08	452.86
40.00	0.003500	24 inch	452.65	452.51
104.00	0.003365	36 inch	452.86	452.51
59.00	0.003220	36 inch	452.51	452.32
66.00	0.003333	36 inch	452.32	452.10
50.00	0.003400	15 inch	452.27	452.10
100.00	0.003300	42 inch	452.10	451.77
390.00	0.002872	42 inch	451.77	450.65

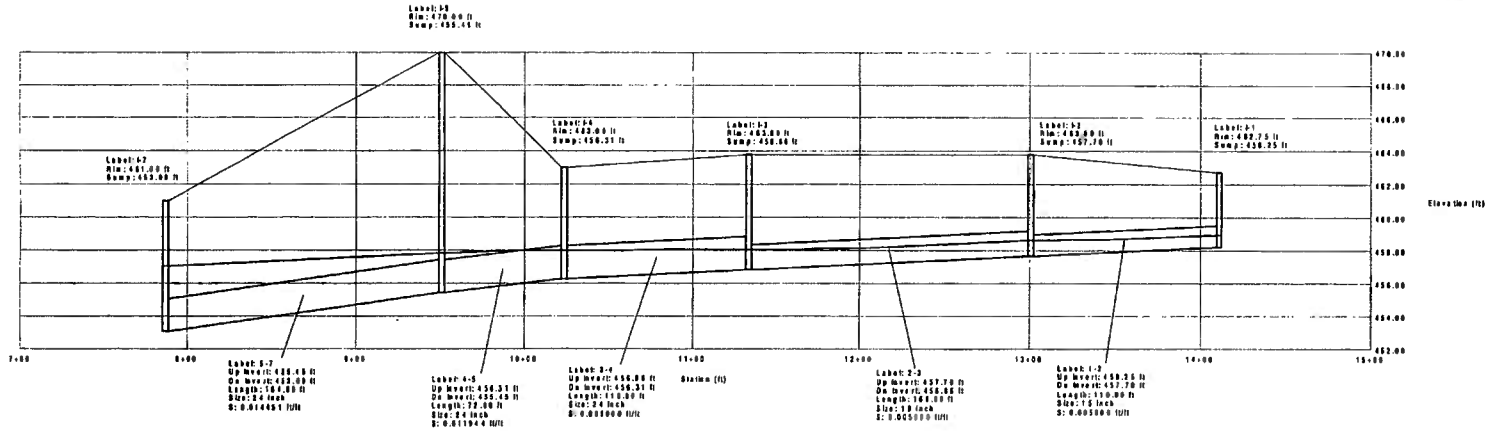
Rev-1

Profile
Scenario: Base



Rev. 1

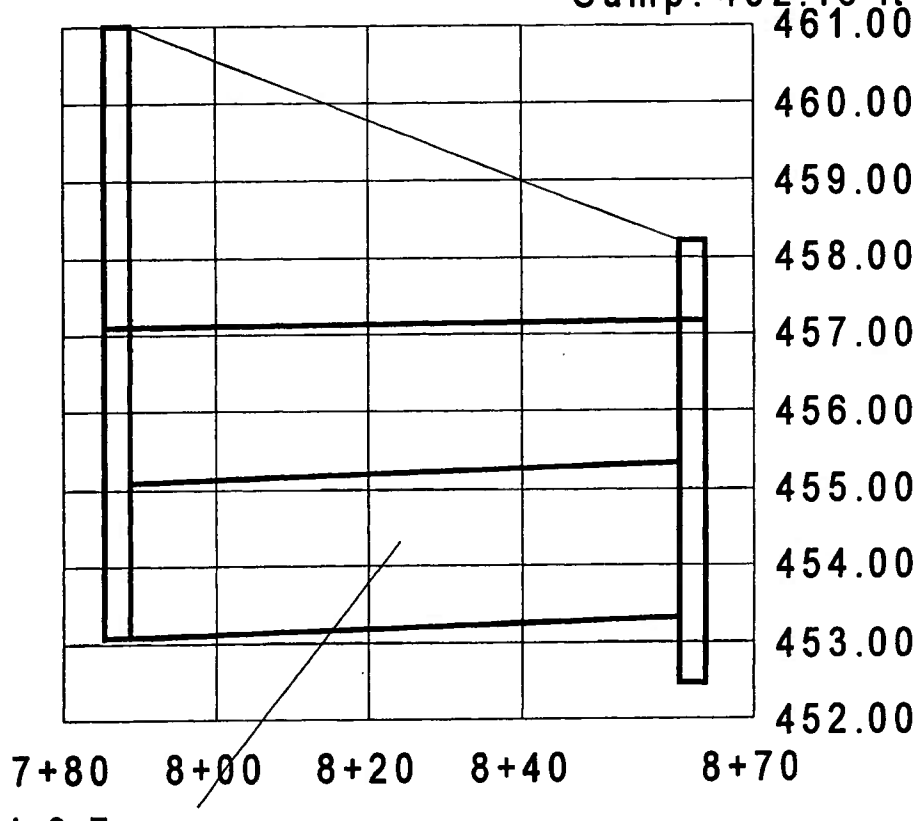
Profile
Scenario: Base



Profile
Scenario: Base

Label: I-7
Rim: 461.00 ft
Sump: 453.08 ft

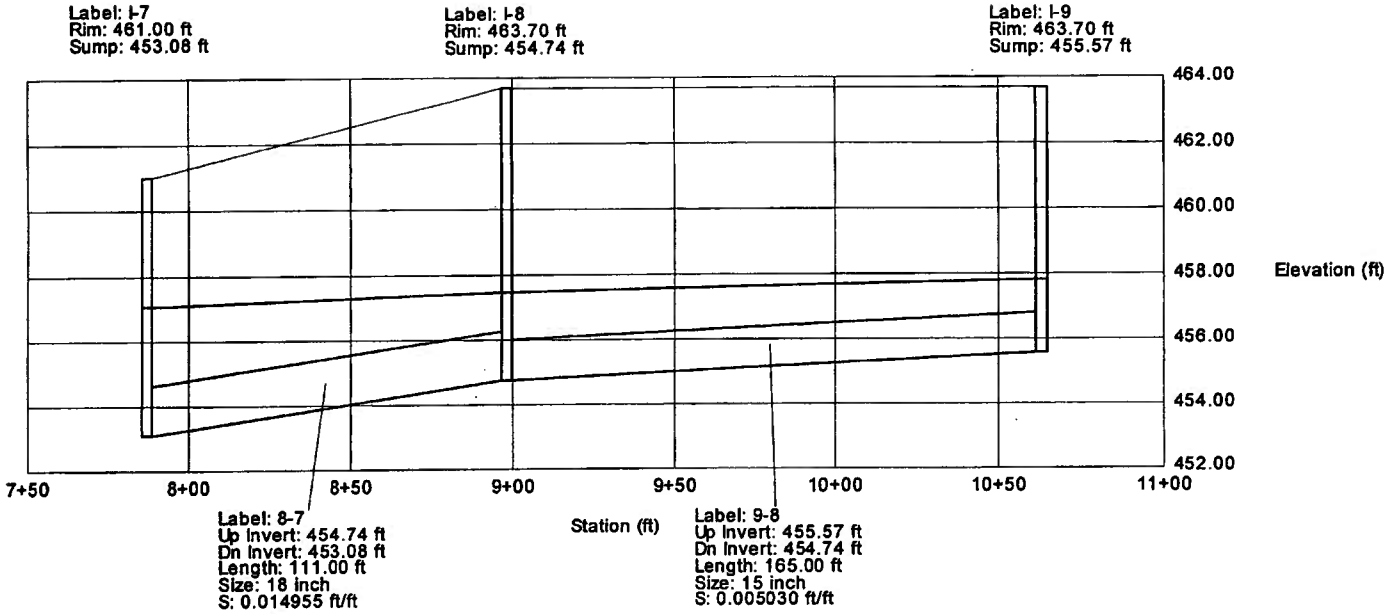
Label: I-6
Rim: 458.20 ft
Sump: 452.48 ft



Label: 6-7
Up Invert: 453.33 ft
Dn Invert: 453.08 ft
Length: 75.00 ft
Size: 24 inch

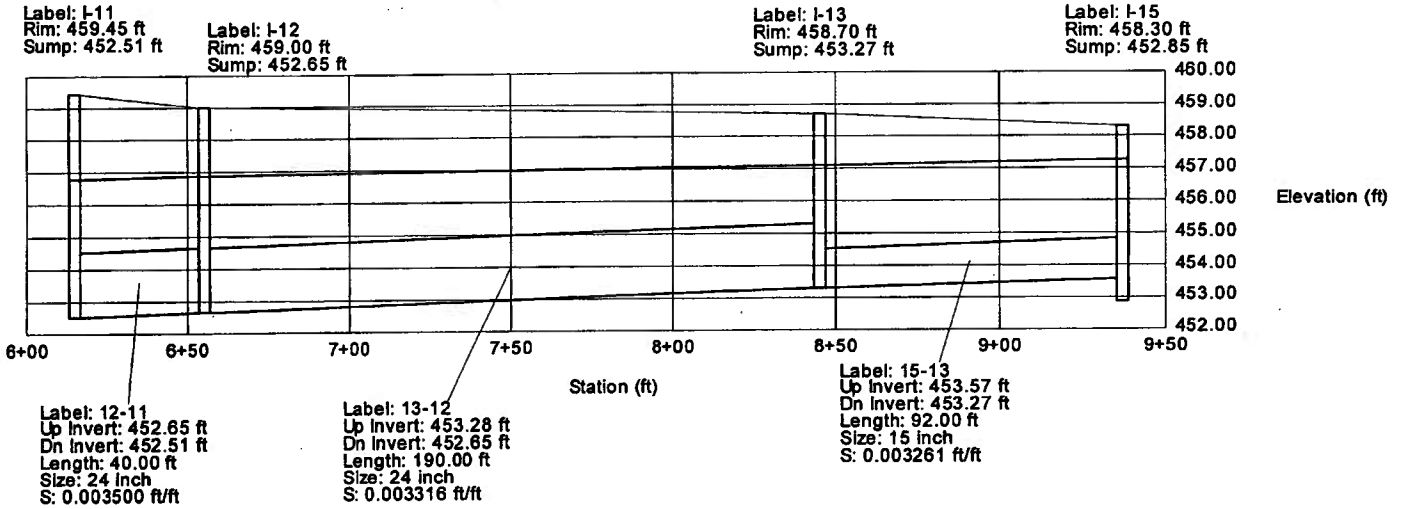
Rev. 1

Profile
Scenario: Base



Rev. 1

Profile
Scenario: Base

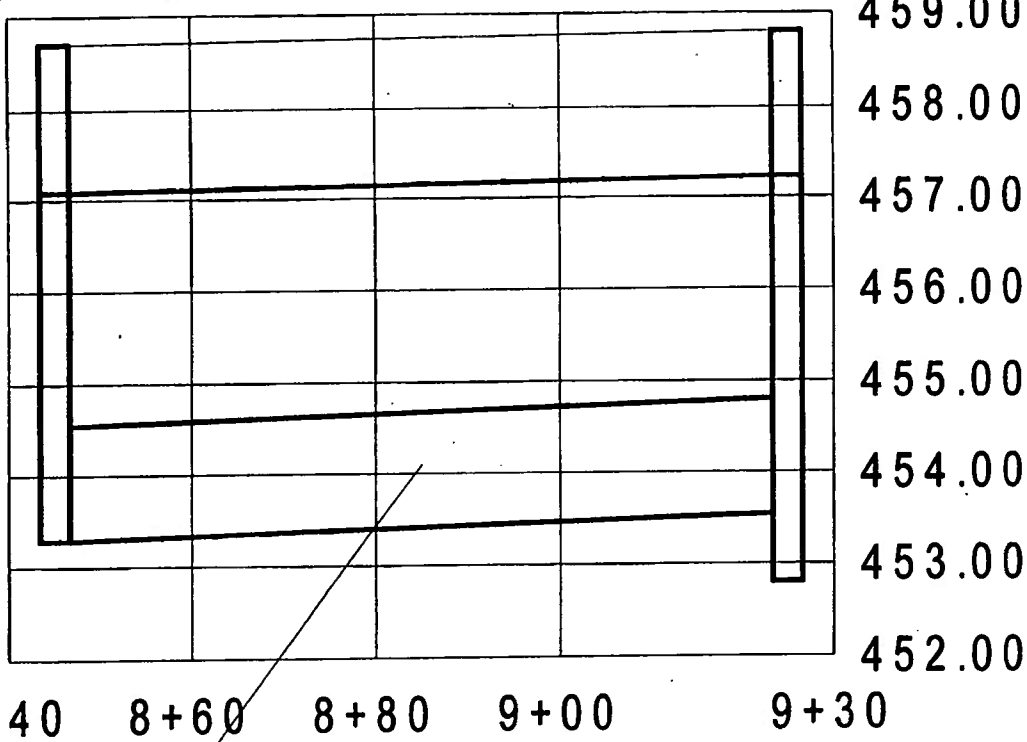


Rev. 1

Profile
Scenario: Base

Label: I-13
Rim: 458.70 ft
Sump: 453.27 ft

Label: I-14
Rim: 458.80 ft
Sump: 452.79 ft



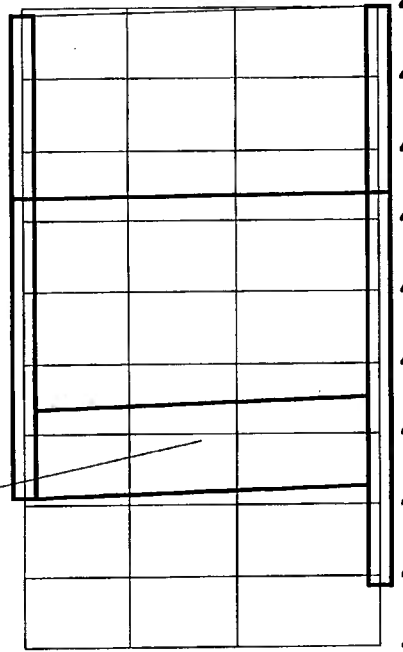
Label: 14-13
Up Invert: 453.54 ft
Dn Invert: 453.28 ft
Length: 80.00 ft
Size: 15 inch

Rev. 1

Profile
Scenario: Base

Label: I-17
Rim: 458.90 ft
Sump: 452.10 ft

Label: I-18
Rim: 459.00 ft
Sump: 450.86 ft



Elevation (ft)

Label: 18-17
Up Invert: 452.27 ft
Dn Invert: 452.10 ft
Length: 50.00 ft
Size: 15 inch
S: 0.003400 ft/ft

Station (ft)

BASIN DISCHARGE PIPE

Rev. 1

*** Information: Subsurface analysis iterations: 1
*** Information: Convergence was achieved.

*** Warning: 33-34 Fails minimum cover constraint.
*** Warning: 33-34 Fails minimum slope constraint.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
I-33	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-34

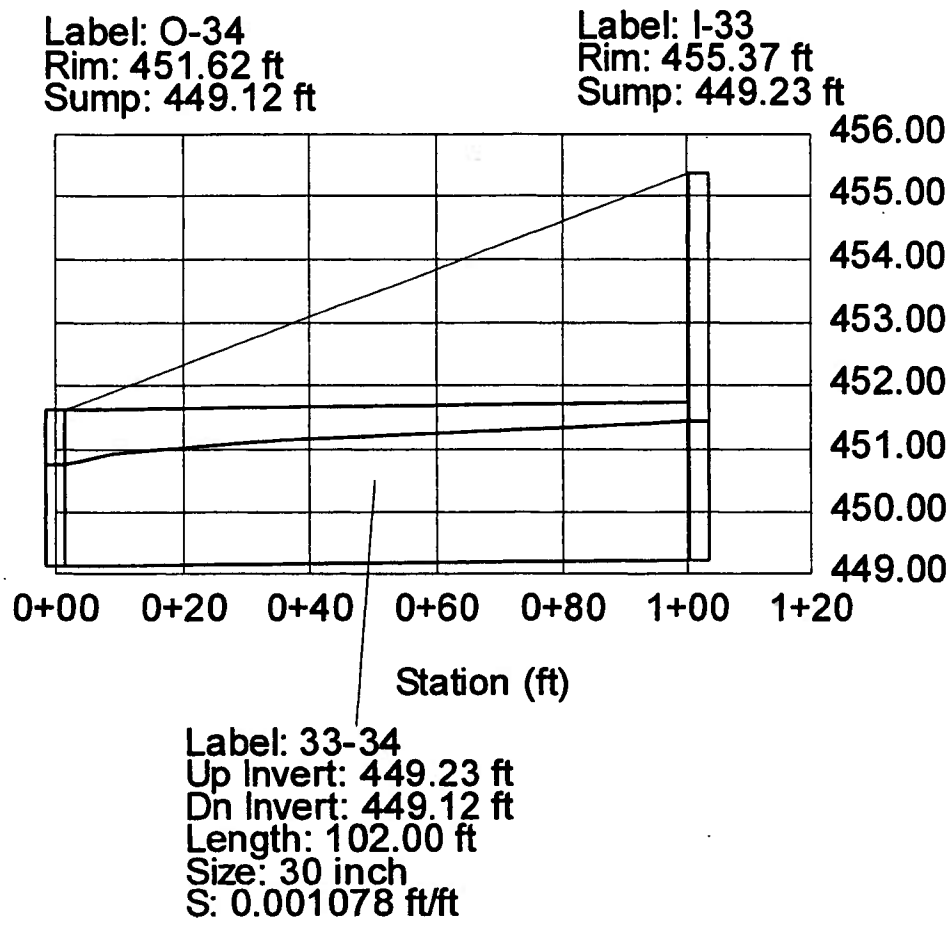
Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
33-34	1	30 inch	Circular	102.00	23.31	5.95	451.43	450.76

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)
O-34	23.31	451.62	450.76	450.76
I-33	23.31	455.37	451.43	451.43

**** Calculation Completed: 07/18/01 09:33:14 AM

Rev. 1

Profile
Scenario: Base



DRIVEWAY CULVERT

CULVERT NUMBER	AREA ACRES	"C"	IMP. AREA	STONE AREA	LAWN AREA
35	2.28	0.417544	0.28		2

*** Information: Subsurface analysis iterations: 2
*** Information: Convergence was achieved.

*** Warning: 35-36 Fails minimum cover constraint.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Top Width (ft)	Ditch Depth (ft)
I-35	Ditch Inlet	Ditch Default	5.02	0.00	100.0	4.82	0.30

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-36

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
35-36	1	24 inch	Circular	58.00	5.02	4.07	454.38	454.11

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)
O-36	4.97	455.32	454.11	454.11
I-35	5.02	455.50	454.38	454.38

**** Calculation Completed: 03/07/01 03:22:11 PM

Parsons Energy & Chemicals Group Inc.
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Rev. 2

*** Information: Subsurface analysis iterations: 2
*** Information: Convergence was achieved.

*** Warning: 35-36 Fails minimum cover constraint.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Top Width (ft)	Ditch Depth (ft)
I-35	Ditch Inlet	Ditch Default	8.78	0.00	100.0	5.65	0.44

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-36

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
35-36	1	24 inch	Circular	154.00	8.78	5.21	454.56	453.79

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)
O-36	8.66	455.32	453.79	453.79
I-35	8.78	455.50	454.56	454.56

**** Calculation Completed: 08/20/01 02:35:50 PM

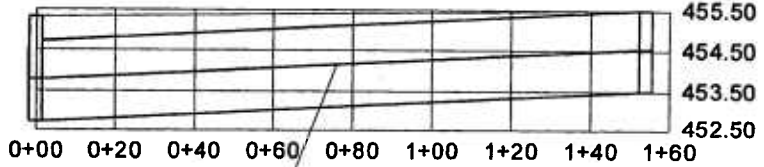
Scenario: Base

Combined Pipe/Node Report

Upstream Node	Downstream Node	Length (ft)	Area (acres)	Inlet C	Inlet CA (acres)	System Contributing Area (acres)	Local Rational Flow (cfs)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Description
I-35	O-36	154.00	2.28	0.42	0.96	0.96	8.78	24 inch	16.00	5.21	453.50	452.73	0.005000	

abel: O-36
im: 455.32 ft
ump: 452.73 ft

Label: I-35
Rim: 455.50 ft
Sump: 453.50 ft



Elevation (ft)

Label: 35-36
Up Invert: 453.50 ft
Dn Invert: 452.73 ft
Length: 154.00 ft
Size: 24 inch
S: 0.005000 ft/ft

Rev. 2

PARSONS	CLIENT NAME:				JOB NO.:
	PROJECT NAME:				
STANDARD CALCULATION SHEET	SUBJECT:				CALC NO.: WAWA-1-DC-SDS-CE-001
	REVISION	0	1	2	3
	ORIGINATOR:	NLG			
	REVIEWER:	JAW			
	DATE:	4-18-01			

Page 1 of

Culvert Calculations

P 37-38 30 inch RCP

Top of Road Elevation 459.04
INV of pipe 452.00
HW = 7.04
HW/D = 2.81

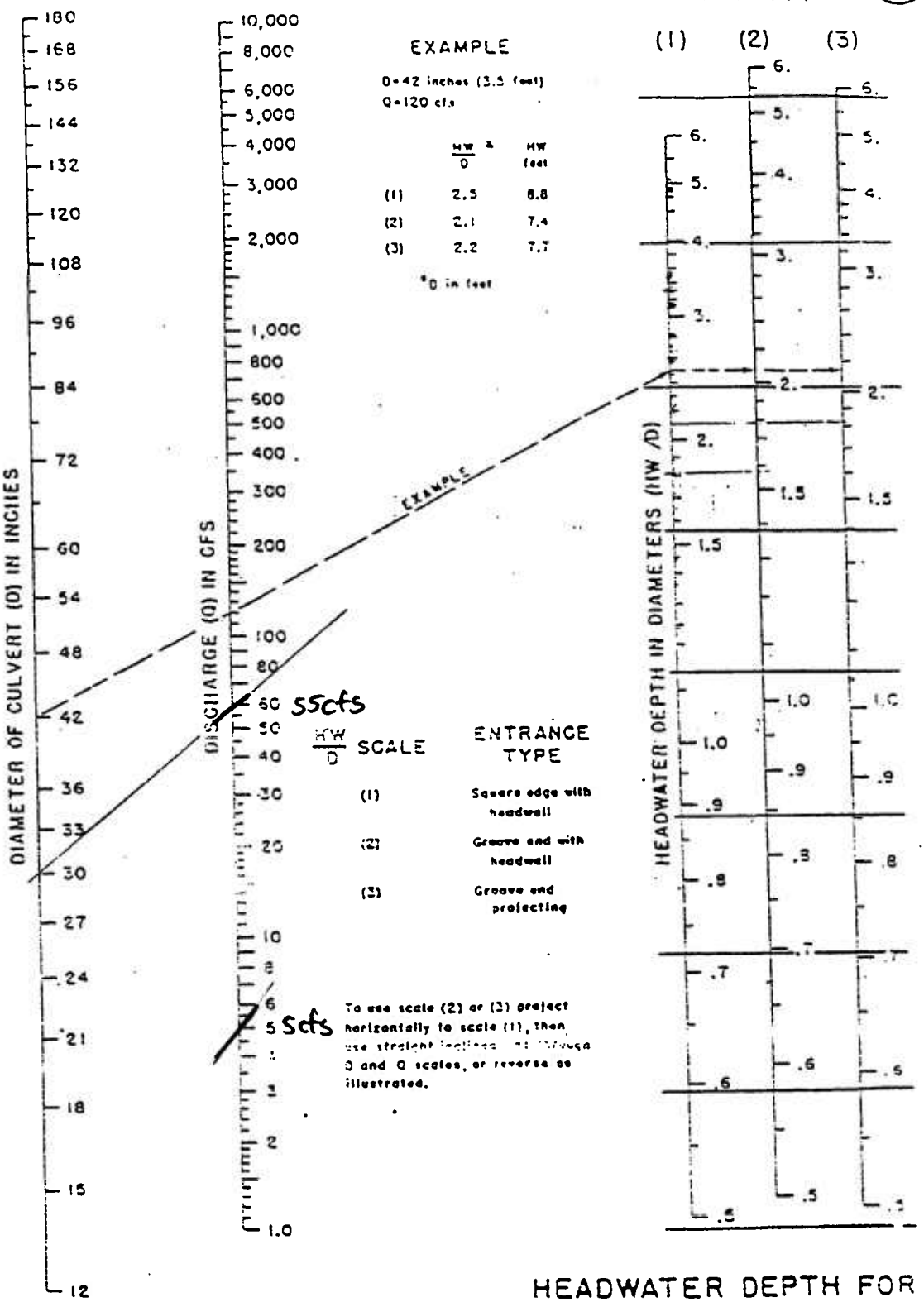
Capacity (from attached chart) 55 cfs

P 39-40 - 12 inch RCP

Top of Road Elevation = 459.47
INV of Pipe = 457.28
HW = 2.19
HW/D = 2.19

Capacity (see chart) = 5.00 cfs

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

ATTACHMENT 3

PREDEVELOPMENT

File.... C:\PROJECTS\CALPINE\WAWA-PRE.PPW
Title... predeveloped

RUNOFF CURVE NUMBER DATA

predeveloped

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
grass/meadow type c/d soil	72	35.970			72.00
COMPOSITE AREA & WEIGHTED CN --->		35.970			72.00 (72)

File.... C:\PROJECTS\CALPINE\WAWA-PRE.PPW
Title... predeveloped

TIME OF CONCENTRATION CALCULATOR

predeveloped

Segment #1: Tc: TR-55 Channel

Flow Area	20.0000 sq.ft
Wetted Perimeter	62.83 ft
Hydraulic Radius	.32 ft
Slope	.020000 ft/ft
Mannings n	.0350
Hydraulic Length	870.00 ft
Avg.Velocity	2.81 ft/sec

Segment #1 Time: .0861 hrs

Segment #2: Tc: TR-55 Shallow
Description: pre

Hydraulic Length	914.00 ft
Slope	.080000 ft/ft
Unpaved	
Avg.Velocity	4.56 ft/sec

Segment #2 Time: .0556 hrs

Segment #3: Tc: TR-55 Sheet
Description: predeveloped

Mannings n	.2400
Hydraulic Length	100.00 ft
2yr, 24hr P	3.5000 in
Slope	.050000 ft/ft
Avg.Velocity	.18 ft/sec

Segment #3 Time: .1576 hrs

Total Tc: .2994 hrs

File.... C:\PROJECTS\CALPINE\WAWA-PRE.PPW
Title... predeveloped

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, ft/ft

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

File.... C:\PROJECTS\CALPINE\WAWA-PRE.PPW
Title... predeveloped

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Pre..2

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall	OUTFALL	JCT	3.360		12.2500	30.47	
	WAWA	AREA	3.360		12.2500	30.47	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Pre.10

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall	OUTFALL	JCT	7.762		12.2000	73.56	
	WAWA	AREA	7.762		12.2000	73.56	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

Rev.2

DEFAULT Design Storm File,ID = WAWANY.RNQ

Storm Tag Name = Pre.25
Description: 25-year return

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall OUTFALL	JCT	10.212		12.2000	97.53	
WAWA	AREA	10.212		12.2000	97.53	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ

Rev. 2

Storm Tag Name = Pre.50
Description: 50-year return

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall	OUTFALL	JCT	11.477		12.2000	109.80	
	WAWA	AREA	11.477		12.2000	109.80	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

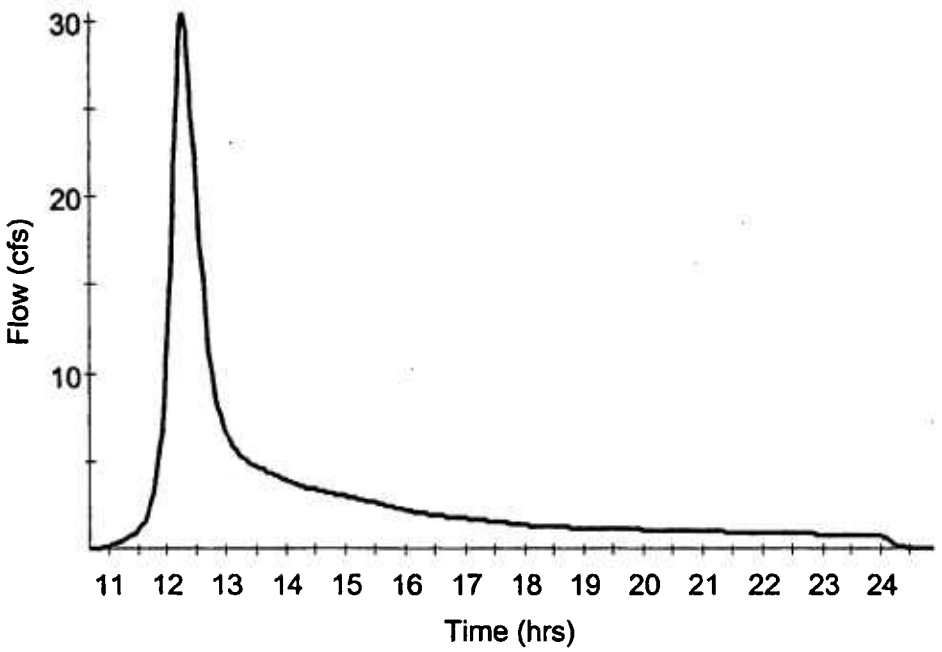
DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Pre100

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

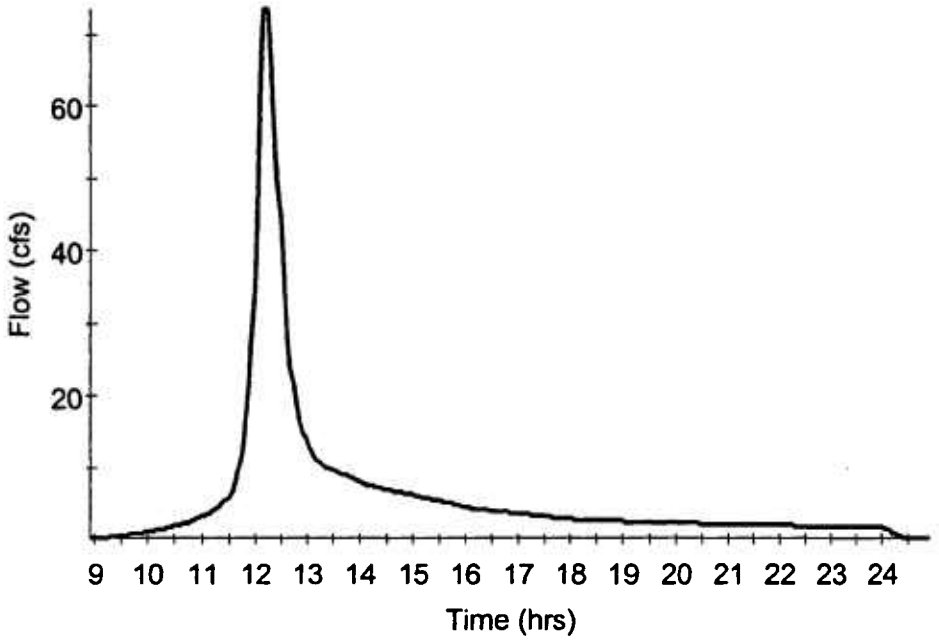
Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall OUTFALL	JCT	12.765		12.2000	122.22	
WAWA	AREA	12.765		12.2000	122.22	

Hydrograph
WAWA Pre..2



Currently Plotted Curves
——— WAWA Pre..2

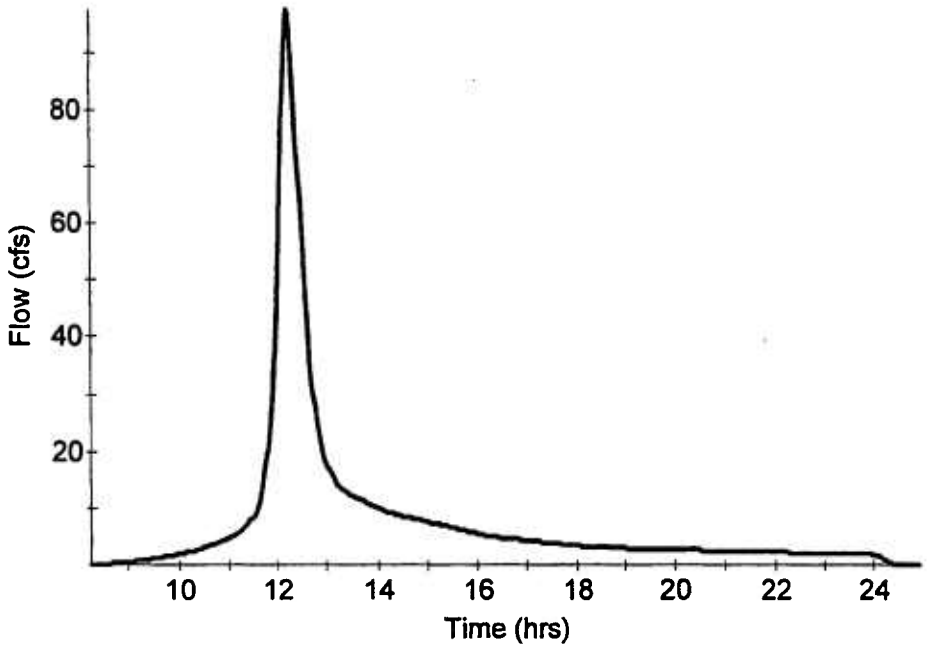
Hydrograph
WAWA Pre.10



Currently Plotted Curves
——— WAWA Pre.10

Hydrograph
WAWA Pre.25

Rev. 2

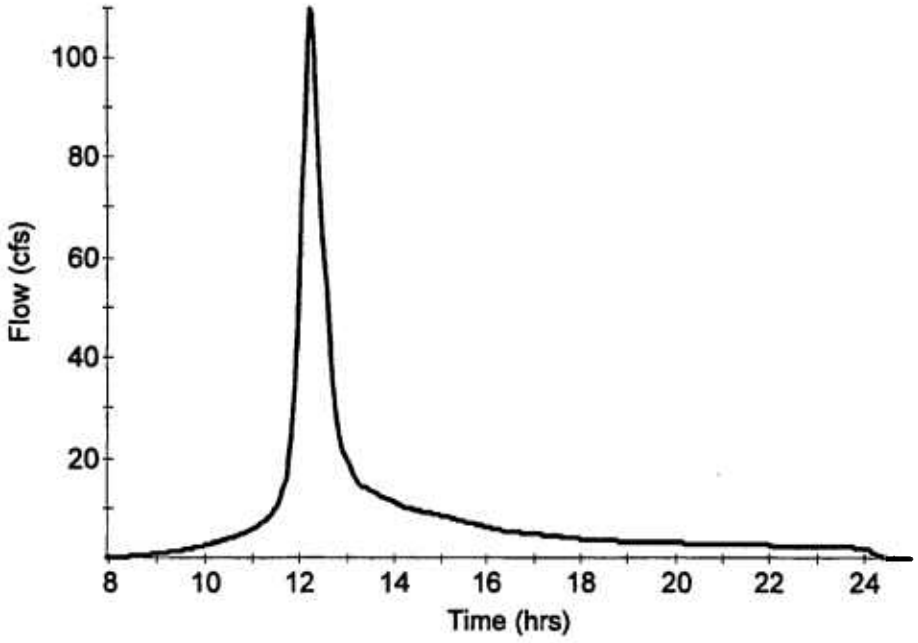


Currently Plotted Curves

——— WAWA Pre.25

Hydrograph
WAWA Pre.50

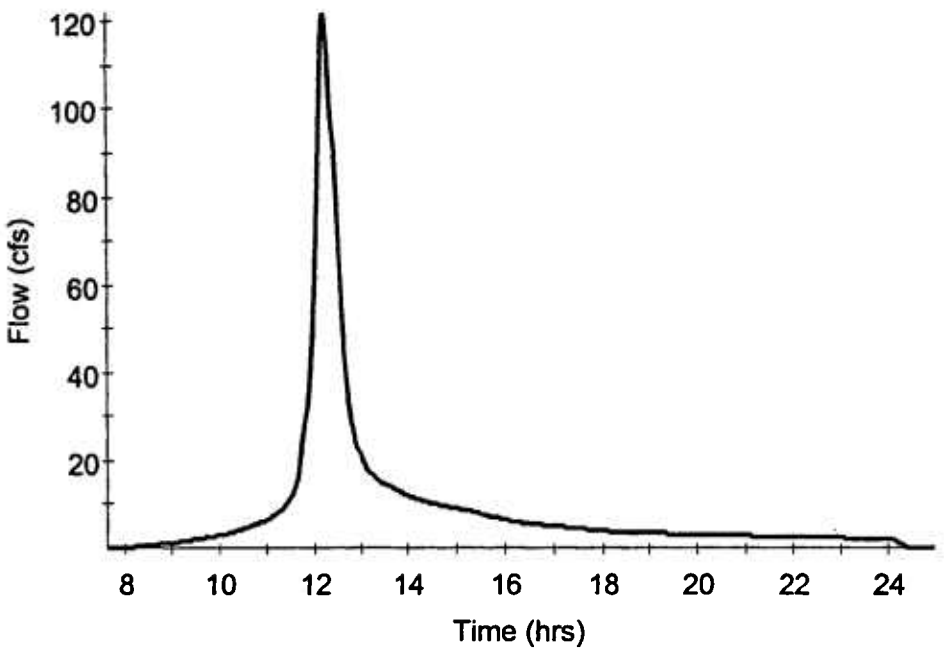
Rev. 2



Currently Plotted Curves

WAWA Pre.50

Hydrograph
WAWA Pre100



Currently Plotted Curves
WAWA Pre100

ATTACHMENT 4

POST-DEVELOPMENT

ATTACHMENT 4a

POST-DEVELOPMENT TO BASIN

File.... C:\PROJECTS\CALPINE\WAWA-POSTBN.PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
pavement/concrete	98	5.350			98.00
gravel	89	7.890			89.00
grass	74	3.040			74.00
COMPOSITE AREA & WEIGHTED CN --->		16.280			89.16 (89)

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: Length & Vel.

Hydraulic Length 1118.00 ft
Avg.Velocity 8.60 ft/sec

Segment #1 Time: .0361 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length 240.00 ft
Slope .005000 ft/ft
Paved

Avg.Velocity 1.44 ft/sec

Segment #2 Time: .0464 hrs

Segment #3: Tc: TR-55 Sheet

Mannings n .0110
Hydraulic Length 100.00 ft
2yr, 24hr P 3.5000 in
Slope .005000 ft/ft

Avg.Velocity .83 ft/sec

Segment #3 Time: .0336 hrs

Total Tc: .1161 hrs

File.... C:\PROJECTS\CALPINE\WAWAYANDA\WAWA-POSTBN.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, ft/ft

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== User Defined Length & Velocity ==========

Tc = (Lf / V) / (3600sec/hr)

Where: Tc = Time of concentration, hrs
Lf = Flow length, ft
V = Velocity, ft/sec

Rev.1

File.... C:\PROJECTS\CALPINE\WAWA-POSTBN.PPW

Rev.0 Rev.1 ← Rev.0 → Rev.1

Elevation (ft)	Planimeter (sq.in) (SF)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
448.43 449.43	-----	.0000	.0000	.000	.000
449.00 450	-----3720	.0854 3795	.0854	.016	.016
450.00 451	-----23,313	.535 23,715	.8344	.278	.294
452.00 453	----43,895	1.007 45,140	2.2773	1.518	1.813
454.00 455	----53,274	1.223 54,460	3.3408	2.227	4.040
456.00 457	----64,826	1.488 65,230	4.0603	2.707	6.747

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

The relocated pond is one foot higher than the Rev.0. The relocated pond is slightly larger at each contour compared to the original pond. The volume is close enough that rerouting the storms through the pond is not required.

Rev. 1
JTW 7-18-01

File.... C:\PROJECTS\CALPINE\WAWA-POSTBN.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 448.43 ft
Increment = .40 ft
Max. Elev.= 456.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Orifice-Circular	OR	--->	CV	448.430	456.000
Weir-Rectangular	RW	--->	CV	451.000	456.000
Weir-Rectangular	RW	--->	CV	451.000	456.000
Culvert-Circular	CV	--->	TW	448.230	456.000

TW SETUP, DS Channel

OUTLET STRUCTURE INPUT DATA

Structure ID = OR
Structure Type = Orifice-Circular

# of Openings = 1
Invert Elev. = 448.43 ft
Diameter = .1670 ft
Orifice Coeff. = .600

Structure ID = RW
Structure Type = Weir-Rectangular

# of Openings = 1
Crest Elev. = 451.00 ft
Weir Length = 3.50 ft
Weir Coeff. = .600000

Weir TW effects (Use adjustment equation)

Structure ID = RW
Structure Type = Weir-Rectangular

# of Openings = 1
Crest Elev. = 451.00 ft
Weir Length = 3.50 ft
Weir Coeff. = .600000

Weir TW effects (Use adjustment equation)

File.... C:\PROJECTS\CALPINE\WAWA-POSTBN.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = CV
Structure Type = Culvert-Circular

No. Barrels	=	1
Barrel Diameter	=	2.5000 ft
Upstream Invert	=	448.23 ft
Dnstream Invert	=	448.02 ft
Horiz. Length	=	70.00 ft
Barrel Length	=	70.00 ft
Barrel Slope	=	.00300 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130	
Ke	=	.5000	(forward entrance loss)
Kb	=	.009217	(per ft of full flow)
Kr	=	.5000	(reverse entrance loss)
HW Convergence	=	.001	+/- ft

INLET CONTROL DATA...

Equation form	=	1
Inlet Control K	=	.0078
Inlet Control M	=	2.0000
Inlet Control c	=	.02920
Inlet Control Y	=	.7400
T1 ratio (HW/D)	=	1.134
T2 ratio (HW/D)	=	1.206
Slope Factor	=	-.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...
At T1 Elev = 451.07 ft ---> Flow = 27.16 cfs
At T2 Elev = 451.24 ft ---> Flow = 31.05 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...

Maximum Iterations	=	30
Min. TW tolerance	=	.01 ft
Max. TW tolerance	=	.01 ft
Min. HW tolerance	=	.01 ft
Max. HW tolerance	=	.01 ft
Min. Q tolerance	=	.10 cfs
Max. Q tolerance	=	.10 cfs

File.... C:\PROJECTS\CALPINE\WAWA-POSTBN.PPW

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Notes		
		Converge		
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
448.43	.00	Free Outfall		(no Q: OR,RW,RW,CV)
448.83	.06	Free Outfall		OR,CV (no Q: RW,RW)
449.23	.09	Free Outfall		OR,CV (no Q: RW,RW)
449.63	.11	Free Outfall		OR,CV (no Q: RW,RW)
450.03	.13	Free Outfall		OR,CV (no Q: RW,RW)
450.43	.15	Free Outfall		OR,CV (no Q: RW,RW)
450.83	.16	Free Outfall		OR,CV (no Q: RW,RW)
451.00	.17	Free Outfall		OR,CV (no Q: RW,RW)
451.23	.63	Free Outfall		OR,RW,RW,CV
451.63	2.27	Free Outfall		OR,RW,RW,CV
452.03	4.57	Free Outfall		OR,RW,RW,CV
452.43	7.36	Free Outfall		OR,RW,RW,CV
452.83	10.58	Free Outfall		OR,RW,RW,CV
453.23	14.17	Free Outfall		OR,RW,RW,CV
453.63	18.10	Free Outfall		OR,RW,RW,CV
454.03	22.35	Free Outfall		OR,RW,RW,CV
454.43	26.88	Free Outfall		OR,RW,RW,CV
454.83	31.53	Free Outfall		OR,RW,RW,CV
455.23	36.19	Free Outfall		OR,RW,RW,CV
455.63	40.91	Free Outfall		OR,RW,RW,CV
456.00	45.32	Free Outfall		OR,RW,RW,CV

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = C:\PROJECTS\CALPINE\
HYG File - ID = POSTBASN.HYG - DEVELOPED TO BAS Dev..2
Tc = .1161 hrs
Drainage Area = 16.280 acres Runoff CN= 89

==========
Computational Time Increment = .01548 hrs
Computed Peak Time = 12.1064 hrs
Computed Peak Flow = 37.89 cfs

Time Increment for HYG File = .1000 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 37.71 cfs
==========

DRAINAGE AREA

ID:DEVELOPED TO BAS
CN = 89
Area = 16.280 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

2.3572 in
3.198 ac-ft

HYG Volume... 3.196 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .11611 hrs (ID: DEVELOPED TO BAS)
Computational Incr, Tm = .01548 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 158.87 cfs
Unit peak time Tp = .07741 hrs
Unit receding limb, Tr = .30963 hrs
Total unit time, Tb = .38703 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration = 24.0000 hrs Rain Depth = 5.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = C:\PROJECTS\CALPINE\
HYG File - ID = POSTBASN.HYG - DEVELOPED TO BAS Dev.10
Tc = .1161 hrs
Drainage Area = 16.280 acres Runoff CN= 89

==========
Computational Time Increment = .01548 hrs
Computed Peak Time = 12.1064 hrs
Computed Peak Flow = 66.37 cfs

Time Increment for HYG File = .1000 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 66.14 cfs
==========

DRAINAGE AREA

ID:DEVELOPED TO BAS
CN = 89
Area = 16.280 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

4.2523 in
5.769 ac-ft

HYG Volume... 5.767 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .11611 hrs (ID: DEVELOPED TO BAS)
Computational Incr, Tm = .01548 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 158.87 cfs
Unit peak time Tp = .07741 hrs
Unit receding limb, Tr = .30963 hrs
Total unit time, Tb = .38703 hrs

Rev. 2

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 24.0000 hrs Rain Depth = 6.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\MY DOCUMENTS\A9698\PROJECTS\CALPINE\NICOLE\PROJECTS\CALPINE\W
HYG File - ID = POSTBASN.HYG - DEVELOPED TO BAS Dev.25
Tc = .1161 hrs
Drainage Area = 16.280 acres Runoff CN= 89

==========
Computational Time Increment = .01548 hrs
Computed Peak Time = 12.1064 hrs
Computed Peak Flow = 80.51 cfs

Time Increment for HYG File = .1000 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 80.26 cfs ←
==========

DRAINAGE AREA

ID:DEVELOPED TO BAS
CN = 89
Area = 16.280 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

5.2208 in
7.083 ac-ft

HYG Volume... 7.081 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .11611 hrs (ID: DEVELOPED TO BAS)
Computational Incr, Tm = .01548 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 158.87 cfs
Unit peak time Tp = .07741 hrs
Unit receding limb, Tr = .30963 hrs
Total unit time, Tb = .38703 hrs

Rev. 2

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 50 year storm
Duration = 24.0000 hrs Rain Depth = 7.0000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = H:\MY DOCUMENTS\A9698\PROJECTS\CALPINE\NICOLE\PROJECTS\CALPINE\W
HYG File - ID = POSTBASN.HYG - DEVELOPED TO BAS Dev.50
Tc = .1161 hrs
Drainage Area = 16.280 acres Runoff CN= 89

==========
Computational Time Increment = .01548 hrs
Computed Peak Time = 12.1064 hrs
Computed Peak Flow = 87.55 cfs

Time Increment for HYG File = .1000 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 87.28 cfs ←
==========

DRAINAGE AREA

ID:DEVELOPED TO BAS
CN = 89
Area = 16.280 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

5.7081 in
7.744 ac-ft

HYG Volume... 7.742 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .11611 hrs (ID: DEVELOPED TO BAS)
Computational Incr, Tm = .01548 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 158.87 cfs
Unit peak time Tp = .07741 hrs
Unit receding limb, Tr = .30963 hrs
Total unit time, Tb = .38703 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = C:\PROJECTS\CALPINE\
HYG File - ID = POSTBASN.HYG - DEVELOPED TO BAS Dev100
Tc = .1161 hrs
Drainage Area = 16.280 acres Runoff CN= 89

==========
Computational Time Increment = .01548 hrs
Computed Peak Time = 12.1064 hrs
Computed Peak Flow = 94.56 cfs

Time Increment for HYG File = .1000 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 94.29 cfs ←
==========

DRAINAGE AREA

ID:DEVELOPED TO BAS
CN = 89
Area = 16.280 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

6.1968 in
8.407 ac-ft

HYG Volume... 8.405 ac-ft (area under HYG curve)

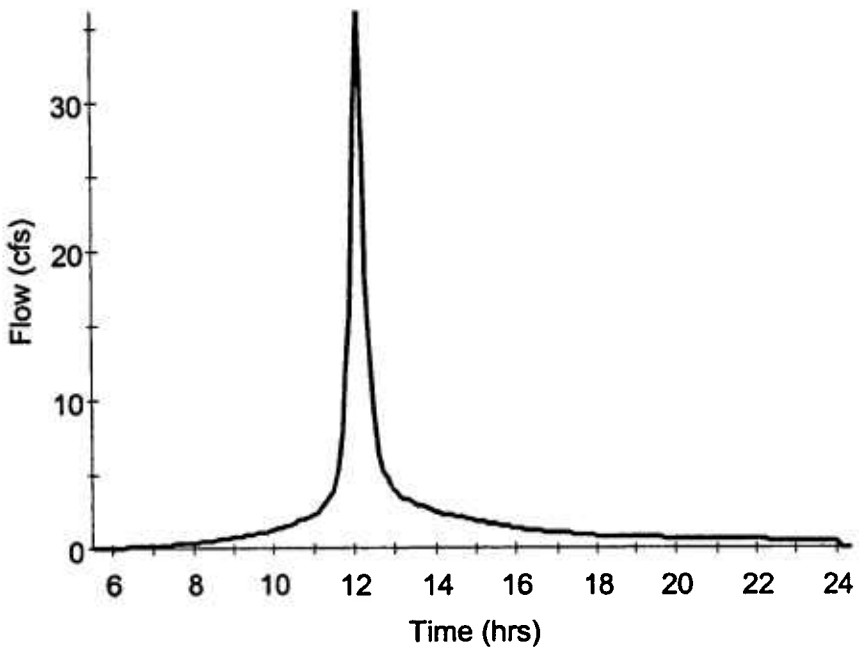
***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .11611 hrs (ID: DEVELOPED TO BAS)
Computational Incr, Tm = .01548 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

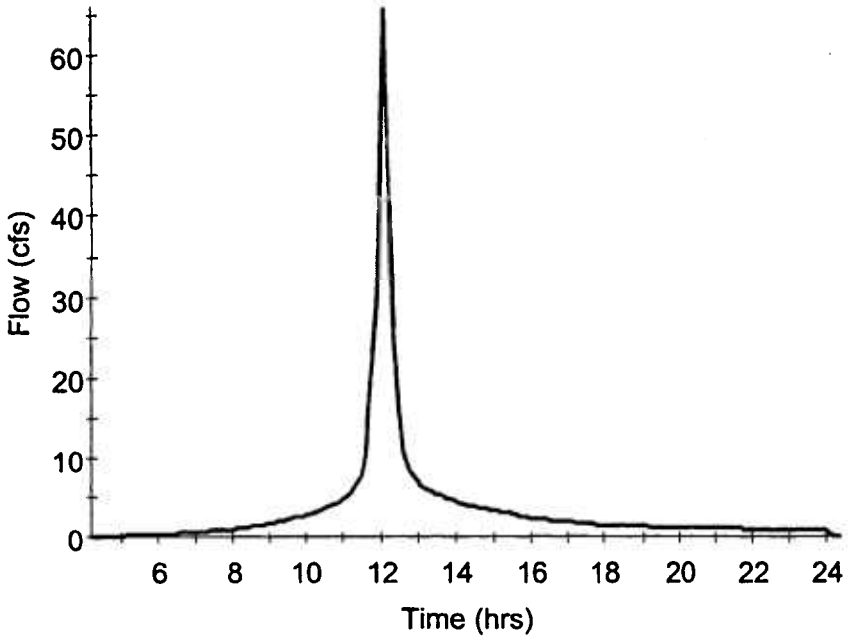
Unit peak, qp = 158.87 cfs
Unit peak time Tp = .07741 hrs
Unit receding limb, Tr = .30963 hrs
Total unit time, Tb = .38703 hrs

Hydrograph
DEVELOPED TO BAS Dev..2



Currently Plotted Curves
——— DEVELOPED TO BAS Dev..2

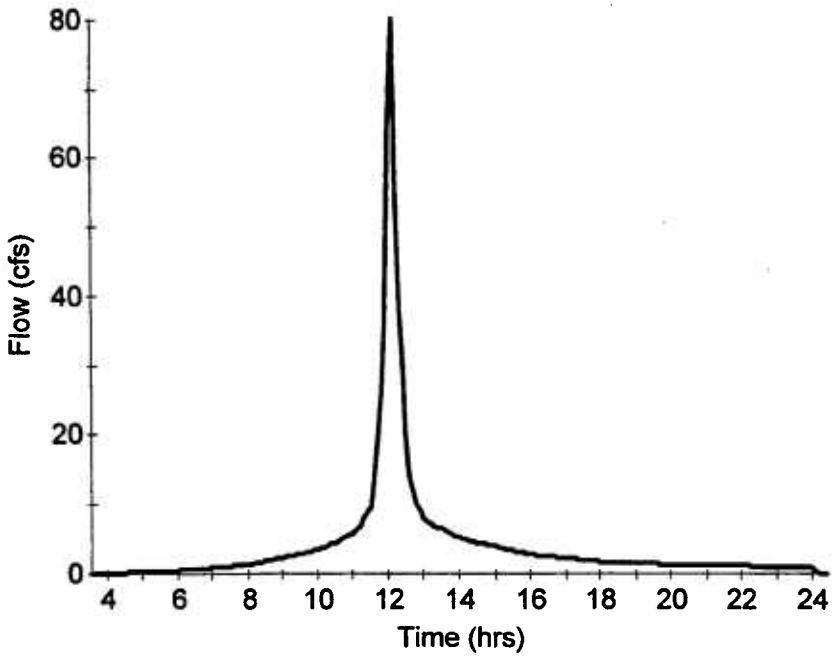
Hydrograph
DEVELOPED TO BAS Dev.10



Currently Plotted Curves

——— DEVELOPED TO BAS Dev.10

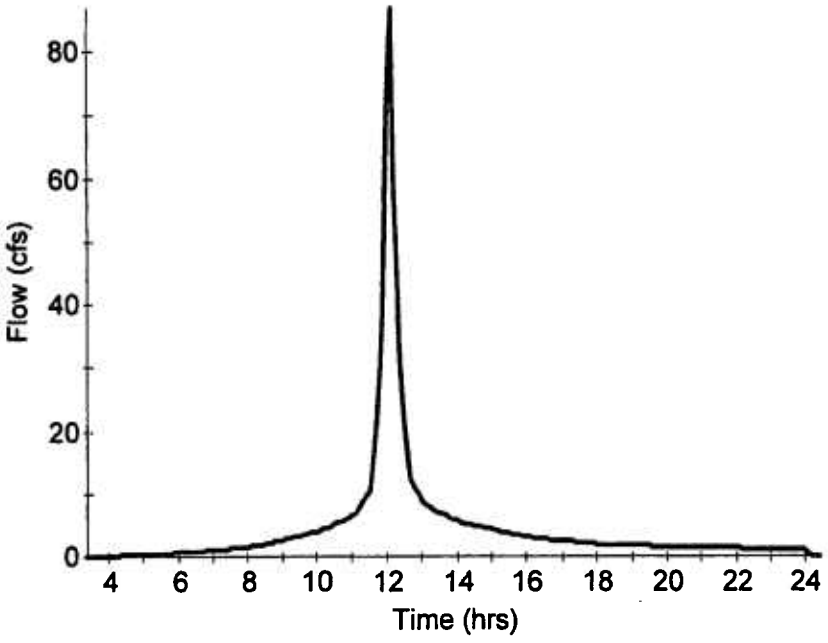
Hydrograph
DEVELOPED TO BAS Dev.25



Currently Plotted Curves

DEVELOPED TO BAS Dev.25

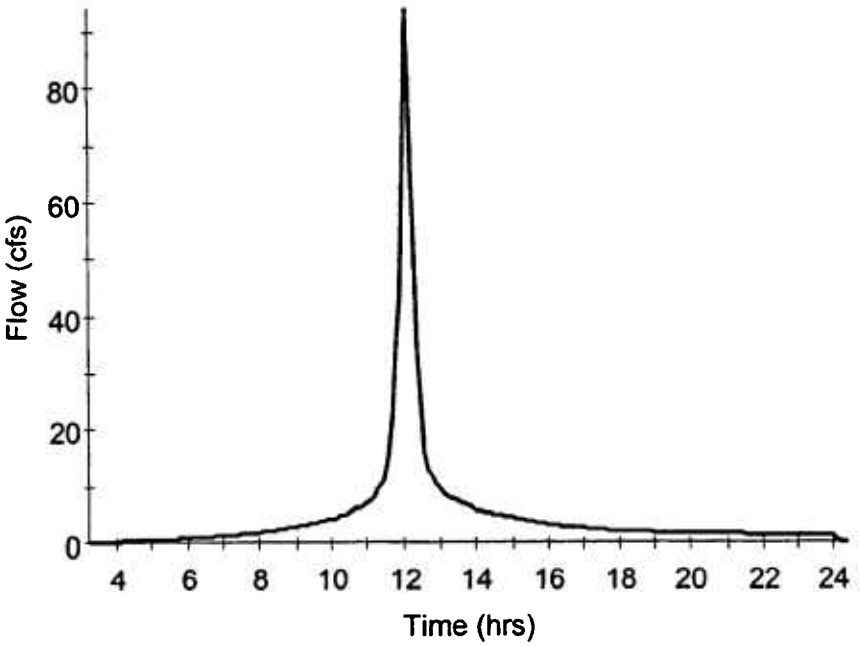
Hydrograph
DEVELOPED TO BAS Dev.50



Currently Plotted Curves

DEVELOPED TO BAS Dev.50

Hydrograph
DEVELOPED TO BAS Dev100



Currently Plotted Curves
——— DEVELOPED TO BAS Dev100

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Dev..2

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID		Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DEVELOPED TO BAS		AREA	3.196		12.1000	37.71	
Outfall OUTFALL		JCT	3.196		13.0000	4.25	
POND	IN	POND	3.196		12.1000	37.71	
POND	OUT	POND	3.196		13.0000	4.25	451.98

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Dev.10

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID		Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
	DEVELOPED TO BAS		AREA	5.767		12.1000	66.14	
Outfall	OUTFALL		JCT	5.767		12.6000	13.30	
	POND	IN	POND	5.767		12.1000	66.14	
	POND	OUT	POND	5.767		12.6000	13.30	453.13

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ Dev..2

Storm Tag Name = Dev.25
Description: 25-year return

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DEVELOPED TO BAS	AREA	7.081		12.1000	80.26	
Outfall OUTFALL	JCT	7.081		12.5000	18.31	
POND IN	POND	7.081		12.1000	80.26	
POND OUT	POND	7.081		12.5000	18.31	453.65

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ Dev..2

Storm Tag Name = Dev.50
Description: 50-year return

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID		Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DEVELOPED TO BAS		AREA	7.742		12.1000	87.28	
Outfall OUTFALL		JCT	7.742		12.5000	20.84	
POND	IN	POND	7.742		12.1000	87.28	
POND	OUT	POND	7.742		12.5000	20.84	453.89

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID		Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
DEVELOPED TO BAS		AREA	8.405		12.1000	94.29	
Outfall OUTFALL		JCT	8.405		12.5000	23.31	
POND	IN	POND	8.405		12.1000	94.29	
POND	OUT	POND	8.405		12.5000	23.31	454.12

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\PROJECTS\CALPINE\
Inflow HYG file = POSTBASN.HYG - POND IN Dev..2
Outflow HYG file = POSTBASN.HYG - POND OUT Dev..2

Pond Node Data = POND
Pond Volume Data = POND
Pond Outlet Data = OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	448.43 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	37.71 cfs	at	12.1000 hrs
Peak Outflow	=	4.25 cfs	at	13.0000 hrs
Peak Elevation	=	451.98 ft		
Peak Storage	=	1.788 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	3.196
- Infiltration	=	.000
- HYG Vol OUT	=	3.196
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.008% of Inflow Volume)

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\PROJECTS\CALPINE\
Inflow HYG file = POSTBASN.HYG - POND IN Dev.10
Outflow HYG file = POSTBASN.HYG - POND OUT Dev.10

Pond Node Data = POND
Pond Volume Data = POND
Pond Outlet Data = OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	448.43 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	66.14 cfs	at	12.1000 hrs
Peak Outflow	=	13.30 cfs	at	12.6000 hrs
Peak Elevation	=	453.13 ft		
Peak Storage	=	3.022 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	5.767
- Infiltration	=	.000
- HYG Vol OUT	=	5.767
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.005% of Inflow Volume)

File.... H:\MY DOCUMENTS\A9698\PROJECTS\CALPINE\NICOLE\PROJECTS\CALPINE\WWAWA-POSTBN.PPW
Storm... TypeIII 24hr Tag: Dev.25

Rev. 2

LEVEL POOL ROUTING SUMMARY

HYG Dir = H:\MY DOCUMENTS\A9698\PROJECTS\CALPINE\NICOLE\PROJECTS\CALPINE\W
Inflow HYG file = POSTBASN.HYG - POND IN Dev.25
Outflow HYG file = POSTBASN.HYG - POND OUT Dev.25

Pond Node Data = POND
Pond Volume Data = POND
Pond Outlet Data = OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	448.43 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	80.26 cfs	at	12.1000 hrs
Peak Outflow	=	18.31 cfs	at	12.5000 hrs
Peak Elevation	=	453.65 ft		
Peak Storage	=	3.618 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	7.081
- Infiltration	=	.000
- HYG Vol OUT	=	7.081
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.004% of Inflow Volume)

Rev. 2

LEVEL POOL ROUTING SUMMARY

HYG Dir = H:\MY DOCUMENTS\A9698\PROJECTS\CALPINE\NICOLE\PROJECTS\CALPINE\W
Inflow HYG file = POSTBASN.HYG - POND IN Dev.50
Outflow HYG file = POSTBASN.HYG - POND OUT Dev.50

Pond Node Data = POND
Pond Volume Data = POND
Pond Outlet Data = OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	448.43 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	87.28 cfs	at	12.1000 hrs
Peak Outflow	=	20.84 cfs	at	12.5000 hrs
Peak Elevation	=	453.89 ft		
Peak Storage	=	3.904 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	7.742
- Infiltration	=	.000
- HYG Vol OUT	=	7.742
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.004% of Inflow Volume)

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\PROJECTS\CALPINE\
Inflow HYG file = POSTBASN.HYG - POND IN Dev100
Outflow HYG file = POSTBASN.HYG - POND OUT Dev100

Pond Node Data = POND
Pond Volume Data = POND
Pond Outlet Data = OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	448.43 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	94.29 cfs	at	12.1000 hrs
Peak Outflow	=	23.31 cfs	at	12.5000 hrs
Peak Elevation	=	454.12 ft		
Peak Storage	=	4.185 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	8.405
- Infiltration	=	.000
- HYG Vol OUT	=	8.405
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.003% of Inflow Volume)

ATTACHMENT 4b

POST-DEVELOPMENT BYPASS

File.... C:\PROJECTS\CALPINE\WAWA-BYPASS.PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
pavement	98	.400			98.00
gravel	89	.150			89.00
grass	74	19.140			74.00
COMPOSITE AREA & WEIGHTED CN --->		19.690			74.60 (75)

File.... C:\PROJECTS\CALPINE\WAWA-BYPASS.PPW

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: TR-55 Channel

Flow Area	10.9000	sq.ft
Wetted Perimeter	12.08	ft
Hydraulic Radius	.90	ft
Slope	.010000	ft/ft
Mannings n	.0350	
Hydraulic Length	1550.00	ft
Avg.Velocity	3.98	ft/sec

Segment #1 Time: .1083 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	440.00	ft
Slope	.080000	ft/ft
Unpaved		
Avg.Velocity	4.56	ft/sec

Segment #2 Time: .0268 hrs

Segment #3: Tc: TR-55 Sheet

Mannings n	.0240	
Hydraulic Length	100.00	ft
2yr, 24hr P	3.5000	in
Slope	.050000	ft/ft
Avg.Velocity	1.11	ft/sec

Segment #3 Time: .0250 hrs

Total Tc: .1601 hrs

File.... C:\PROJECTS\CALPINE\WAWA-BYPASS.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, ft/ft

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

File.... C:\PROJECTS\CALPINE\WAWA-BYPASS.PPW

==== SCS Channel Flow ==

R = Aq / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where: R = Hydraulic radius
Aq = Flow area, sq.ft.
Wp = Wetted perimeter, ft
V = Velocity, ft/sec
Sf = Slope, ft/ft
n = Mannings n
Tc = Time of concentration, hrs
Lf = Flow length, ft

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Dev..2

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall OUTFALL	JCT	2.136		12.1500	23.98	
POST BYPASS	AREA	2.136		12.1500	23.98	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Dev.10

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 5.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall OUTFALL	JCT	4.693		12.1500	53.54	
POST BYPASS	AREA	4.693		12.1500	53.54	

Rev-2

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ

Storm Tag Name = Dev.25
Description: 25-year return

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 6.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall	OUTFALL	JCT	6.091		12.1500	69.24	
	POST BYPASS	AREA	6.091		12.1500	69.24	

Rev. 2

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ

Storm Tag Name = Dev.50
Description: 50-year return

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 7.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall	OUTFALL	JCT	6.808		12.1500	77.20	
	POST BYPASS	AREA	6.808		12.1500	77.20	

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

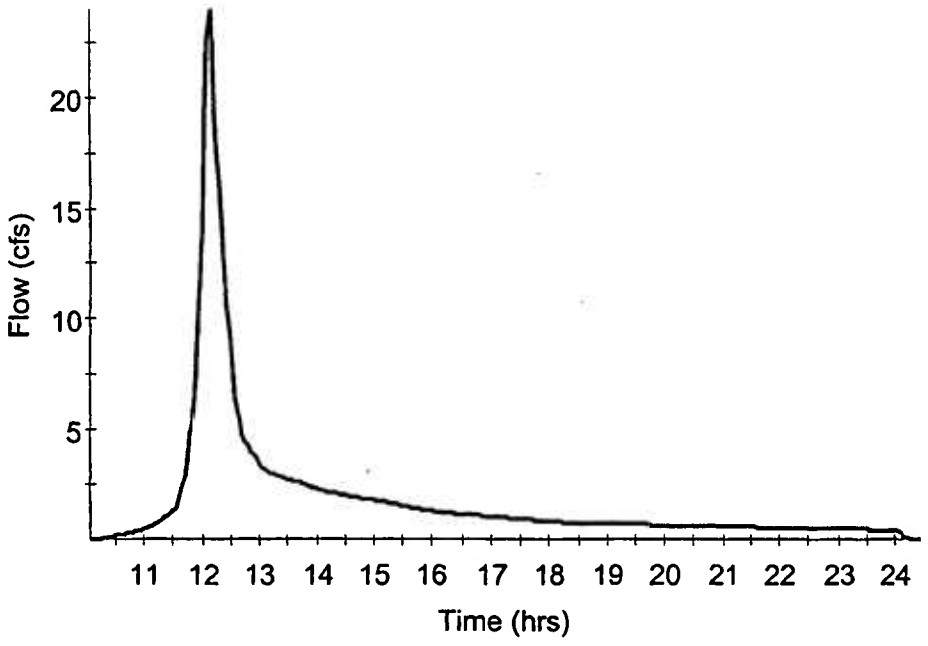
DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

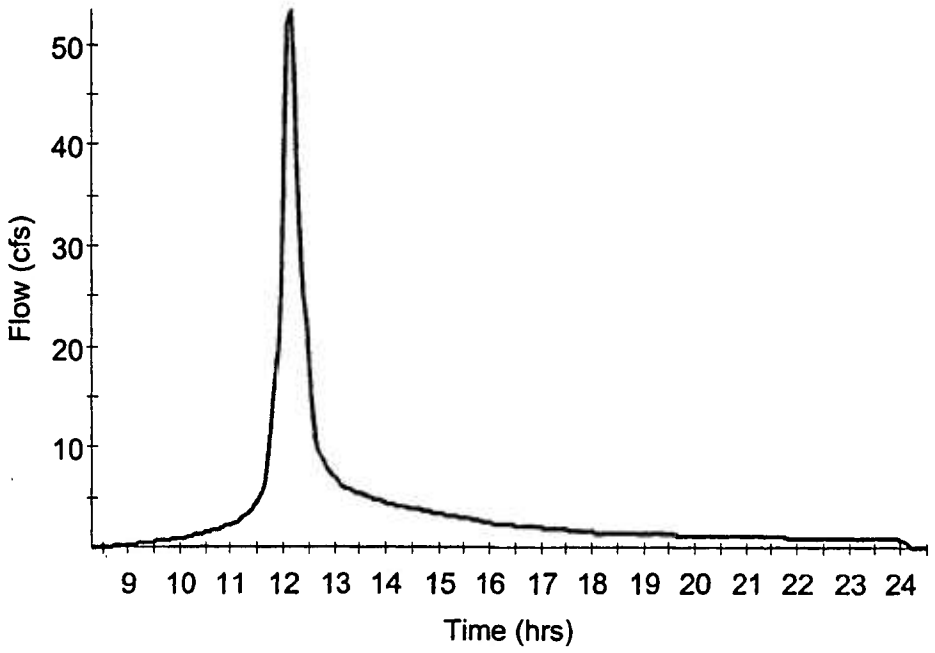
	Node ID	Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
Outfall	OUTFALL	JCT	7.536		12.1500	85.21	
	POST BYPASS	AREA	7.536		12.1500	85.21	

Hydrograph
POST BYPASS Dev..2



Currently Plotted Curves
——— POST BYPASS Dev..2

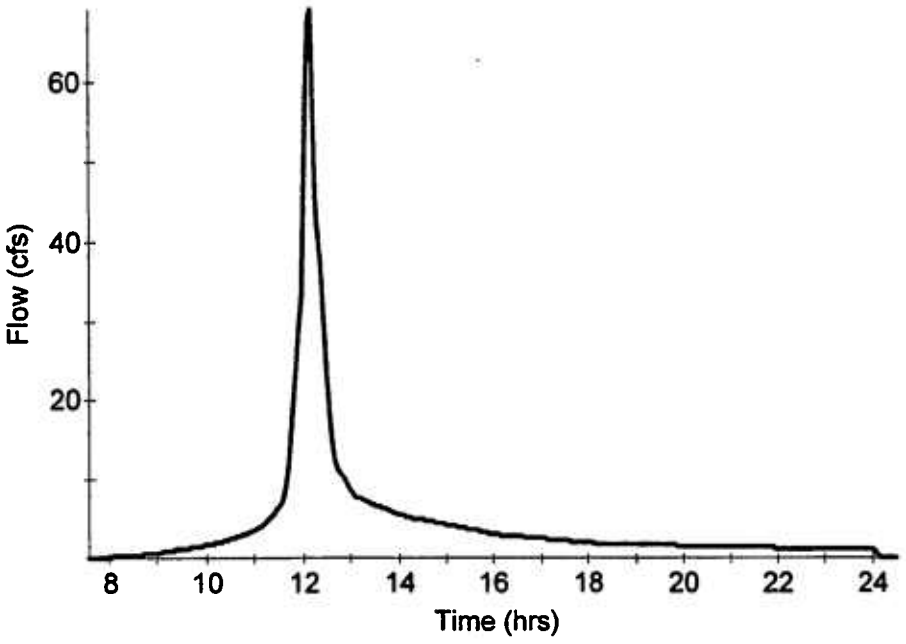
Hydrograph
POST BYPASS Dev.10



Currently Plotted Curves
——— POST BYPASS Dev.10

Hydrograph
POST BYPASS Dev.25

Rev. 2

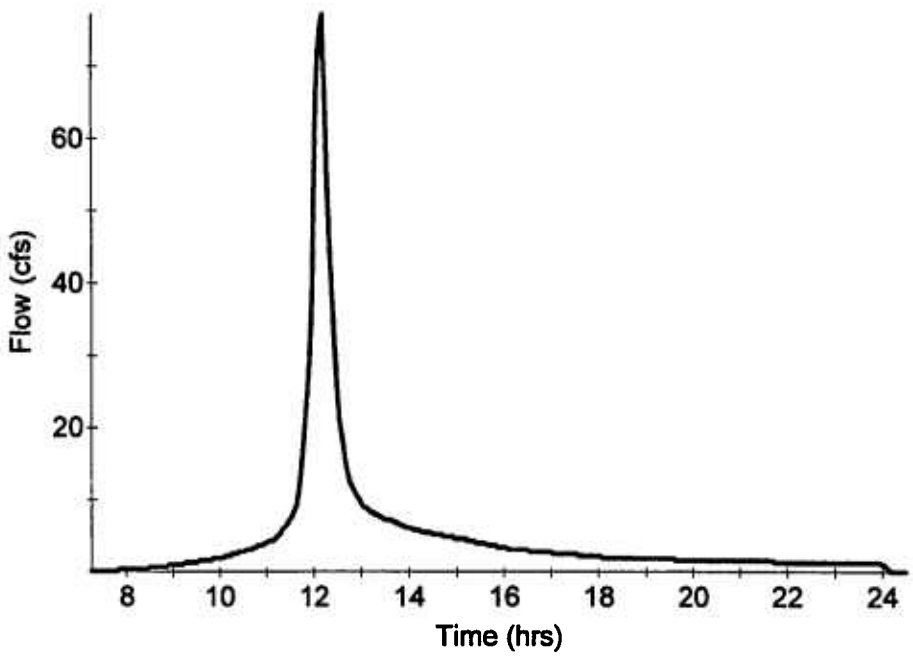


Currently Plotted Curves

——— POST BYPASS Dev.25

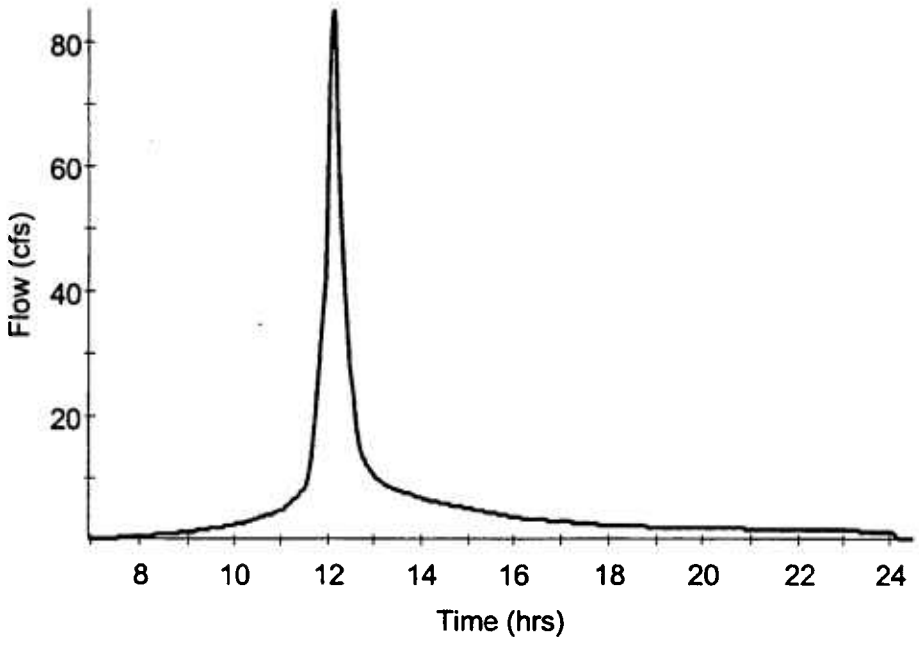
Hydrograph
POST BYPASS Dev.50

Rev. 2



Currently Plotted Curves
POST BYPASS Dev.50

Hydrograph
POST BYPASS Dev100



Currently Plotted Curves
——— POST BYPASS Dev100

ATTACHMENT 5

FIRST FLUSH ANALYSIS

BMP FIRST FLUSH CALCULATIONS

First Flush Depth = .5000 in
Drainage Area = 16.280 acres

Volume = Flush Depth * Drainage Area

First Flush volume = .678 ac-ft

File.... C:\PROJECTS\CALPINE\WAWA-POSTBN.PPW

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\PROJECTS\CALPINE\
Inflow HYG file = NONE STORED - Zero Inflow
Outflow HYG file = NONE STORED - FIRST FLUSH TOUT

Pond Node Data = pond
Pond Volume Data = POND
Pond Outlet Data = OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	450.63 ft
Starting Volume	=	.673 ac-ft
Starting Outflow	=	.15 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.15 cfs
Time Increment	=	.5000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	.00 cfs	at	.5000 hrs
Peak Outflow	=	.15 cfs	at	.5000 hrs
Peak Elevation	=	450.61 ft		
Peak Storage	=	.662 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.673
+ HYG Vol IN	=	.000
- Infiltration	=	.000
- HYG Vol OUT	=	.672
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.036% of Outflow Volume)

POND ROUTED TOTAL OUTFLOW HYG...
HYG file =
HYG ID = FIRST FLUSH TOUT
HYG Tag =

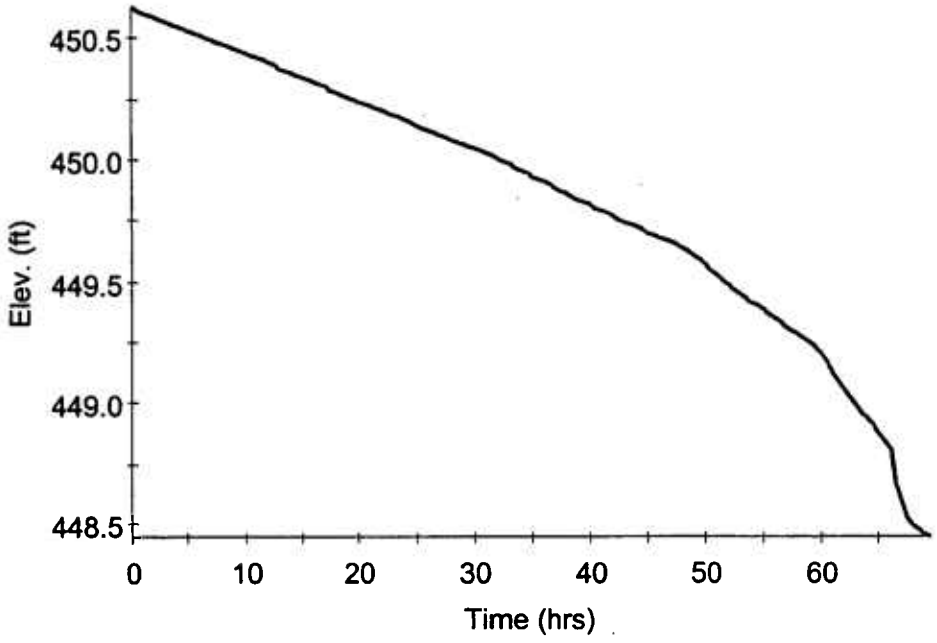
Peak Discharge =	.15 cfs
Time to Peak =	.5000 hrs
HYG Volume =	.672 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .5000 hrs
Time on left represents time for first value in each row.

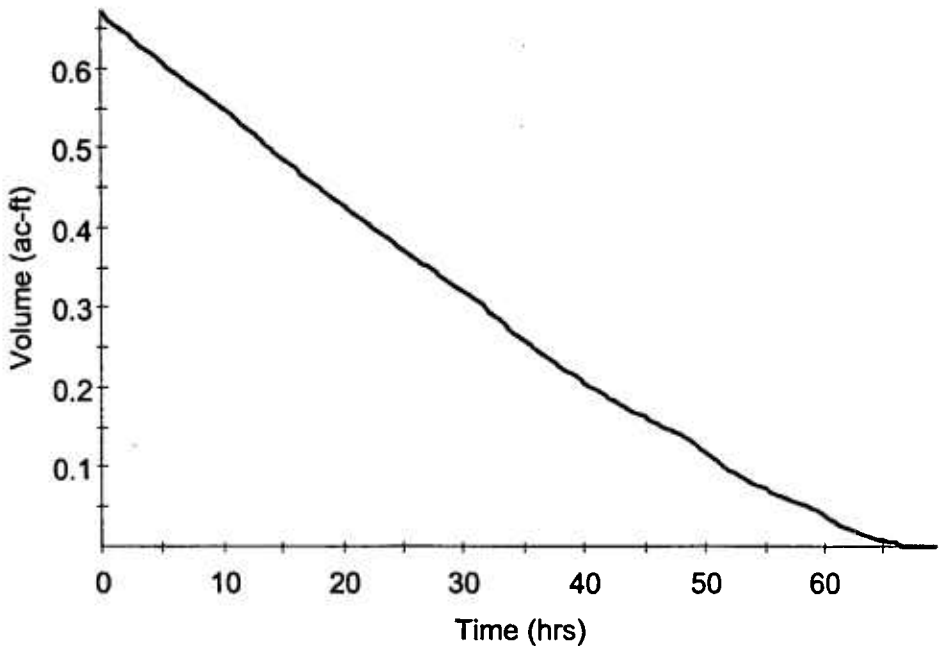
Time hrs					
.0000	.15	.15	.15	.15	.15
2.5000	.15	.15	.15	.15	.15
5.0000	.15	.15	.15	.15	.15
7.5000	.15	.15	.15	.15	.15
10.0000	.15	.15	.15	.15	.14
12.5000	.14	.14	.14	.14	.14
15.0000	.14	.14	.14	.14	.14
17.5000	.14	.14	.14	.14	.14
20.0000	.14	.14	.14	.14	.14
22.5000	.14	.14	.14	.14	.13
25.0000	.13	.13	.13	.13	.13
27.5000	.13	.13	.13	.13	.13
30.0000	.13	.13	.13	.13	.13
32.5000	.13	.13	.13	.13	.13
35.0000	.13	.12	.12	.12	.12
37.5000	.12	.12	.12	.12	.12
40.0000	.12	.12	.12	.12	.12
42.5000	.12	.12	.12	.12	.12
45.0000	.11	.11	.11	.11	.11
47.5000	.11	.11	.11	.11	.11
50.0000	.11	.11	.11	.10	.10
52.5000	.10	.10	.10	.10	.10
55.0000	.10	.10	.10	.09	.09
57.5000	.09	.09	.09	.09	.09
60.0000	.09	.08	.08	.08	.08
62.5000	.07	.07	.07	.07	.07
65.0000	.06	.06	.06	.04	.02
67.5000	.02	.01	.01	.00	.00

Elev. vs. Time
FIRST FLUSH TOUT



Currently Plotted Curves
——— FIRST FLUSH TOUT

Volume vs. Time
FIRST FLUSH TOUT



Currently Plotted Curves
——— FIRST FLUSH TOUT

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: .3 year storm
Duration = 24.0000 hrs Rain Depth = 1.0000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = C:\PROJECTS\CALPINE\
HYG File - ID = POSTBASN.HYG - DEVELOPED TO BAS Dev..3
Tc = .1161 hrs
Drainage Area = 16.280 acres Runoff CN= 89

==========
Computational Time Increment = .01548 hrs
Computed Peak Time = 12.1219 hrs
Computed Peak Flow = 4.45 cfs

Time Increment for HYG File = .1000 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 4.29 cfs
WARNING: The difference between calculated peak flow
and interpolated peak flow is greater than 1.50%
==========

DRAINAGE AREA

ID:DEVELOPED TO BAS
CN = 89
Area = 16.280 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

.2850 in
.387 ac-ft

HYG Volume... .386 ac-ft (area under HYG curve)

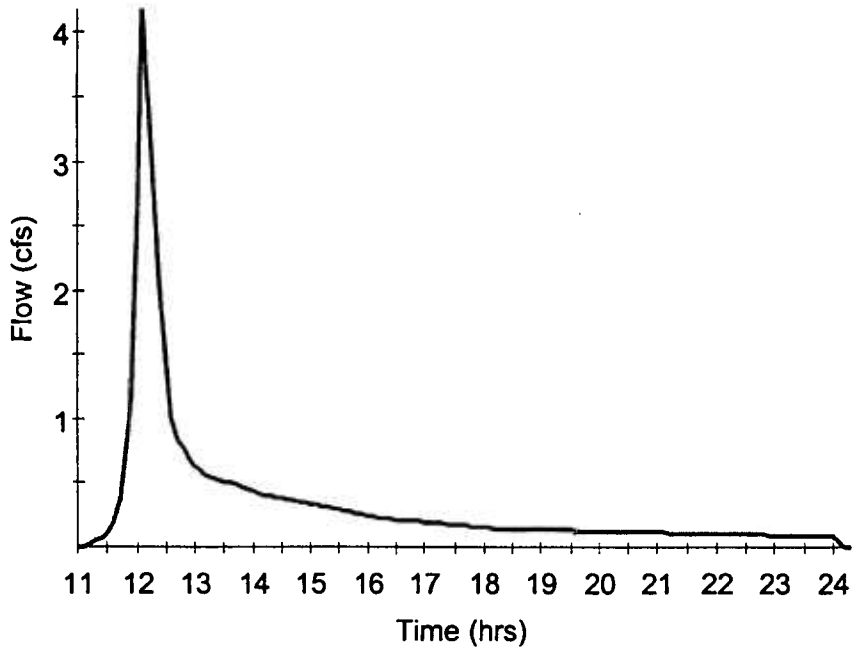
***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .11611 hrs (ID: DEVELOPED TO BAS)
Computational Incr, Tm = .01548 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 158.87 cfs
Unit peak time Tp = .07741 hrs
Unit receding limb, Tr = .30963 hrs
Total unit time, Tb = .38703 hrs

Hydrograph
DEVELOPED TO BAS Dev..3



Currently Plotted Curves
——— DEVELOPED TO BAS Dev..3

NETWORK SUMMARY -- NODES
(Trun.= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left & Rt)

DEFAULT Design Storm File,ID = WAWANY.RNQ wawa

Storm Tag Name = Dev..3
Description: 1 inch storm

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeIII 24hr
Storm Frequency = .3 yr
Total Rainfall Depth= 1.0000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

	Node ID		Type	HYG Vol ac-ft	Trun.	Qpeak hrs	Qpeak cfs	Max WSEL ft
	DEVELOPED TO BAS		AREA	.386		12.1000	4.29	
Outfall	OUTFALL		JCT	.386		16.2000	.12	
	POND	IN	POND	.386		12.1000	4.29	
	POND	OUT	POND	.386		16.2000	.12	449.93

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\PROJECTS\CALPINE\
Inflow HYG file = POSTBASN.HYG - POND IN Dev..3
Outflow HYG file = POSTBASN.HYG - POND OUT Dev..3

Pond Node Data = POND
Pond Volume Data = POND
Pond Outlet Data = OUTLET

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	448.43 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.1000 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	4.29 cfs	at	12.1000 hrs
Peak Outflow	=	.13 cfs	at	16.2000 hrs
Peak Elevation	=	449.93 ft		
Peak Storage	=	.259 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.386
- Infiltration	=	.000
- HYG Vol OUT	=	.386
- Retained Vol	=	.000
Unrouted Vol	=	-.000 ac-ft (.070% of Inflow Volume)

File.... C:\PROJECTS\CALPINE\WAWA-POSTBN.PPW

POND ROUTED TOTAL OUTFLOW HYG...
HYG file =
HYG ID = FIRST FLUSH TOUT
HYG Tag =

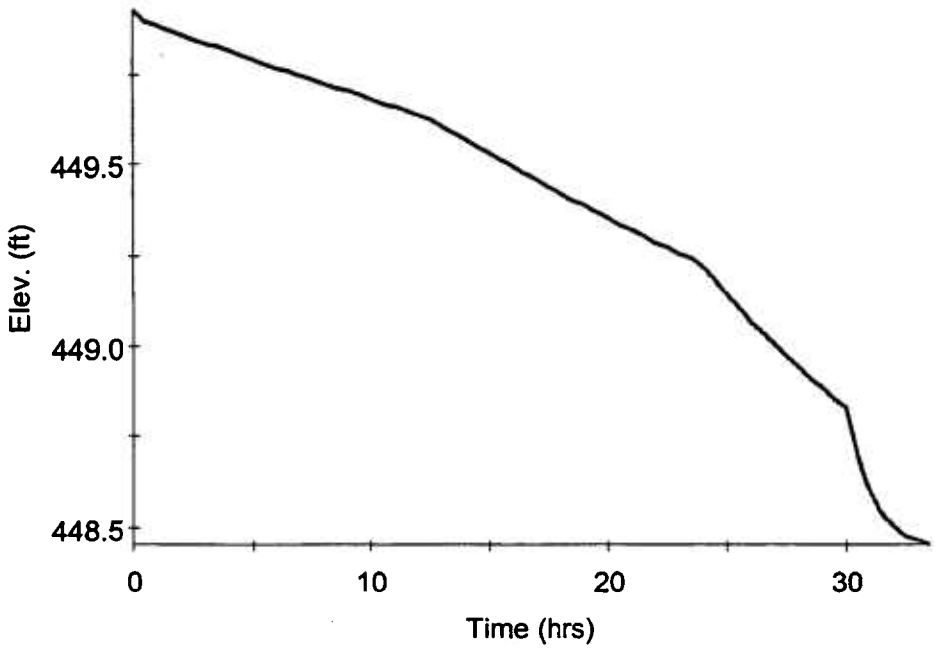
Peak Discharge =	.12 cfs
Time to Peak =	.5000 hrs
HYG Volume =	.258 ac-ft

WARNING: Hydrograph truncated on left side.

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .5000 hrs
Time on left represents time for first value in each row.

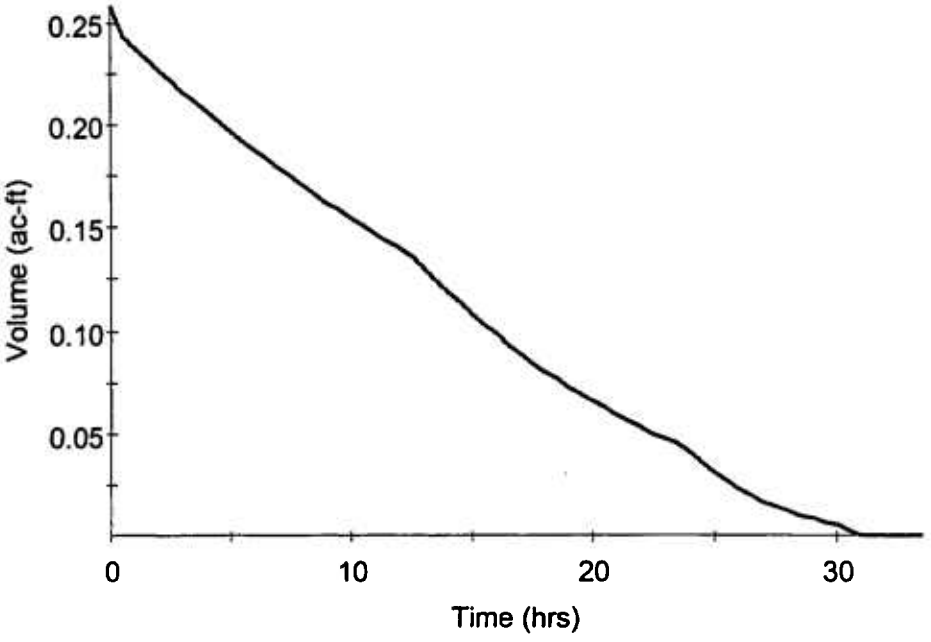
Time hrs					
.0000	.13	.12	.12	.12	.12
2.5000	.12	.12	.12	.12	.12
5.0000	.12	.12	.12	.12	.12
7.5000	.12	.12	.12	.11	.11
10.0000	.11	.11	.11	.11	.11
12.5000	.11	.11	.11	.11	.11
15.0000	.11	.10	.10	.10	.10
17.5000	.10	.10	.10	.10	.10
20.0000	.10	.10	.09	.09	.09
22.5000	.09	.09	.09	.09	.09
25.0000	.08	.08	.08	.07	.07
27.5000	.07	.07	.07	.06	.06
30.0000	.06	.04	.03	.02	.01
32.5000	.01	.00	.00		

Elev. vs. Time
FIRST FLUSH TOUT



Currently Plotted Curves
——— FIRST FLUSH TOUT

Volume vs. Time
FIRST FLUSH TOUT



Currently Plotted Curves
——— FIRST FLUSH TOUT

ATTACHMENT 6

EMERGENCY SPILLWAY CALCULATION

PARSONS	CLIENT NAME: CALPINE PROJECT NAME: WAWA	JOB NO.: 537162-00108
STANDARD CALCULATION SHEET	SUBJECT: SW MGT	CALC NO.: WAWA-1-DC-SDS-CE-001

REVISION	0	1	2	3	Page 1 of
ORIGINATOR:	NLG	JAW			
REVIEWER:	JAW				
DATE:	4-18-01	7-18-01			

Emergency Spillway Calculation

$Q = CLH^{1.5}$

$Q_{100} = 94.29$

$L = 140$ Rev. 1 $L = 150'$ OK

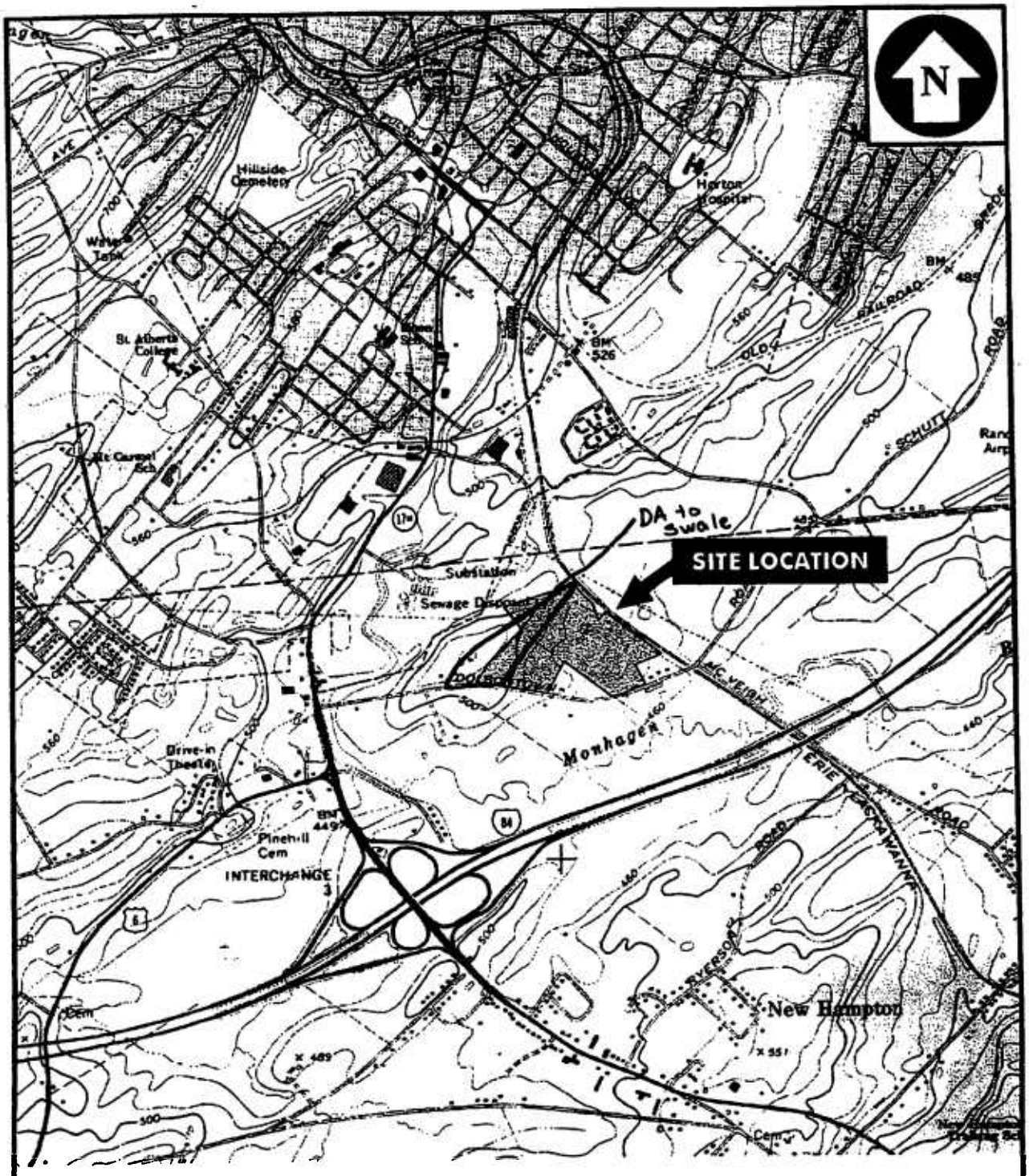
$C = 3.0$

$H = \left(\frac{Q}{CL}\right)^{2/3} = \left(\frac{94.29}{(3.0)(140)}\right)^{2/3} = 0.37$

Emergency Spillway Elevation	:	454.62
Depth of Q_{100} going over Spillway	:	0.37 FT
Elevation of Q_{100} over spillway	:	454.99
Freeboard	:	1.00
Top of Berm	:	456.00

ATTACHMENT 7

PERMANENT SWALES ANALYSIS



BASE MAP IS A PORTION OF THE FOLLOWING 7.5' USGS TOPOGRAPHIC QUADRANGLE:
MIDDLETOWN, NY, 1969; PHOTOINSPECTED 1976

0 2000 4000

scale in feet

QUADRANGLE LOCATION

L00-2161ITOPO

TRC

Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

SITE LOCUS MAP

WAWAYANDA ENERGY CENTER
WAWAYANDA, NEW YORK

FIGURE 1-1	PROJ. NO. 29154

PARSONS	CLIENT NAME: CALPINE PROJECT NAME: WAWA	JOB NO.: 537162-00108
STANDARD CALCULATION SHEET	SUBJECT: SW MGT	CALC NO.: WAWA-1-DC-SDS-CE-001

REVISION	0	1	2	3
ORIGINATOR:	NLG	JAW		
REVIEWER:	JAW			
DATE:	6-18-01	7-18-01		

Page 1 of 2

Swale 1 Calculation:

DA = 17.30 Acres per WAWA-1-SK-SPI-735-002, Rev. 1, DA = 15.68 acres, so this calc. is still OK. | R1

Runoff Coefficient

Surface Condition	Area	"C"	Product
Pavement	0.50	0.90	0.4275
Grass	16.80	0.35	5.88
Total			6.3075

"C" = 6.3075/17.30 = 0.36

Time of Concentration

Segment 1
Swale flow
Length = 600 FT
Slope = 6%
velocity = 3 fps

T_{c1} = 3.33

Segment 2
Swale Flow
Length = 1550 FT
Slope = 1%
velocity = 2.00 fps

T_{c2} = 12.92

Tc = 16 minutes

PARSONS

CLIENT NAME: CALPINE
PROJECT NAME: WAWA

JOB NO.: 53762-00108

STANDARD CALCULATION SHEET

SUBJECT: SW MGT

CALC NO.: WAWA-1-DC-SDS-CE-001

REVISION	0	1	2	3
ORIGINATOR:	NLG	JAW		
REVIEWER:	JAW			
DATE:	4-18-01	7-18-01		

$I_{100} = 6.8$

$Q = 17.30 \times 0.36 \times 6.8 = 42.35$ cfs

Swale 1B:

DA = 2.4, Use $Q = \frac{2.4}{17.3} \times 42.35 = 5.9$ cfs

Say 10 cfs for sizing swale

R1

Worksheet
Worksheet for Triangular Channel

Swale 1

Project Description	
Worksheet	Triangular Channe
Flow Element	Triangular Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.035	
Slope	010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	42.35	cfs

Results		
Depth	1.89	ft
Flow Area	10.7	ft²
Wetted Perim	11.96	ft
Top Width	11.35	ft
Critical Depth	1.65	ft
Critical Slope	0.020400	ft/ft
Velocity	3.95	ft/s
Velocity Head	0.24	ft
Specific Ener	2.13	ft
Froude Numb	0.72	
Flow Type	Subcritical	

PARSONS
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Wawayanda Energy Center
Worksheet for Trapezoidal Channel

Rev. 4

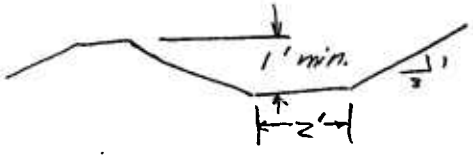
Project Description	
Project File	h:\my documents\a9698\projects\calpine\nicole\projects\calpine\wawayanda\wawa
Worksheet	Swale 1B
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.053	
Channel Slope	0.100000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	2.00	ft
Discharge	10.00	cfs

Depth of Swale = 1' − .58' = 0.42'

> 0.30' (Req'd.) OK

Results		
Depth	0.58	ft
Flow Area	2.15	ft²
Wetted Perimeter	5.64	ft
Top Width	5.46	ft
Critical Depth	0.66	ft
Critical Slope	0.056296	ft/ft
Velocity	4.66	ft/s
Velocity Head	0.34	ft
Specific Energy	0.91	ft
Froude Number	1.31	
Flow is supercritical.		



SWALES 2 & 3

SWALE NUMBER	AREA ACRES	"C"	Tc MINUTES	I100	FLOW cfs	IMP. AREA	STONE AREA	LAWN AREA
2	0.49	0.521429	5	9.1	2.32505	0.13	0.05	0.31
3	0.31	0.474194	5	9.1	1.3377	0.07	0	0.24

Worksheet
Worksheet for Trapezoidal Channel

SWALE 2

flattest slope

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.035	
Slope	010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	2.00	ft
Discharge	2.33	cfs

Results		
Depth	0.39	ft
Flow Area	1.3	ft²
Wetted Perim	4.84	ft
Top Width	4.73	ft
Critical Depth	0.29	ft
Critical Slope	0.030484	ft/ft
Velocity	1.78	ft/s
Velocity Head	0.05	ft
Specific Energ	0.44	ft
Froude Numb	0.60	
Flow Type	Subcritical	

Worksheet
Worksheet for Trapezoidal Channel

SWALE 2

STEEPEST SLOPE

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.035	
Slope	043000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	2.00	ft
Discharge	2.33	cfs

Results		
Depth	0.27	ft
Flow Area	0.8	ft²
Wetted Perim	3.94	ft
Top Width	3.86	ft
Critical Depth	0.29	ft
Critical Slope	0.030484	ft/ft
Velocity	2.99	ft/s
Velocity Head	0.14	ft
Specific Energ	0.40	ft
Froude Numb	1.17	
Flow Type	Supercritical	

PARSONS
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Worksheet
Worksheet for Trapezoidal Channel

SWALE 2

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.110	← retardance coefficient
Slope	.010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	2.00	ft
Discharge	2.33	cfs

Results		
Depth	0.69	ft
Flow Area	3.0	ft²
Wetted Perim	7.00	ft
Top Width	6.80	ft
Critical Depth	0.29	ft
Critical Slope	0.301102	ft/ft
Velocity	0.77	ft/s
Velocity Head	0.01	ft
Specific Energ	0.70	ft
Froude Numb	0.20	
Flow Type	Subcritical	

Depth of swale = 1.00 FT − 0.69 FT = 0.31 FT

Free board = 0.31 FT ≥ 0.30 FT (Required)

Worksheet
Worksheet for Trapezoidal Channel

Rev. 1.

swale 3

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.035	
Slope	.017400	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	1.34	cfs

Results		
Depth	0.26	ft
Flow Area	0.7	ft²
Wetted Perim	3.62	ft
Top Width	3.54	ft
Critical Depth	0.21	ft
Critical Slope	0.032959	ft/ft
Velocity	1.89	ft/s
Velocity Head	0.06	ft
Specific Ener	0.31	ft
Froude Numb	0.74	
Flow Type	Subcritical	

Delete Swale 3.

No longer required.

Worksheet
Worksheet for Trapezoidal Channel

Rev. 1

Swale 3

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.098	← reterdance coeff
Slope	.017400	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	1.34	cfs

Delete

Results		
Depth	0.44	ft
Flow Area	1.5	ft²
Wetted Perim	4.80	ft
Top Width	4.66	ft
Critical Depth	0.21	ft
Critical Slope	0.258396	ft/ft
Velocity	0.91	ft/s
Velocity Head	0.01	ft
Specific Energ	0.46	ft
Froude Numb	0.29	
Flow Type	Subcritical	

Depth of Swale = 1.00 FT − 0.44 FT = 0.56 FT

Freeboard = 0.56 FT > 0.30 FT (Required)

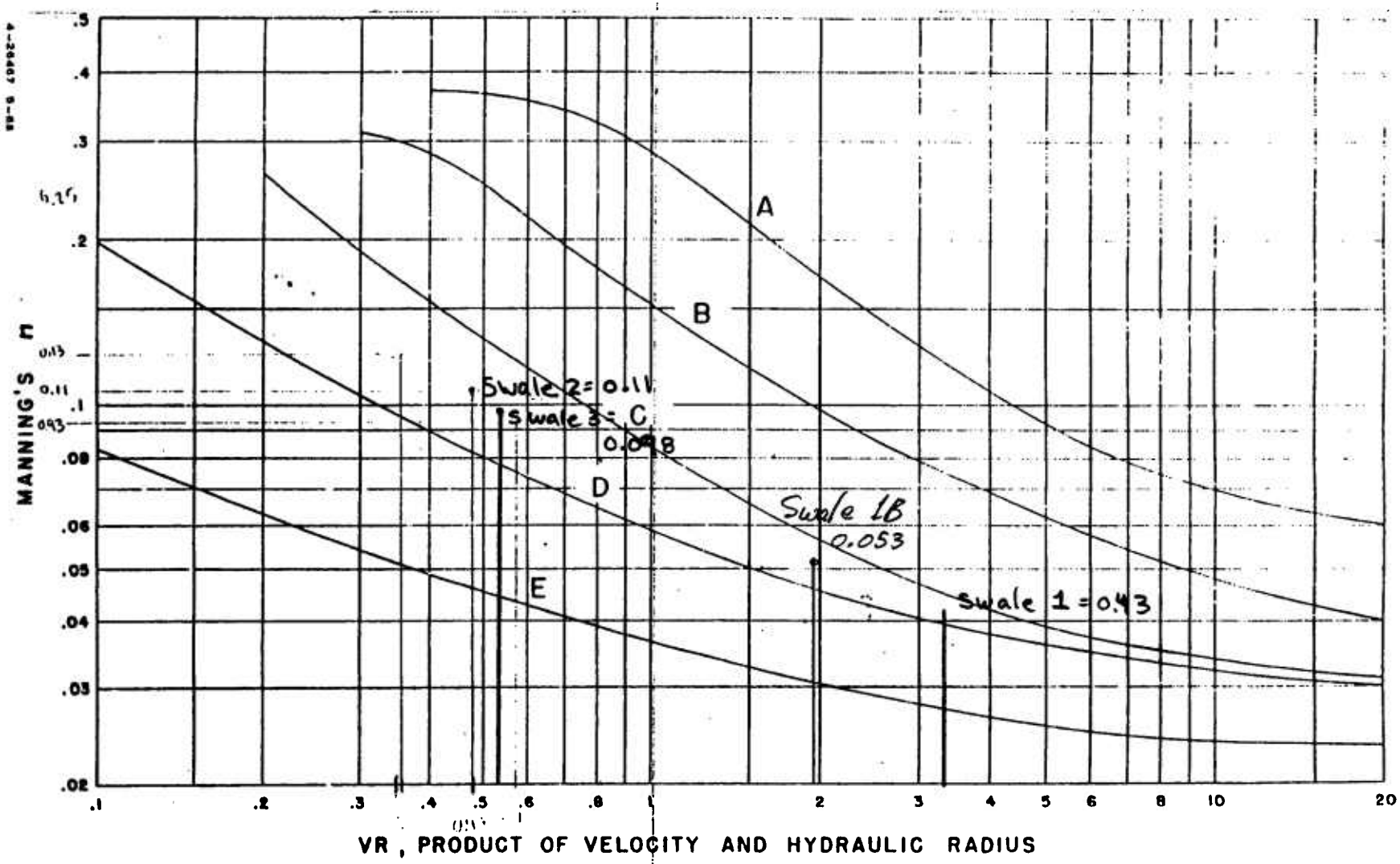


Exhibit 7-1. Manning's "n" related to velocity, hydraulic radius, and vegetal retardance.

R1

ATTACHMENT 8

RIPRAP APRON DESIGN

Figure 5B.13
Outlet Protection Design - Maximum Tailwater Condition
(Design of Outlet Protection from a Round Pipe Flowing Full, Maximum Tailwater Condition: $T_W \geq 0.5D_O$)

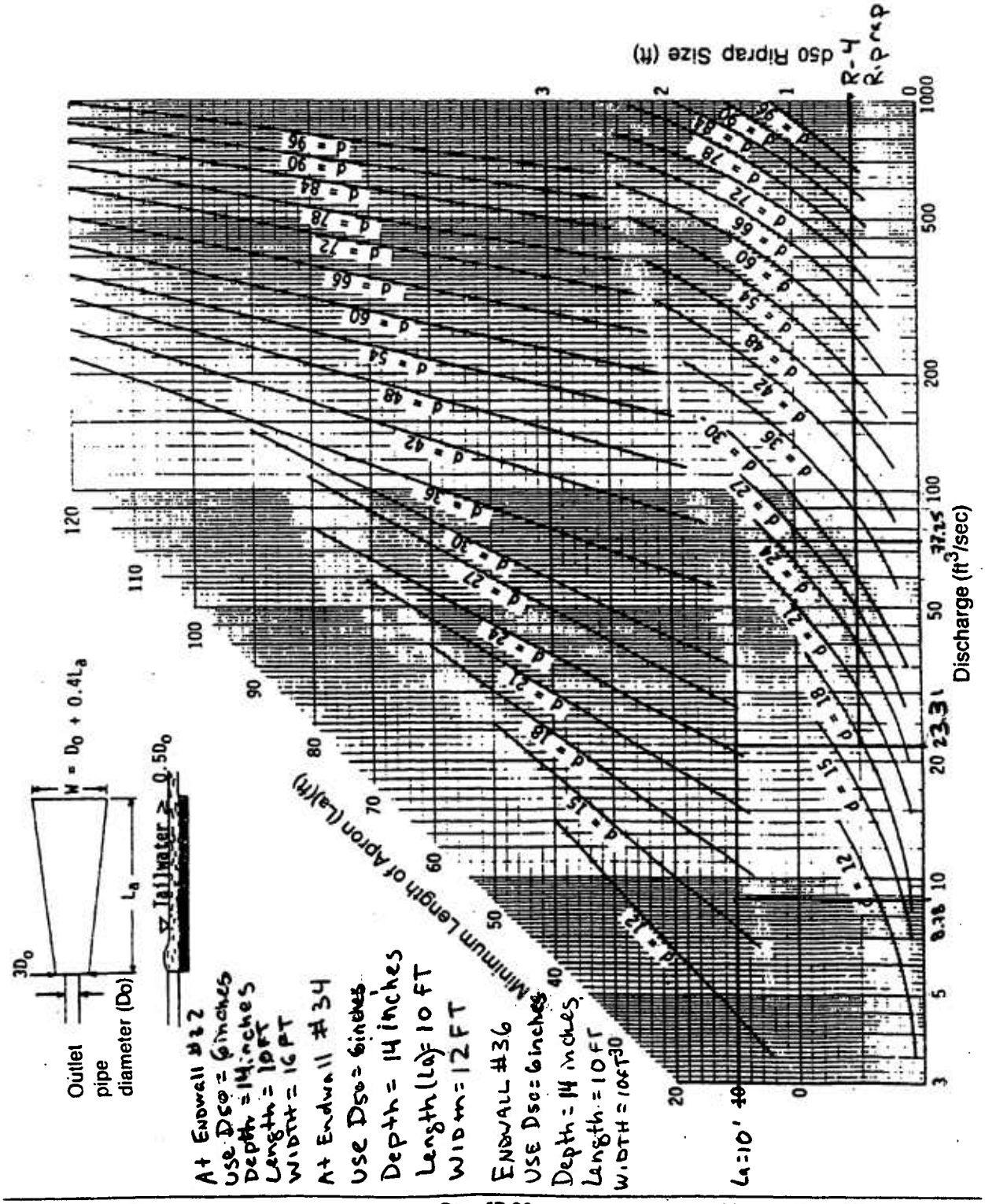
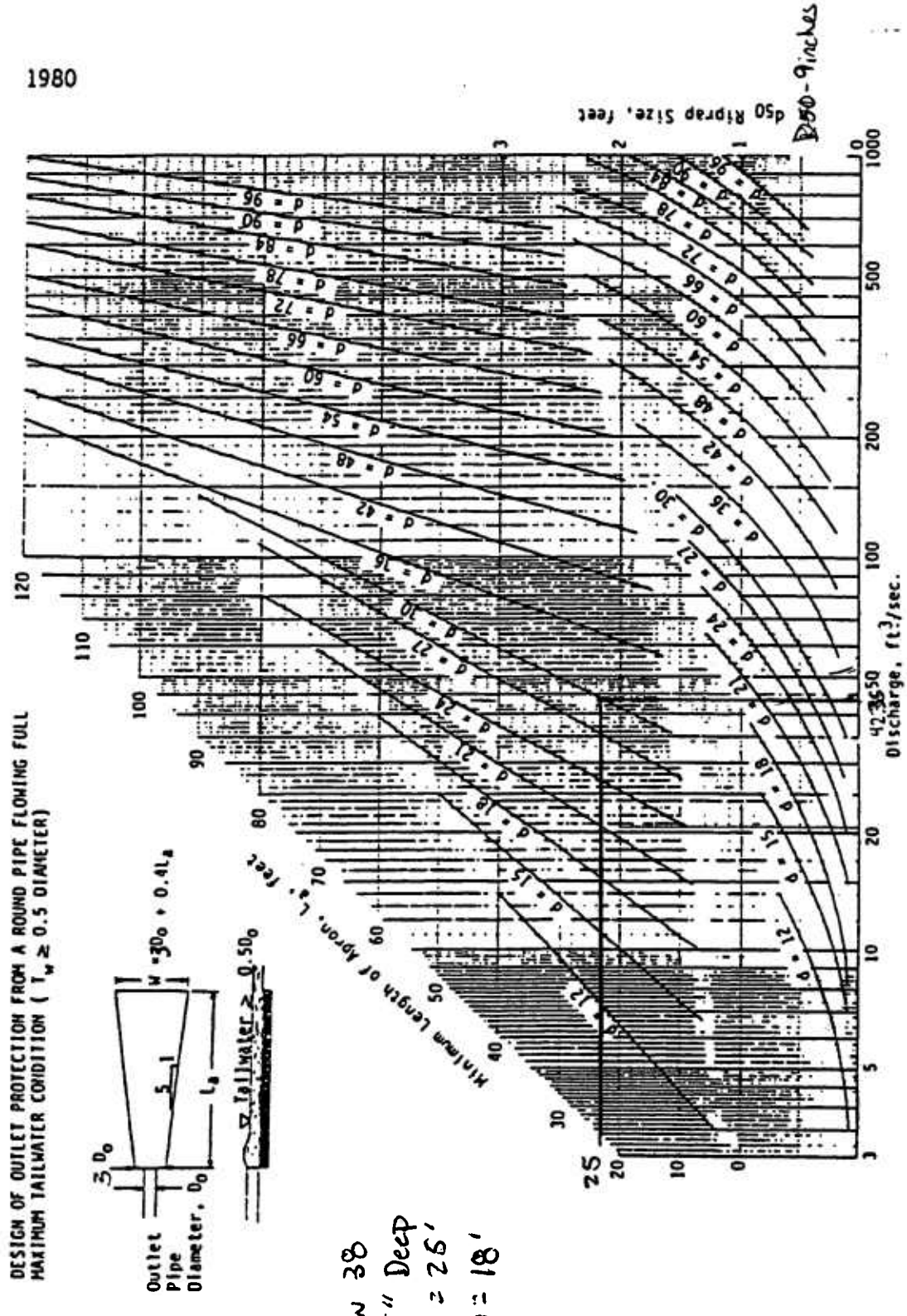
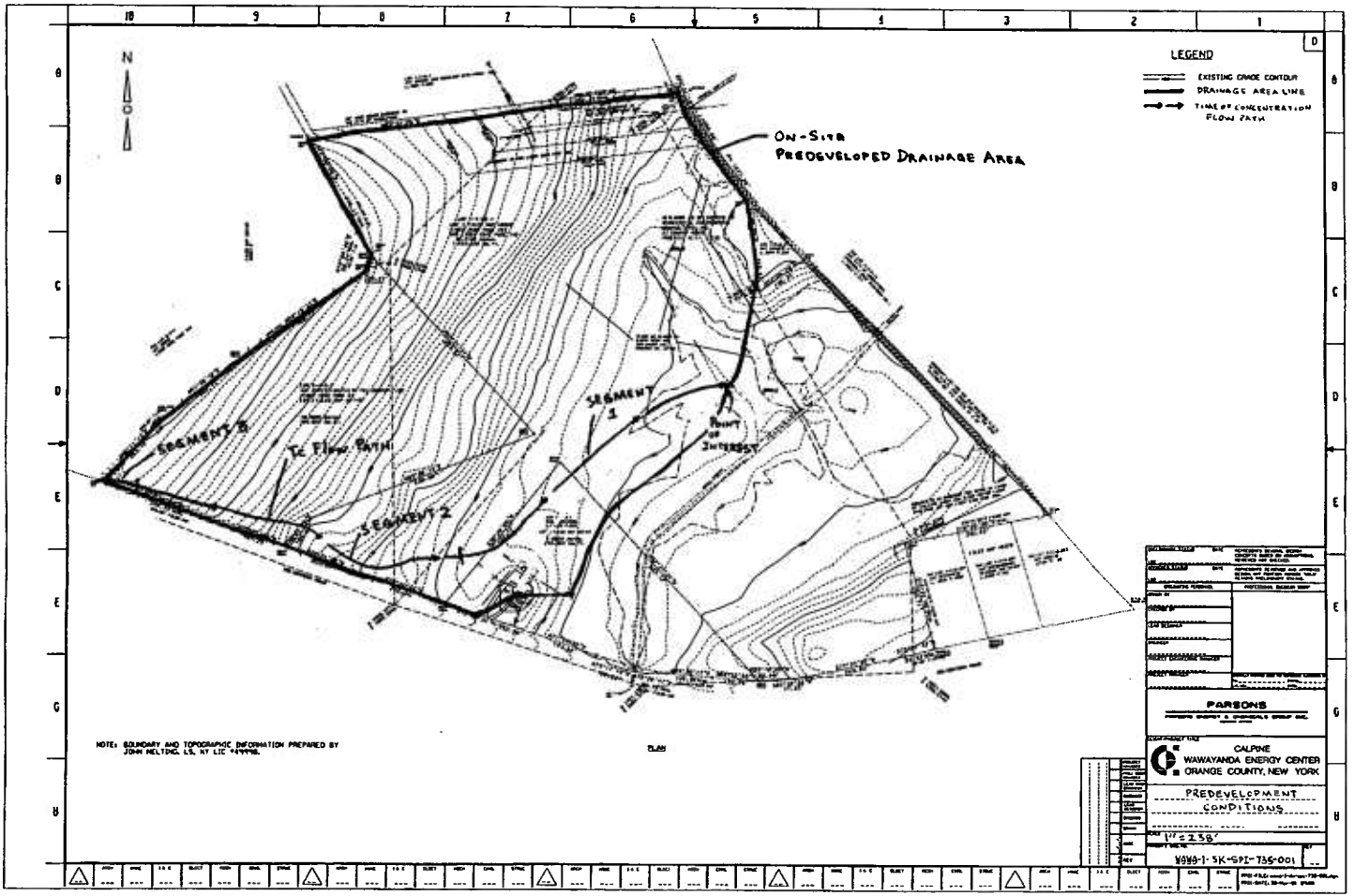
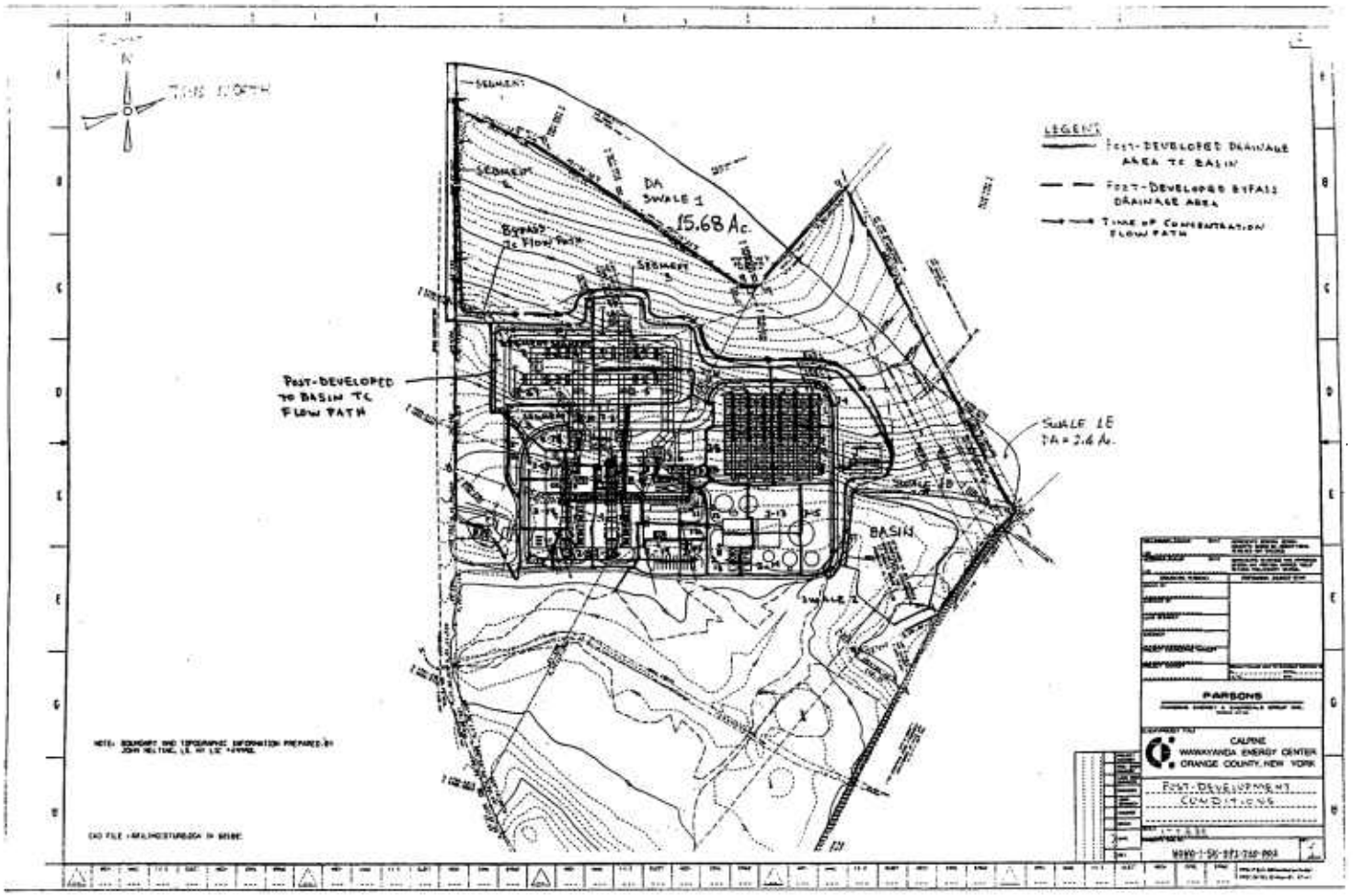


FIGURE 4.13 Apron Design, Maximum Tailwater Condition



Source: USDA-SCS


LEGEND
EXISTING GRADE CONTOUR
DRAINAGE AREA LINE
TIME OF CONCENTRATION FLOW PATH
ON-SITE
PREDEVELOPED DRAINAGE AREA
SEGMENT 3
Tc FLOW PATH
SEGMENT 2
SEGMENT 1
POINT OF INTEREST
N
NOTE: BOUNDARY AND TOPOGRAPHIC INFORMATION PREPARED BY JOHN NELTNER, LS, NY LIC #49998.
PLAN
PARSONS
CALPINE
WAWAYANDA ENERGY CENTER
ORANGE COUNTY, NEW YORK
PREDEVELOPMENT CONDITIONS
1" = 250'
W0W0-1-SK-GPI-736-001


N
LEGEND
POST-DEVELOPED DRAINAGE AREA TO BASIN
POST-DEVELOPED BYPASS DRAINAGE AREA
TIME OF CONCENTRATION FLOW PATH
DA SWALE 1
15.68 Ac.
BYPASS Tc FLOW PATH
SEDIMENT
POST-DEVELOPED TO BASIN Tc FLOW PATH
SWALE 1E
DA = 2.4 Ac.
BASIN
SWALE 1
PARSONS
CALPINE
WAWAYANDA ENERGY CENTER
ORANGE COUNTY, NEW YORK
POST-DEVELOPMENT CONDITIONS

E-3: SPILL PREVENTION AND CONTROL

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PART II: DISCHARGE PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN AND SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

PART III: DISCHARGE CLEANUP AND REMOVAL PLAN

PART IV: ENVIRONMENTALLY SENSITIVE AREAS PROTECTION PLAN

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A DISCHARGE REPORTS
B FINANCIAL RESPONSIBILITY DOCUMENTS
C LEPC LETTER
D PROTECTION AND CLEAN-UP METHODS
E STANDARD OPERATING PROCEDURES
F ANNUAL AND 8-HOUR REFRESHER TRAINING COURSE OUTLINES
G WASTEWATER DISCHARGE PERMIT
H INVENTORY OF ON-SITE AND OUTSIDE RESPONDER CONTAINMENT AND CLEANUP EQUIPMENT
I SOURCES OF INFORMATION

OTHER TABS

MAPS

1. Locus
2. Site Plan
3. Land Use and Drainage Map
4. ESAPP Staging Map
5. ESA Key Map No. 1
6. ESA Key Map No. 2
7. ESA Key Map No. 3

EMERGENCY TELEPHONE NUMBERS

REPORTABLE QUANTITIES (RQ) TABLE

PART I: INTRODUCTION

SECTION 1: REGULATORY REVIEW

This *Discharge Prevention, Containment, and Countermeasure (DPCC) Plan* and *Discharge Cleanup and Removal (DCR) Plan*, and *Spill Prevention Control and Countermeasure (SPCC) Plan*, hereafter referred to as the "DPCC/DCR Plan" has been prepared for the Calpine Newark, Inc. Facility (Facility) to meet the requirements as defined in New Jersey Administrative Code (N.J.A.C.) at 7:1E-1 et seq. and Title 40 of the Code of Federal Regulations (CFR) at Part 112. This DPCC/DCR Plan has the full approval and total support of Calpine Newark, Inc. which will commit the necessary resources required for implementation. The intent of this DPCC/DCR Plan is to provide a working document meeting the requirements of the following three regulatory-mandated documents:

- Spill Prevention Control and Countermeasure (SPCC) Plan - 40 CFR 112;
- Discharge Prevention, Containment, and Countermeasure (DPCC) Plan - N.J.A.C. 7:1E-4.2; and
- Discharge Cleanup and Removal (DCR) Plan - N.J.A.C. 7:1E-4.3.

1.1 Applicable Federal Statutes and Regulations

1.1.1 Federal Water Pollution Control Act (33 USC 1251 et seq.)

The Federal Water Pollution Control Act (FWPCA) established the legislative authority for the United States Environmental Protection Agency (USEPA) to adopt regulations concerning discharges of oil (40 CFR 110) and oil pollution prevention (40 CFR 112). Oil pollution prevention regulations apply to non-transportation-related onshore and offshore facilities that handle oil which could reasonably be expected to reach the navigable waters of the United States or adjoining shorelines in the event of a spill.

As required by 40 CFR 112.3, a SPCC Plan must detail various aspects of spill prevention and control to be implemented at a facility. This DPCC/DCR Plan satisfies these requirements and also serves as the SPCC Plan for the Facility.

The FWPCA further provides USEPA with authority to adopt regulations which designate hazardous substances (40 CFR 116) and notification requirements for reportable quantities (RQ) of spills of hazardous substances (40 CFR 117). Notification requirements for these hazardous substance spills are included in this document.

The United States Coast Guard (USCG) subsequently adopted regulations pursuant to the FWPCA concerning notification procedures for discharges of oil and hazardous substances and procedures for

removal of discharged oil (33 CFR 153). Regulations applicable to marine oil transfer facilities are set forth in 33 CFR 154 and 156. The Facility does not own or operate a marine transfer facility.

1.1.2 Comprehensive Environmental Response, Compensation, and Liability Act (42 USC 9601 et seq.)

Among other things, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) established the legislative authority for USEPA to adopt regulations concerning RQs for releases of hazardous substances (40 CFR 302). These regulations describe notification requirements if a reportable spill of a hazardous substance occurs. "Hazardous wastes" are defined as "hazardous substances" under CERCLA. Notification requirements for reportable spills of hazardous substances are included in this document.

1.1.3 Emergency Planning and Community Right-to-Know Act (42 USC 11001 et seq.)

Section 302 of the Emergency Planning and Community Right-to-Know Act (SARA Title III) requires USEPA to publish a list of Extremely Hazardous Substances and threshold planning quantities. Section 304 establishes requirements for immediate reporting of certain releases of Extremely Hazardous Substances. Regulations promulgated pursuant to these sections of the Act are set forth in 40 CFR 355. Specifically, if a RQ of an Extremely Hazardous Substance is released and non-Facility personnel could be exposed, Local Emergency Planning Committees (LEPC) and the State Emergency Response Commission must be notified in addition to the National Response Center. Notification requirements for reportable spills of Extremely Hazardous Substances are included in this DPCC/DCR Plan.

1.1.4 Resource Conservation and Recovery Act (42 USC 6901 et seq.)

The Resource Conservation and Recovery Act (RCRA) was enacted by Congress in 1976 to provide for the safe disposal of discarded materials and to regulate the management of hazardous waste. Hazardous materials or products are not regulated under RCRA. Subtitle C of RCRA addresses five major elements for the management of hazardous waste:

1. Classification of waste and hazardous waste;
2. Cradle-to-grave manifest system, record keeping and reporting requirements;
3. Standards to be followed by generators, transporters and owners or operators of treatment, storage, or disposal facilities;
4. Enforcement of the standards through a permitting program and civil penalty policies; and
5. The authorization of State programs to operate in lieu of the federal RCRA program.

1.1.5 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Regulations (42 USC 6901 et seq.)

Any employer whose employees are engaged in emergency response must comply with the provisions of 29 CFR 1910.120. This regulation requires employers to prepare and implement an emergency response plan that addresses pre-emergency planning, actions to be taken in the event of an emergency, and post-emergency actions. In addition, employees serving on an emergency response team must receive in-depth emergency response training.

1.2 Applicable New Jersey Statutes and Regulations

1.2.1 Spill Compensation and Control Act (N.J.S.A. 58:10-23.11 et seq.)

Among other things, the Spill Compensation and Control Act (Spill Act) authorized the New Jersey Department of Environmental Protection (NJDEP) to adopt regulations implementing spill prevention and control guidelines, procedures, and requirements. These regulations, set forth in N.J.A.C. 7:1E-1 et seq., are applicable to major facilities that handle petroleum and other hazardous substances. These regulations require that such facilities prepare a DPCC Plan and a DCR Plan. The regulations also establish inspection, record keeping, training, notification and reporting requirements. This DPCC/DCR Plan serves as the DPCC and DCR Plan for the Facility.

1.2.2 New Jersey Solid Waste Management Act (N.J.S.A. 13:1E-1 et seq.)

The New Jersey Solid Waste Management Act (NJSWMA) establishes a statutory framework for the management and coordination of New Jersey's Hazardous Waste Management Program. The Act authorizes the NJDEP to promulgate and administer regulations governing the identification and management of hazardous waste. New Jersey has been authorized to develop and implement its own hazardous waste management program by the USEPA pursuant to RCRA. In many respects, New Jersey's regulations exceed RCRA requirements by regulating more wastes and providing for fewer exceptions and exclusions than allowed under RCRA.

1.2.3 New Jersey Underground Storage Tank Law (N.J.S.A. 58:10A-21-37)

The New Jersey Underground Storage Tank (UST) Law and Regulations (N.J.A.C. 7:14B) are applicable to non-residential storage tanks with capacities in excess of 1,100 gallons. These regulations establish requirements for construction, testing, inspection, containment, monitoring, and decommissioning of USTs. The Facility does not have any USTs.

1.2.4 New Jersey Toxic Catastrophe Prevention Act (N.J.S.A. 13:1K-19 et seq.)

The New Jersey Toxic Catastrophe Prevention Act (TCPA) was established to prevent large-scale releases of Extraordinarily Hazardous Substances to the environment. TCPA authorized NJDEP to adopt implementing regulations N.J.A.C. 7:31-1 et seq. which apply to industrial facilities that use, store, or manufacture listed Extraordinarily Hazardous Substance chemicals in excess of the registration quantity. Registrants are required to develop and implement a Risk Management Program

(RMP) approved by NJDEP.

Anhydrous Ammonia, a TCPA chemical, is currently used at the Facility below TCPA registration quantity. The Facility has de-registered under TCPA but still follow parts of the TCPA RMP.

SECTION 2: SITE-SPECIFIC INFORMATION

In response to the NJDEP rules (N.J.A.C. 7:1E-1 et seq.) for "Discharges of Petroleum and Other Hazardous Substances", the Facility, located in Newark, New Jersey, supplies the following information to address Parts 4.2 and 4.3 of Subchapter 4 of N.J.A.C. 7:1E concerning the development of a DPCC Plan and a DCR Plan for the Facility. This Plan is maintained by Calpine Eastern Corporation and distribution of this Plan, including all amendments, is as follows:

Copy 1	- Facility Manager;
Copy 2	- Shift Supervisor (Control Room);
Copy 3	- Facility Operations Manager and
Copy 4, 5	- New Jersey Department of Environmental Protection (Bureau of Discharge Prevention).

The Facility is capable of generating 60 MW of electrical power. Electricity is produced utilizing a steam turbine generator and a combustion turbine generator. Steam for the steam turbine is supplied by a steam header from the Newark Boxboard Company while the combustion turbine generator operates utilizing natural gas or kerosene from two aboveground storage tanks.

The date of initial operation for the Facility was November 7, 1990, however, operations ceased on December 25, 1992 after a serious fire. Following reconstruction of the Facility, Plant operations resumed in October 1993.

Detailed engineering plans of the Facility are available on-site in the Facility administrative offices. Regulatory agency inspectors and authorized personnel may gain access to these plans by contacting the Facility Manager or Operations Manager during normal working hours. Telephone numbers of these personnel are listed under the Emergency Telephone Numbers Tab. In addition, there are no groundwater monitoring activities on-site.

SECTION 3: CERTIFICATIONS

Calpine Newark, Inc. includes the following certifications in order to comply with N.J.A.C. 7:1E-4.11(a), (b) and (e). A SPCC certification pursuant to 40 CFR 112.3(d) is also included. In addition, Calpine Newark, Inc. can demonstrate financial responsibility (N.J.A.C. 7:1E-4.4) for taking corrective actions (See Appendix B) resulting from the discharge of a hazardous substance and for the

removal of any abandoned structure owned or operated, as the case may be, for the owner or operator.

3.1 Corporate Officials (N.J.A.C. 7:1E-4.11(a))

I certify under penalty of law that the information provided in this document is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant civil and criminal penalties, including the possibility of fines or imprisonment or both, for submitting false, inaccurate, or incomplete information.

_____ _____

Robert Aiff — Date
Senior Vice President
Calpine Eastern Corporation

As reflected in the above noted changes Calpine Newark, Inc. has replaced NRG Generating (Newark) Cogeneration Inc. [whom had previously replaced O'Brien (Newark) Cogeneration Management Inc.] as the owner of record of the cogeneration facility. Since no changes have been made to this document relative to the Environmentally Sensitive Area Protection Plan a revised certification for Section 3.2 has not been made. Additionally, since no physical changes were made to the facility a revised professional certification in Section 3.3 also has not been provided.

3.2 Ecologist and Ornithologist (NJAC 7:1E-4.11(e))

I certify that the Environmentally Sensitive Area Protection Plan (ESAPP) included in Part IV of this DPCC/DCR Plan for O'Brien's Newark Cogeneration Facility, based on acceptable scientific methods and the best information available at the time of this submission, identifies those environmentally sensitive areas that could be affected by a discharge from this facility and the seasonal sensitivities of those areas, provides for protection from, and mitigation of any potential adverse impact on the identified areas, and for an environmental assessment in the event of a discharge.

Thomas J. Belton, M.A.
Ecologist and Ornithologist

Date

3.3 Registered Professional Engineer Certification

I hereby certify that I have examined the facility known as O'Brien (Newark) Cogeneration and that I am familiar with the provisions of 40 CFR 112, "Oil Pollution Prevention". I certify that the O'Brien (Newark) Cogeneration DPCC/DCR Plan dated January, 1995, has been prepared in accordance with good engineering practices.

KEVIN R BRYSON

Printed Name of Registered Professional Engineer

Kevin R. Bryson

Signature of Registered Professional Engineer

Date Signed 3/29/95 Registration No. 25407

PE Seal

SECTION 4: AMENDMENTS TO PLAN (N.J.A.C. 7:1E-4.8)

Written notice shall be provided to the NJDEP at least 60 days prior to commencement of any new construction or installation, substantial modification or replacement of an aboveground storage tank or storage space, any appurtenant structures, or leak detection or other monitoring, prevention or safety system or device.

Within 30 days, any change in Facility design, construction, operation or maintenance which could materially affect the potential for discharges will be reported to NJDEP. This DPCC/DCR Plan will be updated to reflect the change prior to submittal for approval. Amendments to this DPCC/DCR Plan will be certified in accordance with N.J.A.C. 7:1E-4.11. Amendments to this Plan will be implemented promptly upon approval by the NJDEP.

At least once every three years, this Plan will be reviewed and evaluated by the Operations Manager and Facility Manager to assure continued compliance with regulations and to ensure that the Plan still reflects actual practices. A renewal notice will be sent to NJDEP which will consist of the revised Plan or a certification stating the existing Plan on file is current. The renewal will be certified in accordance with N.J.A.C. 7:1E-4.11, and as appropriate, with 40 CFR 112.

The following table for amendments and review shall be updated whenever changes or amendments to this DPCC/DCR Plan are made.

DPCC/DCR PLAN TABLE FOR AMENDMENTS AND REVIEW

4.1 DPCC/DCR Plan Review

Reviews to this Plan will be made on a regular basis and recorded below. Amendments to this Plan shall be reviewed by the Operations Manager and Facility Manager to determine the need for certification by a New Jersey Registered Professional Engineer.

Date	Authorized Signature	Section Changed or Reviewed

SECTION 5: CROSS-REFERENCE TABLE FOR 40 CFR 112 AND N.J.A.C. 7:1E-1 et seq.

5.1 SPCC and DPCC/DCR Cross-Reference Table

The following table has been created to satisfy the requirements as set forth in a jointly prepared document by the USEPA Region II and the NJDEP to assist facilities combining their SPCC and DPCC/DCR Plans. Since the following DPCC/DCR Plan does not follow the sequence of 40 CFR 112.7, this cross-reference table is to be used to find the applicable sections within this Plan in accordance with 40 CFR 112.7.

40 CFR 112 CITATION	APPLICABLE SECTION IN DPCC/DCR PLAN (N.J.A.C. 7:1E-1 et seq.)	PART	PAGE NUMBER
112.7(a)	1.7 Discharge History	II	II-3
112.7(b)	4.1.1 Discharge Scenarios	IV	IV-29
112.7©	2.4.1 Containment Systems 2.4.2 Diversionary Systems	II	II-6 II-8
112.7(e)(1)(i)	2.4.1.1 Outdoor Tanks 2.10 Housekeeping and Maintenance	II	II-6 II-12
112.7(e)(1)(ii)	N/A (No discharge to water)	----	----
112.7(e)(1)(iii)	N/A	----	----
112.7(e)(1)(iv)	N/A	----	----
112.7(e)(1)(v)	N/A	----	----
112.7(e)(2)(i)	2.1.1 Outdoor Storage Tanks	II	II-4
112.7(e)(2)(ii)	2.4 Secondary Containment/Diversion Systems	II	II-6
112.7(e)(2)(iii)	N/A	----	----

40 CFR 112 CITATION	APPLICABLE SECTION IN DPCC/DCR PLAN (N.J.A.C. 7:1E-1 et seq.)	PART	PAGE NUMBER
112.7(e)(2)(iv)	N/A	----	---
112.7(e)(2)(v)	N/A	----	----
112.7(e)(2)(vi)	2.2 Matrix Analysis For Tank Testing	II	II-5
112.7(e)(2)(vii)	N/A	----	----
112.7(e)(2)(ix)	N/A	----	----
112.7(e)(2)(x)	2.10 Housekeeping and Maintenance	II	II-12
112.7(e)(2)(xi)	2.4.1.3 Mobile or Portable Tanks	II	II-7
112.7(e)(3)(i) 112.7(e)(3)(ii)	2.6 In-Facility Pipes For Hazardous Substances	II	II-10
112.7(e)(3)(iii)	2.9.5 Pipeline Inspections	II	II-12
112.7(e)(3)(iv)	2.10 Housekeeping and Maintenance	II	II-12
112.7(e)(3)(v)	2.9.5 Pipeline Inspections	II	II-12
112.7(e)(4)(i) 112.7(e)(4)(ii) 112.7(e)(4)(iii) 112.7(e)(4)(iv)	2.3 Tank Truck Transfer Areas	II	II-5
112.7(e)(8)	2.10.2 Inspections and Preventative Maintenance	II	II-14
112.7(e)(9)	2.12 Description of Security	II	II-16
112.7(e)(10)	2.11 Training Program	II	II-14

PART II: DISCHARGE PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN AND SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

SECTION 1: GENERAL INFORMATION

Part 4.2 of Subchapter 4 of N.J.A.C. 7:1E specifically states, "*the owner or operator of a major facility shall prepare a DPCC Plan demonstrating compliance with the standards in N.J.A.C. 7:1E-2, and shall appoint a response coordinator for each site who shall be responsible for insuring compliance with the DPCC Plan, the Act, and this Chapter. The response coordinator shall be responsible for submission of all reports required by this chapter to the Department.*"

The sections in Part II outline the DPCC Plan requirements for the Facility.

1.1 Facility Information (N.J.A.C. 7:1E-4.2(b)1)

Name:	Calpine Newark, Inc.
Address:	35 Blanchard Street Newark, NJ 07105
Phone Number:	(973) 817-7936
Town:	Newark
County:	Essex
Coordinate Centroid (NJ):	2,151,800, 693,400

Tax Lot and Block Information

This Plan includes the following property (taken from current City of Newark tax records):
Lot: 75 Block: 2412

1.2 Owner/Operator (N.J.A.C. 7:1E-4.2(b)2)

Owner
Calpine Newark, Inc.
35 Blanchard Street
Newark, NJ 07105
(973) 817-7936

Operator
Calpine Newark, Inc.
35 Blanchard Street
Newark, NJ 07105
(973) 817-7936

1.3 Registered Agent (N.J.A.C. 7:1E-4.2(b)3)

The owner's registered agent is:

Robert Alff, Senior Vice President
Calpine Eastern Corporation
The Pilot House, 2nd Floor
Lewis Wharf
Boston, MA 02110
(617) 723-7200

1.4 Site Plan (N.J.A.C. 7:1E-4.2(b)4)

The Newark facility occupies approximately two acres of land. A Locus Map (Map Tab, Map 1) shows the site location. The boundary or lease line of the site is shown in the site plan. A general Site Plan (Map Tab, Map 2), reflecting the current facility conditions, was prepared by reviewing an existing Site Plan in association with a site walkdown and survey of the entire Facility to determine and correct any discrepancies.

This map was developed showing the locations of bulk storage tanks, drum storage areas, process buildings, regularly used transfer areas, and any other structures in or on which hazardous substances are stored or handled, or which are used for the prevention of discharges of hazardous substances. Table II-1[1], Facility Storage & Process Areas, presents an itemized list of containers and equipment where hazardous substances are stored or utilized. Table II-2, Facility Truck Unloading Area, presents an itemized list of truck unloading areas where hazardous substances are unloaded from tank trucks. For each item number, Tables II-1 and II-2 provide grid coordinates that correspond to the

[1] Tables II-1 through II-3 are located in Section 4 of Part II.

Inventory Map. Thus, by cross-referencing Tables II-1 and II-2 with the Site Plan, storage tanks, process areas, containers, and tank truck unloading areas can be located quickly.

1.5 Drainage and Land Use Map (N.J.A.C. 7:1E-4.2(b)5)

The Drainage and Land Use Map (Map 2) was prepared in accordance with the items specified in N.J.A.C. 7:1E-4.10. The drainage element of this Plan was completed by on-site inspection and verification of the existing Site Plan, survey, and data sources.

Off-site storm sewers were located from information obtained through the City of Newark engineers office. The primary data source used to map watercourses was the "MarkHurd" State of New Jersey Wetland Maps. United States Geological Survey (USGS) 7.5 minute quadrangle maps were used as a secondary data source. The NJDEP, Environmental Regulation Program, was contacted for listings and locations of all water supply wells generating more than 100,000 gallons per day.

1.6 Topographical Maps (N.J.A.C. 7:1E-4.2(b)6)

See Part IV, Environmentally Sensitive Areas Protection Plan (ESAPP), Section 2.2, for a discussion of topographical maps prepared in accordance with the format prescribed in N.J.A.C. 7:1E-4.10. Maps are provided in the Map Tab.

1.7 Discharge History (N.J.A.C. 7:1E-4.2(c))

A description of any reportable discharge event at the Facility since the last plan approval is included in Appendix A, Discharge Reports, of this DPCC/DCR Plan, as well as a description of any corrective actions taken and plans for preventing recurrences. There have been no reportable spill incidents since the last plan approval.

SECTION 2: TECHNICAL INFORMATION

2.1 Storage Areas at the Facility (N.J.A.C. 7:1E-4.2(d)1)

The facility has a total above ground-storage capacity of 319,460 gallons. All facilities that rest on-grade are rested on an impermeable barrier of concrete. All above ground storage tanks that have a capacity of 2,000 gallons or less (See Table II-1) will have an individual present at all times during the filling procedures pursuant to N.J.A.C. 7:1E-2.2(e). All above ground storage tanks that have a capacity over 2,000 gallons (See Table II-1) are equipped with overfill lines and secondary containment pursuant to N.J.A.C. 7:1E-2.2(d). Table II-1 provides details on the overflow protection

devices that are provided with each tank. In addition, the Facility will employ the use of direct communication between tank gauger and the pumping station at all times during storage tank filling as part of its SOPs and as required by N.J.A.C. 7:1E2.2(d). There are no underground tanks at the facility. The caustic tank is equipped with an internal coil electric heater.

2.1.1 Outdoor Storage Tanks

Fuel Oil Tanks

Two fuel oil storage tanks (Item No. 1), have a combined 260,000 gallon (130,000 gallons each) storage capacity. These tanks are utilized for storing kerosene for the combustion turbine generator and are located at coordinates N1+43 and E0+16 on the Inventory Map. Secondary containment for the tanks is provided by a concrete floor and diked area. Pipes leading to and from each tank which enter the tank below the liquid level are equipped with valves that are readily accessible in the event of a leak or discharge. The valves are sufficiently close to the tank so that they can prevent the contents of the tank from escaping the secondary containment area in the event of a pipe rupture outside the containment area. There are no internal heating coils in the tanks.

Facility operating personnel conduct surveillance of the tanks and associated equipment daily. Visual inspections are performed on a daily, weekly, monthly and quarterly basis pursuant to NJDEP regulations and API 653 guidance. Copies of the checklists utilized for the inspections are included in Appendix E - Standard Operating Procedures. Special emphasis is placed on proper housekeeping and maintenance practices to minimize any potential problems (Refer to Part II, Section 2.10, Housekeeping and Maintenance).

The inspection and testing schedule established for the tanks is presented in Part II, Section 2.2, Matrix Analyses for Tank Testing. Fuel oil for these tanks is delivered via tank truck.

Miscellaneous Outdoor Tanks

Table II-1 includes a listing of remaining aboveground storage tanks in service at the Facility and provides detailed information, including tank location and grid coordinates used to locate each tank on the Inventory Map, tank capacity, tank contents, and type of containment. Tanks are constructed in accordance with appropriate specifications (i.e., API, ASME, ASTM, etc). These tanks are equipped with valves that are readily accessible in the event of leak or discharge, and which are sufficiently close to the tank so that they can prevent the contents of the tank from escaping outside the secondary containment in the event of a pipe rupture outside the containment area.

The following six (6) aboveground tanks are located outdoors:

Anhydrous ammonia storage tank	Item No. 2;
Caustic storage tank	Item No. 3;
Acid storage tank	Item No. 4;
Cooling tower water additive	Item No. 5;
Boiler water additive	Item No. 6; and
Oxygen Scavenger	Item No. 7.

2.1.2 Mobile or Portable Storage Tanks

Mobile or portable storage tanks may be used at the Facility to provide transfer capacity during maintenance operations and construction activities. These tanks are protected by adequate secondary containment of sufficient capacity to contain or divert the contents of the tanks.

2.1.3 Drum Storage Areas for Hazardous Substances

Two (2) drum storage areas at the Facility (Item Nos. 17 and 18) are used for the storage of hazardous substances in drums. These areas are identified in Table II-1. Drum storage areas are either located indoors or within portable covered containment skids especially designed to prevent discharges of hazardous substances. Materials are typically stored in these areas in 55-gallon drums and include such items as lubricating oil, sulfuric acid, and boiler water treatment chemicals.

2.2 Matrix Analyses for Tank Testing (N.J.A.C. 7:1E-2.2(a)4)

The exterior and interior of every aboveground storage tank with a capacity greater than 2,000 gallons was integrity tested after completion of reconstruction following a December 1992 fire. Since then, the facility has committed to following the API 653 protocol for tank inspection. The API 653 protocol comprises 4 components; 1) monthly on-site visual inspections by facility personnel with results logged and filed, 2) external visual inspection by an API 653-certified inspector, 3) in service ultrasonic inspections, and 4) internal inspections. The ultrasonic inspection for those tanks that rest on legs or elevated supports will be performed externally on the exposed bottoms. This includes the caustic, acid, and ammonia storage tanks. Since the kerosene tanks rest on a concrete pad, the ultrasound testing will need to be performed internally. Table II-3 provides a description of the tanks entered into the API 653 program, their history of testing and the dates of upcoming inspections pursuant to API 653. Testing for all other permanent facility tanks will be performed in accordance with manufacturer's recommendations/instructions and accepted industry standards which include, but are not limited to ASME Section V, ASME Section VIII, and ASME Section X.

2.3 Tank Truck Transfer Areas (N.J.A.C. 7:1E-4.2(d)2)

Table II-2 lists the (Item No. 19) hazardous substance tank truck unloading location at the Facility. The fuel oil and acid/caustic unloading areas have containment areas that consist of sloped concrete pads surrounded by a trench with grating. The trench drains to the containment of the fuel oil storage tanks and then can be directed into the oily water sump or chemical sump.

To ensure maximum protection of Facility employees, the public, and the environment, a generic SOP for tank truck deliveries of acids, caustics, kerosene and ammonia has been developed. SOP #13 has been revised and is included in Appendix E for reference. The SOP includes provisions for chocks to be placed under the tires of tank trucks before delivery to prevent tank truck departures prior to complete disconnection of transfer lines, as required by N.J.A.C. 7:1E-2.3(d). There are no rail car unloading areas at the facility.

2.4 Secondary Containment/Diversion Systems (N.J.A.C. 7:1E-4.2(d)4)

To the maximum extent practicable, all areas of the Facility in which hazardous substances are routinely stored, processed, or transferred have been constructed to prevent the largest probable spill from flowing, draining, or leaching into the lands and waters of the State of New Jersey. In addition, overfill lines on storage tanks are diverted into secondary containments.

Small spills into containment systems or onto concrete or asphalt will be cleaned up immediately as described in Part II, Section 2.10, Housekeeping and Maintenance, of this DPCC/DCR Plan. Large spills into dikes will be addressed by the Site Emergency Coordinator (SEC) according to the type of material spilled. An immediate attempt will be made to contain large spills with sorbent materials or pads to keep the spilled material on the concrete or asphalt.

2.4.1 Containment Systems

Impermeable containment systems are in place at the Facility where practicable. Such systems have been designed and are maintained to block all probable routes by which spilled hazardous substances could reasonably be expected to flow, migrate, or escape from within the contained area. Several different types of secondary containment and diversion structures are used at the Facility. These structures include dikes, curbs, drip pans, and sumps. Equipment and systems without individual secondary containments are under daily surveillance by Facility personnel to guard against spills and/or are diverted to one of two collection sumps described in Part II, Section 2.4.2.1.

2.4.1.1 Outdoor Tanks

Fuel Oil Storage Tanks

The secondary containment for the fuel oil storage tanks consists of a concrete dike, with two kerosene pipes penetrating one wall and the floor of the dike. These penetrations have been sealed so that the integrity of the secondary containment is not impaired. Rainwater collected inside the secondary containment either flows to the oily water sump for processing through the oil/water separator or is allowed to evaporate.

Other Aboveground Storage Tanks

All tanks located outdoors have concrete or steel dike containment systems. Pipes that penetrate any walls, dikes, or berms used as secondary containment have been or will be (See Table II-1) properly sealed so that the integrity of the secondary containment is not impaired. Rainwater collected inside secondary containment is manually pumped and processed through the oil/water separator or chemical waste neutralization sump as appropriate.

2.4.1.2 Indoor Process Equipment Reservoirs

All indoor process areas are supplied with diversionary systems allowing spills to be diverted into plant drains leading to one of the sumps. In addition, larger indoor process equipment reservoirs are contained within curbed areas. In the event of an equipment failure releasing a hazardous substance within the building, the spilled material will either be contained by isolation within curbed areas or at one of the Facility sumps (i.e., the building will act as containment). These sumps will flow to either the oil/water separator or chemical neutralization tank. Thus, all indoor containers and equipment are provided with containment or regulated diversion for the maximum possible protection of the environment.

Leaks are prevented from reaching the lands or waters of the State by employing good housekeeping and maintenance procedures (i.e., inspections and checklists) as described in Part II, Section 2.10, Housekeeping and Maintenance.

2.4.1.3 Mobile or Portable Tanks

When mobile or portable tanks are required, they will be protected by adequate secondary containment of sufficient capacity to contain or divert the contents of the tanks.

2.4.1.4 Drum Storage Areas for Hazardous Substances

Drum storage areas at the Facility, identified in Table II-1 and described below by item number, are

Facility sumps. Two drum storage areas at the Facility (Inventory Map Item Nos. 17 and 18) are used for the storage of hazardous substances in drums.

A drum storage area for lube oil (Item No. 17) is located adjacent to the gas combustion turbine generator within the power plant building. These drums are used to refill the lube oil dispensing skid (Item No. 8). Containment for the drums is provided by containment/diversion to one of two building sumps.

Drum storage for sulfuric acid (Item No. 18) is located outside southwest of the cooling water towers. These drums are used to supply acid for the demineralized water process. Containment for the drums consists of a portable containment skid. The drums are plastic in order to prevent corrosion.

2.4.1.5 Oil-Containing Electrical Equipment

The Facility maintains two transformers as part of the electrical system. In order to prevent discharges, each transformer is equipped with individual secondary containment consisting of a concrete dike. In addition, operators perform a daily inspection of each transformer and associated containment structure. A written checklist, used for each inspection, is completed daily and maintained in a file at the Facility.

2.4.2 Diversionary Systems

Spills that may occur at the Facility are either directly contained or drawn into a collection/diversionary system which discharges into one of the underground sumps prior to treatment and disposal. Effluent water from the sumps is discharged into the City of Newark sewer system which goes to the Passaic Valley treatment facility. A letter of agreement authorizes the Facility to discharge effluents to the city sewer system. A copy of the POTW permit is provided in Appendix G.

2.4.2.1 Underground Sumps

There are two underground sumps at the Facility which are used to capture spills of waste oils and chemicals occurring in process areas, containment dikes, and truck unloading areas. The oily water sump (Item No. 14) is constructed of concrete, has a capacity of 5,385 gallons, and serves as a collection area for oily water from various Facility drains, containments, and equipment. Waste oil and water collected by the oily water sump is pumped to an oil/water separator for treatment and disposal. Treated water is injected to the City of Newark sanitary sewer while the waste oil is drummed for disposal. The oily water sump is equipped with a level indicator and alarm monitored continuously in the Facility control room.

The 2,115 gallon chemical waste collection sump (Item No. 16) is constructed of concrete and serves to collect chemical effluent from various process areas and containment dikes throughout the Facility. Chemical wastes collected by the sump are pumped to a 20,000 gallon neutralization tank prior to injection into the City of Newark sanitary sewer. The chemical waste sump is equipped with a level indicator and alarm monitored continuously in the Facility control room.

2.4.3 Spills Within the Building

Numerous process vessels and other equipment that contain hazardous liquids are located in the power plant building. Some of the process equipment is contained within curbed areas; however, failure of associated piping could result in a spill onto the floor of the building. Once a spill is detected, the sumps will be isolated, thus containing the spill within one of the sumps. Appropriate Facility personnel or clean-up contractors will be summoned to clean up the spill before the material can escape to the environment.

2.5 Process Areas For Hazardous Substances

A spill from any of the process areas located inside the power plant building can be contained within the building or at one of the sumps. The following subsections briefly describe the primary process areas within the power plant building.

2.5.1 Demineralizer Area

The demineralizer anion and cation resin beds are routinely regenerated. The regeneration process uses sulfuric acid and sodium hydroxide solutions (Item Nos. 3 and 4) to restore the resins to their useful form. Containment/diversion for this area is provided by the chemical waste neutralization sump.

2.5.2 Boiler Chemical Feed

HRSG treatment chemicals are routinely used in the boiler water treatment process to maintain a specified quality of boiler feedwater. The treatment chemicals are stored in 1,000 gallon tanks outside the power plant building and are pumped into the boiler water as required. Secondary containment for each tank is supplied by a steel dike.

2.5.3 Lubricating Oil System

Lubricating oils are used throughout the Facility for efficient and reliable operation of equipment. These oils are generally stored inside contained reservoirs and are piped to the individual equipment which they support. If oil leaks escape containment, oil will flow to Facility drains which are piped to one of the underground sumps prior to treatment and discharge to the City of Newark sewer system.

2.5.4 Oil-Containing Electrical Equipment

Transformers are filled with dielectric fluid to provide cooling and electrical insulation and are designed to operate as self-contained, sealed units. The two transformers at the Facility are provided with secondary containment structures to provide maximum protection to the environment.

2.6 Facility Pipes For Hazardous Substances

The Facility complies with the New Jersey Right-to-Know labeling requirements. The Right-to-Know law is designed to protect and inform Facility employees, contract workers, and outside emergency responders who could be called into the Facility for assistance of potential hazards associated with hazardous substance piping and equipment. Whenever possible, new pipe installations will be installed aboveground. Pipelines not in service will be capped or blank-flanged at the terminal connection at the transfer point.

2.7 Marine Transfer Area Lighting(N.J.A.C. 7:1E-4.2(d)5)

The Facility does not own or operate a marine transfer facility.

2.8 Flood Hazard Areas (N.J.A.C. 7:1E-4.2(d)6)

Flood Insurance Rate Maps[2] (FIRM) were used to determine if the Facility is within a flood hazard area. Panel 5 of the Newark, New Jersey FIRM indicates the entire Facility property is located above the 100- and 500-year flood plain boundaries. Thus all major structures, process areas, and hazardous substance tanks are adequately protected from flooding or washout.

2.9 Leak Detection/Monitoring (N.J.A.C. 7:1E-4.2(d)7)

Storage tanks over 2,000 gallons at the Facility are equipped with high liquid level alarms with an audible or visual signal designed to alert personnel of overfills. In addition, the Facility will employ the use of direct communication between tank gauger and the pumping station at all times during storage tank filling as part of its SOPs and as required by N.J.A.C. 7:1E-2.2(d).

In order to detect any leaks or discharges, visual inspections of all equipment and portions of the major facility in service using hazardous substances are performed in accordance with SOPs. At a minimum, visual inspections shall be performed:

- prior to each use for all transfer areas lighting, and all aboveground transfer valves, pumps, flanges and connections, unless they are not readily accessible, that are to be used in the transfer;
- prior to each use all flexible hose lines used in material transfers are visually inspected and visibly damaged or deteriorated hoses are immediately taken out of service;
- once daily for process areas and all secondary containment systems for aboveground storage tanks which are not impermeable;
- once weekly for all other storage areas and secondary containment or diversion systems, and all aboveground pipes;
- once quarterly for all other aboveground valves, pumps, flanges, connections and equipment, and all security fences and locks; and
- once every five years for the interior of aboveground tanks, unless the tank has an inspection and maintenance program that is in compliance with API 653. Aboveground tanks with a

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2 U.S. Department of Housing and Urban Development (Effective Date: March 28, 1980)

capacity of 2,000 gallons or less are exempt from this requirement (See Section 2.2, Matrix Analysis for Tank Testing).

See Section 2.10, Housekeeping and Maintenance, and Section 2.13, Standard Operating Procedures, for a discussion of inspection procedures.

2.9.1 Fuel Oil Storage Tanks

Visual inspections of the fuel oil storage tanks and containment system are performed daily to identify any leaks. To further reduce the risk of an unnoticed leak escaping to containment, fuel level is recorded daily and upon receipt of a fuel oil delivery. (See Visual Inspection Checklist in Appendix E).

2.9.2 Other Tanks and Containers

Equipment located inside the power plant building are protected by containment/diversion to one of the underground sumps. All storage tanks and equipment located outdoors have appropriate containment systems as described in Part II, Section 2.4, Secondary Containment/Diversion Systems. Contents escaping from any of these tanks would be identified during daily inspections (Refer to Part II, Section 2.10, Housekeeping and Maintenance). In general, leaks can be prevented from reaching the waters of the State by employing good housekeeping and maintenance procedures as described in Part II, Section 2.10.

2.9.3 Underground Sumps

The Facility has two concrete sumps which are equipped with level alarms and continuously monitored by the Facility control room.

2.9.4 Oil-Containing Electrical Equipment

Two transformers maintained by the Facility are located within secondary containment and are inspected during daily rounds for evidence of leaks.

2.9.5 Pipeline Inspections

Housekeeping checklists are being developed to provide for regular inspections of pipelines as per N.J.A.C. 7:1E-2.10. During these inspections, operators examine the general condition of pipelines, including flange joints, expansion joints, valve gland packing and bodies, catch pans, pipeline supports, valve position locking (if applicable), and metal surface conditions.

2.10 Housekeeping and Maintenance (N.J.A.C. 7:1E-4.2(d)8)

2.10.1 Housekeeping

To minimize the potential for accidental spills, all hazardous substances at the Facility are maintained in containers (e.g., tanks and drums) or equipment suitable for their storage, use, or processing. Stationary containers exposed to the elements are protected with corrosion inhibitors. Table II-1 identifies the composition of containers used at the Facility.

If a spill does occur, it is cleaned up promptly. The DCR Plan, presented in Part III, details the procedures used to clean up a spill or discharge. If an equipment leak is detected, the leaking material is captured and contained using drip pans, buckets, sorbent materials, or pads. The leaking equipment, where practical, will be promptly repaired, replaced, or taken out of service within 15 days after the leak is detected unless the shutdown of a process unit is necessary. The leak will be repaired at the earliest period in which either the process unit is not in operation or the particular unit is out of service, whichever occurs first.

All spills or loose quantities of hazardous substances are promptly cleaned up and kept from remaining on the grounds, floors, walls or equipment, or other places within the Facility. The Facility has adequate quantities of sorbent materials and a spill kit for emergencies. Because bulk storage tanks and most pieces of equipment that use hazardous substances have secondary containment devices, spills or loose quantities of hazardous substances will be prevented from reaching the lands or waters of the State. Operators conducting inspections are trained to identify spills, whether contained or not, and these occurrences are immediately reported to the Shift Supervisor. Spill and discharge response procedures are detailed in the Facility Spill/Discharge Emergency Response Standard Operating Procedure in Appendix E.

Facility personnel are trained and instructed to use appropriate personal protective equipment (PPE) while cleaning up spills of hazardous materials. A supply of PPE, including boots, gloves, and respirators, is maintained at the Facility.

Flexible hoselines used to transfer hazardous substances are visually inspected prior to each use. Visibly damaged or deteriorated hoses are immediately taken out of service and removed from the work area.

2.10.2 Inspections and Preventive Maintenance

The Facility uses a computerized system to ensure inspections and/or preventive maintenance occurs as scheduled and as required. The Facility uses a computerized maintenance management system, to assist plant management, operations, and maintenance personnel in carrying out an effective maintenance program. To supplement the system, SOPs and checklists are used to ensure all critical equipment and systems are inspected routinely or, if necessary, daily. The computerized maintenance management system and SOPs will provide inspection prompts to detect leaks or spills of hazardous substances and detect potential equipment failures. Emergency response equipment (e.g., sorbent material), PPE, hazardous waste storage areas, bulk storage tanks, and secondary containment systems will all be inspected as required by the computerized system or SOPs. Inspections may be initiated by the computerized system or by SOPs. The supervisor in charge of inspections may note deficiencies and, if necessary, initiate a work order to correct the deficiency. Spills or discharges identified through an inspection and/or the computerized system will be immediately reported to the Shift Supervisor. Inspection records are stored and are available on demand.

Other inspection procedures include patrolling the process lines and in-facility pipes for leaks when starting up or shutting down process equipment, ensuring prompt cleanup and repair of any defective components or equipment, and evaluating Facility security.

2.11 Training Program (N.J.A.C. 7:1E-4.2(d)9)

The Facility has a training program so that all employees receive basic site training. Other employees receive training relevant to their specific job descriptions as appropriate. Appendix F lists the program at the facility for training employees involved in the handling of hazardous substances. N.J.A.C. 7:1E-2.12(b) specifies minimum requirements for contents of the training program. Following is a summary description of the existing training program.

The facility manager is responsible for ensuring all plant employees are trained. All employees are issued a qualification card that lists the requirements to be completed for the qualification of a particular operations position and is an official record of an individual's qualification. Written and oral qualification exams are given to all employees as pursuant to requirements for N.J.A.C. 7:1E-2.12.

2.11.1 Orientation Training

All newly hired or transferred employees are required to participate in the general orientation program within 30 days from date of hire or transfer. Training items include general site rules and practices, familiarization with the site, safety procedures and equipment, accident investigation procedures, alarm recognition, and site emergency procedures and emergency response plan familiarization.

2.11.2 Technical Training

Before operators are considered fully qualified for the job, classroom training is supplemented with hands-on training including demonstration of the required mechanical job skills and use of safety equipment. Training includes 40-hour Health and Safety and 8-hour annual refresher courses. Please note, this training is provided in support of overall facility maintenance and not as a result of any TCPA requirements, which are no longer applicable to the facility. A copy of the course outlines for the initial 40-hour training, as well as 8-hour refresher course is provided in Appendix F. Training courses are developed to cover the material in revised SOPs as necessary.

Employees will receive training on the SOPs, including explanations of specific hazards of the operation. Courses will be developed to train employees on the content of this DPCC/DCR Plan. These courses will include identification and location of environmentally sensitive areas (ESAs) delineated in Part IV, Section 6, of this Plan.

2.11.3 Refresher Training

Employees that handle hazardous substances will receive an 8-hour refresher training course at least once a year. The refresher training includes a written exam. Spill prevention and awareness briefings will be conducted as part of the refresher training courses. Topics will include discussion of the DPCC/DCR Plan and preventive measures in place to prevent spills, review of previous spill events, and the precautionary measures taken to prevent future spills.

2.11.4 Emergency Response Training

Emergency response training is required for all employees at the site. This training is outlined in the training program. Emergency response orientation, initial emergency response, and refresher training are provided pursuant to the course outline contained in Appendix F.

2.11.5 Documentation

All training records which document employee job descriptions, job qualifications, and prerequisite training requirements are maintained in the Facility administrative office. Documentation of all training, evaluation, and qualifying activities is kept for each employee in a file in the administrative office.

2.11.6 Contractor Training

A procedure is in place to ensure that all employees of outside contractors are trained (Administrative Instruction No. 28, Contractor Environmental, Health, and Safety). A permit to work must be completed before contractor work can begin.

2.12 Description of Security (N.J.A.C. 7:1E-4.2(d)10)

The Facility is manned 24 hours a day, 7 days per week, and its perimeter is completely enclosed by a chain link fence. Access gates are either locked, guarded, or under observation by Facility personnel at all times. Visitors can enter the Facility only through the entrance at the administrative office. Visitors must identify themselves and the employee who has arranged or authorized the visit. The remaining access gates remain closed and locked at all times, except during emergencies, when these gates can be used to provide access for equipment and vehicles into the Facility.

Adequate lighting is available to permit surveillance of the Facility perimeter and operating and storage facilities during low light or nighttime conditions. Additional security measures include routine patrols conducted by Facility employees on foot. Facility personnel are instructed to report any breach of security in their respective areas to the Shift Supervisor.

2.13 Standard Operating Procedures (N.J.A.C. 7:1E-4.2(d)11)

A group of SOPs for the Facility will be prepared to comply with N.J.A.C. 7:1E-2.14. Suitable cross-referencing will be made between the SOPs and those specific operating instructions pertinent to equipment associated with the handling of hazardous substances to facilitate usage. These SOPs and operating instructions are made readily available to all operators and regulatory agency inspectors. A catalog list of SOPs is included in Appendix E.

2.14 Description of Record Keeping System (N.J.A.C. 7:1E-4.2(d)12)

An on-site computer maintenance management system provides documentation and inspection checklists that address emergency response equipment, containers, and containment structures are documents that serve as records. All applicable system records, inspection checklists, and tests described in this DPCC/DCR Plan are maintained at the Facility or an off-site location for the required time period as defined in N.J.A.C. 7:1E-2.15 are outlined below:

- Records of employee training, drills for discharge prevention and hazardous substances inventories are kept for a period of 3 years;
- Records of confirmation reports on discharges pursuant to N.J.A.C. 7:1E-5.8, inspection, major maintenance, and major repair of all structures other than aboveground storage tanks, equipment, and detection or monitoring, prevention or safety devices related to discharge prevention and response for 10 years or the lifetime of the structure, equipment or device, whichever is shorter;
- Records of integrity testing, inspection, major maintenance, and major repair of all above ground storage tanks for the lifetime of the tank;
- All records shall be available for inspection upon the request of the Department or appropriate local agencies. Records older than two years may be stored off-site and can be retrieved within two business days; and
- Records may be retained on microfilm or microfiche or may be kept in an electronic or computerized form if they are adequately backed-up.

SECTION 3: SCHEDULE FOR UPGRADES *(N.J.A.C. 7:1E-4.2(e))*

All facility upgrades have been completed. No additional upgrades are required or planned at this time.

SECTION 4: TABLES

This section contains the following tables associated with Part II of this DPCC/DCR Plan:

1. Table II-1 - Facility Storage & Process Facilities
2. Table II-2 - Facility Truck Unloading Areas
3. Table II-3 - Facility Tank Testing Matrix

TABLE II-1
FACILITY STORAGE & PROCESS AREAS

Calpine Newark, Inc.

Revision 1: November 1995
Revision 2: August 1997
Revision 3: September 1998
Revision 4: April 2000

Item No.	*North South*	*East West*	*Designation*	*Container Type*	*Location*	*Product Type*	*Product Quantity*	*Containment/ Diversion Type*	*Containment Quantity*	*Level Device*	*Corrosion Protection*
Tank Codes: P = Process; ES = Exterior Storage; IS = Interior Storage											
Storage Areas *(Total Storage Capacity = 319,460 gal.)*											
1	N1+43	E0+16	Fuel Oil Storage Tanks (2)	Steel Tank (concrete base) (ES)	Northwest Corner of Property	Kerosene	130,000 gal/ea	Concrete Dike	147,850 gal	High Liquid Level Alarm	Outside, Aboveground, Painted
2	N0+95	E0+27	Ammonia Storage Tank	Steel horizontal tank (ES)	West Side of Property	Anhydrous Ammonia	4,220 gal (max)	Concrete Dike & Neutralization Tank	10,700 gal	Low Liquid Level Alarm	Outside, Aboveground, Painted
3	N0+80	E0+27	Caustic Storage Tank ~~(Out of Service)~~	Steel Tank Epoxy Lined (ES)	West Side of Property	Sodium Hydroxide	6,000 gal	Concrete Dike & Neutralization Tank	10,700 gal	High Liquid Level Alarm	Outside, Aboveground, Painted
4	N0+69	E0+27	Acid Storage Tank ~~(Out of Service)~~	Steel Tank (ES)	West Side of Property	Sulfuric Acid	6,000 gal	Concrete Dike & Neutralization Tank	10,700 gal	High Liquid Level Alarm	Outside, Aboveground, Painted
5	N1+20	E0+80	Cooling Tower Water Additive	Plastic Tank (ES)	Southwest of Cooling Tower	Continuum 29037 Haz. Cas Nos.: 2809-21-4 1310-58-3 29385-43-1	1,000 gal	Steel Dike	1000 gal	None	Outside, Aboveground

TABLE II-1
FACILITY STORAGE & PROCESS AREAS

Calpine Newark, Inc.

Revision 1: November 1995
Revision 2: August 1997
Revision 3: September 1998
Revision 4: April 2000

Item No.	*North South*	*East West*	*Designation*	*Container Type*	*Location*	*Product Type*	*Product Quantity*	*Containment/ Diversion Type*	*Containment Quantity*	*Level Device*	*Corrosion Protection*
Tank Codes: P = Process; ES = Exterior Storage; IS = Interior Storage											
6	N1+20	E0+80	Boiler Water Additive	Plastic Tank (ES)	Southwest of Cooling Tower	Balance Polymer 5482 Haz. Cas Nos.: 108-91-8	1,000 gal	Steel Dike	1000 gal	None	Outside, Aboveground
7	N0+55	E0+76	Boiler Water Additive (Oxygen Scavenger)	Plastic Tank (ES)	East of Heat Recovery Steam Generator	Cor-Trol 778-P Haz. Cas Nos.: 123-31-9	1,000 gal	Building	1000 gal	None	Outside, Aboveground
8	N0+25	E0+94	Lube Oil Dispensing Skid (4 Tanks)	Plastic Tanks (IS)	Adj. to Gas Combustion Generator	Lube Oils	240 gal Total 60 gal/ea	Building	N/A	None	Inside, Aboveground
Process Areas											
9	N0+27	E1+40	Steam Turbine Lube Oil Storage Reservoir	Steel Tank (P)	Below Steam Turbine Gen.	Lube Oil	1,800 gal	Concrete Curb Within Building	> 1,800 gal	Low Liquid Level Alarm	Inside, Aboveground, Painted
10	N0+17	E0+63	Gas Combustion Turbine Lube Oil Storage Reservoir	Steel Tank (P)	Below Gas Turbine Engine	Lube Oil	1,700 gal	Steel and Concrete Curbing	> 1,700 gal	High and Low Liquid Level Alarms	Inside, Aboveground, Painted
11	N1+00	E1+60	Main Transformer	Steel Reservoir (P)	Substation	Transformer Oil	4,340 gal	Concrete Dike	8,700 gal	None	Outside, Aboveground, Painted
12	N1+00	E1+70	Auxiliary Transformer	Steel Reservoir (P)	Substation	Transformer Oil	280 gal	Concrete Dike	308 gal.	None	Outside, Aboveground, Painted

TABLE II-1
FACILITY STORAGE & PROCESS AREAS

Calpine Newark, Inc.

Revision 1: November 1995
Revision 2: August 1997
Revision 3: September 1998
Revision 4: April 2000

Item No.	*North South*	*East West*	*Designation*	*Container Type*	*Location*	*Product Type*	*Product Quantity*	*Containment/ Diversion Type*	*Containment Quantity*	*Level Device*	*Corrosion Protection*
Tank Codes: P = Process; ES = Exterior Storage; IS = Interior Storage											
Secondary Containment/Diversionary Systems Components											
13	N0+94	E0+06	Oil/Water Separator	Steel Tank (P)	West of Ammonia Storage Tank	Waste Oil and Water	30 gpm Flowthrough	None	N/A	None	Outside, Aboveground, Painted
14	N0+94	E0+06	Oily Water Sump	Concrete Sump (P)	Below Oil/Water Separator	Waste Oil and Water	5,385 gal	None	N/A	Control Room Level Indicator	Outside, Belowground
15	N0+52	E0+08	Neutralization Tank	Steel Tank (P)	Southwest of Acid Tank	Rinse Water from Regeneration Beds	20,000 gal	None	N/A	Control Room Level Indicator	Outside, Aboveground, Painted
16	N0+52	E0+27	Chemical Waste Neutralization Sump	Concrete Sump (P)	East of Neutralization Tank	Rinse Water from Regeneration Beds	2,115 gal	None	N/A	Control Room Level Indicator	Outside, Belowground
Miscellaneous Drum Storage											
17	N0+25	E0+94	Lube Oil Drums	Steel Drums (IS)	Adj. to Gas Combustion Generator	Lube Oil	(2) 55-gal Drums	Building	N/A	None	Inside, Aboveground
18	N1+20	E0+80	Sulfuric Acid Drums	Plastic Drums (ES)	Southwest of Cooling Water Tower	Sulfuric Acid (98%)	(2) 55-gal Drums	Portable Containment Skid	> 55 gal	None	Outside, Aboveground

END OF TABLE

TABLE II-2
FACILITY TRUCK UNLOADING AREAS

Calpine Newark, Inc.

Revision 1: November 1995
Revision 2: August 1997
Revision 3: September 1998
Revision 4: April 2000

Item No.	*North South*	*East West*	*Designation*	*Location*	*Product Type*	*Product Quantity*	*Containment Type*	*Containment Quantity*
19			Truck Unloading Area	Along Fence West of Plant	Ammonia Sulfuric Acid Sodium Hydroxide Kerosene	750 gal (Ammonia) 3,200 gal (Acid) 3,550 gal (Caustic) 6,300 gal (Kerosene)	Concrete Trench	> 6,300 gal

END OF TABLE

TABLE II-3
FACILITY TANK TESTING MATRIX

Calpine Newark, Inc.

Revision 1: November 1995
Revision 2: August 1997
Revision 3: September 1998
Revision 4: April 2000

Tank Descriptions/Spill History/API 653 Test Schedule

Tank (1)	*Tank Type*	*Product*	*Quantity (gal)*	*Year Installed*	*Proximity to Surface Water (ft)*	*No. Leaks in Past 5 Years*	*Last Date Tested*	*Type of Test*	*Next Test Date*		
									External Visual by API 653 qualified inspector	*Ultra-Sound (2)*	*Internal Visual (2)*
Fuel Oil Storage Tanks	Steel	Kerosene	130,000 gal each	1989	>500	0	November 1997 (Tank A) October 1997 (Tank B)	Full Integrity, API-653 Visual	November 2002 (Tank A) October 2002 (Tank B)	Based on corrosion rate calculations a 12.2 & 12.7 year period was recommended until the next tests for Tanks A & B, respectively. Next testing will be performed 10-years from the last tests	
Ammonia Storage Tank	Steel	Ammonia	4,220	1989	>500	0	May 1998	External Ultrasound, API-653 Visual	May 2003	No substantial defects or corrosion noted by the API-653 inspector. No other testing required until next 5-year external visual	
Caustic Storage Tank	Steel (Epoxy Liner)	Sodium Hydroxide	6,000	1989	>500	0	May 1998	External Ultrasound, API-653 Visual	May 2003		
Acid Storage Tank	Steel (Epoxy Liner)	Sulfuric Acid	6,000	1989	>500	0	May 1998	External Ultrasound, API-653 Visual	May 2003		

END OF TABLE

(1) All tanks undergo a monthly visual inspection by facility personnel as described in Appendix E "Monthly API 653 Inspection Log"
(2) Fuel oil tanks rest on concrete platform, ultrasound testing and internal visual must be performed internally and follow the schedule determine by the corrosion rate calculations. The ammonia, caustic and acid tanks rest on legs and can have ultrasound testing performed externally. The futures test dates for the horizontal tanks (ammonia, caustic, acid) should follow the recommendations of the API-653 inspector. Pressurized tanks, such as the ammonia tanks, can follow API-510 in lieu of API-653.

PART III: DISCHARGE CLEANUP AND REMOVAL PLAN

This part of the DPCC/DCR Plan outlines procedures for responding to discharges and notifying management, government agencies, and Station clean-up personnel and/or contractors in the event of a discharge of hazardous substances to the soil or surface waters of the State. In the event of an incident requiring emergency response, the following facility personnel should be contacted first and foremost. A list of additional contact numbers is provided in the tabbed section labeled "Emergency Telephone Numbers" at the end of this binder.

EMERGENCY RESPONSE COORDINATORS - CONTACT NUMBERS

	NAME	TELEPHONE NUMBER
SEC:	Robert Hilbert Plant Manager	(973) 817-7936 (work) (800) 514-0321 (beeper) (609) 728-8499 (home)
Alternative SEC:	Mark Doughty Operations & Maintenance Manager	(973) 817-7936 (work) (973) 205-2058 (beeper)

In the event of a spill incident, the chain of command is as follows (Section 4 of the DCR provides additional emergency response detail):

SPILL INCIDENT CHAIN OF COMMAND

1. Any employee who discovers the potential for, or an actual discharge of, a hazardous substance or substances, will immediately notify their shift supervisor.
2. The shift supervisor will contact the SEC (Robert Hilbert).
3. If the SEC is unavailable, the shift supervisor will contact the alternate SEC (Mark Doughty).
4. While contact is being made with the SEC or alternate SEC, the shift supervisor and supporting staff will initiate actions to stop the leak, contain the spill and clean-up any contamination (as required).
5. The SEC or alternate SEC, upon arrival, will assume control of the incident and assist responding personnel.
6. The SEC or alternate SEC will determine the severity of the incident and whether off-site emergency assistance is required.
7. The SEC or alternate SEC will determine if the incident is reportable and whether outside assistance will be required for clean-up.

SECTION 1: SPILLS AND DISCHARGES

1.1 Reportable Discharges

A reportable discharge is any event that results in the release of a hazardous substance either into the waters or onto the lands of the State. Such discharges *in any quantity* are prohibited and require notification of appropriate authorities. If a reportable discharge occurs, the facility will submit a discharge notification report within 30 days of discharge to the NJDEP, Bureau of Discharge Prevention, P.O. Box 424, Trenton, New Jersey 08520.

A leak is not considered a discharge. As an example, a leak or spill of any quantity of a hazardous substance into its containment structure is not a discharge (i.e. does not require notification of

authorities) as long as the spill is fully contained and does not escape to the environment (i.e., lands or waters of the State). A spill contained on asphalt, concrete, or other similar material is not a discharge as long as the spill can be cleaned up before it migrates to the soil, air, or groundwater. Similarly, a leak or spill of a hazardous substance that is diverted to a treatment facility is not a discharge.

At the Facility, response is immediate to prevent spills and leaks from developing into discharges. In the event that a discharge occurs, it is to be reported within the required time period according to the procedures outlined in this Plan.

1.2 Spill Diversion Systems

The Facility is comprised of a main power plant building which houses various process reservoirs and equipment. A diversionary system for the building allows spills to be diverted into one of two underground sumps. In addition, larger indoor lube oil reservoirs are also equipped with concrete berms. In the event of an equipment failure that releases a hazardous substance within the building, the spilled material will be contained by the building or ultimately one of the sumps.

All outdoor tanks and process equipment at the Facility are equipped with secondary containment systems. In the event of a tank or equipment failure, the spilled material will be contained within the individual containment structures.

SECTION 2: EMERGENCY RESPONSE PERSONNEL

2.1 Qualified Facility Personnel (N.J.A.C. 7:1E-4.3)

Generally, Facility personnel are qualified to clean up incidental small scale spills and discharges of hazardous substances which they routinely handle in their areas of responsibility. In the event of spills and discharges of this nature, individual employees will clean up the material. Facility employees assigned to the job positions delineated in this section are qualified and available to respond to emergencies that require implementation of this DPCC/DCR Plan. Employees filling these positions will have complete introductory and technical training as described in Part II, Section 2.11.2, Technical Training, and will be qualified to operate emergency response equipment as required. Employees serving on the Emergency Response Team (ERT) have received additional training as described in Part II, Section 2.11.4, Emergency Response Training, and are available to respond to

discharges of kerosene, ammonia, or hazardous substances.

2.2 Emergency Response Team (N.J.A.C. 7:1E-4.3(a)1)

Response to emergencies at the facility is the responsibility of the Site Emergency Coordinator (SEC) with backup support from the ERT. The team is directed by the SEC and is equipped and trained to respond to small fires, spills, or discharges or hazardous substances. In the event that outside emergency response teams (e.g., fire department, emergency response contractors) are called to assist in emergency response measures, the ERT may assume a secondary role once outside teams arrive at the Facility. In this secondary role, the ERT will assist and augment, if necessary, the outside responders.

2.3 Site Emergency Coordinator (N.J.A.C. 7:1E-4.3(a)1)

The Facility Manager is designated as the SEC for the Facility. The SEC is on call 24 hours a day and is responsible for emergency response coordination with state and local agencies. The designated alternate, or shift supervisor, will act as a SEC when necessary.

The SEC is responsible for the coordination of all emergency response activities at the Facility, and as such is thoroughly familiar with all aspects of the DPCC/DCR Plan, all operations and activities, the locations and characteristics of all hazardous substances, the Facility layout, the locations of records, and the locations of all ESAs within the defined study area. The SEC has access to all areas of the Facility and has full authority to commit all resources required to execute this DPCC/DCR Plan.

SEC: Site emergency coordinator. The SEC is responsible for the following tasks:

1. Assess the situation and determine if an emergency exists;
2. Activate and direct the Emergency Response Team as necessary;
3. Contact all necessary support help and all outside agencies as required;
4. Determine the need for total or selective evacuation;
5. Communicate with the alternate to the SEC;
6. Direct ERT members to clean up and restore emergency equipment after each incident; and
7. Assemble the ERT and assist the Alternate in a critique of the Emergency Response Actions.

Alternate to the SEC: The Alternate SEC provides assistance to the SEC during the emergency and in the post emergency clean-up. The Alternate SEC also serves as the SEC when the SEC is unavailable.

Entry Team: This team consists of the duty operator and the "on-call" operator.

Survey Team: This team consists of the "on-call" shift supervisor and the "on-call" mechanic.

Cleanup Contractor: Upon responding to the Facility call, the Cleanup contractor will take commands from the SEC unless specifically directed by the SEC to report to someone else.

2.3.1 Notification Authority

The SEC is authorized to notify management, government agencies, and clean-up contractors in the event of a discharge or other emergency. The SEC will contact the NJDEP at (800) 927-6337 or (609) 292-7172 within 15 minutes of the time of discovery of a discharge from the Facility. If the NJDEP's number is inoperable, then the State Police will be notified at (609) 882-2000. Upon arriving at the spill site, the SEC will assess the condition and follow the prescribed notifications and response procedures as set forth in this DPCC/DCR Plan.

2.3.2 Response Authority

The SEC and designated alternatives have full authority to hire contractors and expend funds for discharge response, containment, clean-up, and removal.

SECTION 3: EMERGENCY RESPONSE EQUIPMENT (N.J.A.C. 7:1E-4.3(a)5)

3.1 On-site Equipment

The facility maintains a variety of emergency response equipment, selected and positioned to provide maximum in-house emergency response capabilities. The emergency response equipment is inspected and serviced regularly to ensure proper operation. The Emergency Response Equipment List in the Facility Risk Management Program provides the location and physical description of identified equipment with a brief description of its capabilities. An inventory of equipment maintained on-site to support containment and clean-up operations is provided in Appendix H.

3.2 Emergency Response Clean-up Contractors

In the event a discharge or spill requires additional manpower and/or equipment for containment and clean-up, the Facility has a stand-by contract with Clean Harbors to cover this contingency.

3.3 Other Sources of Equipment (N.J.A.C. 7:1E-4.3(a)5)

Cleanup contractors and outside responders (i.e, LEPC) can supplement equipment available at the Facility in the event of a spill or discharge as needed. The LEPC is a group of government and non-government agencies who coordinate planning and implementation of emergency response procedures. A copy of the LEPC letter of agreement is provided in Appendix C.

SECTION 4: EMERGENCY RESPONSE PROCEDURES (N.J.A.C. 7:1E-4.3(a))

Emergency response actions and notification requirements in the event of a hazardous substance spill are described in the following sections.

4.1 Reporting of Emergencies

Any employee who discovers the potential for, or an actual discharge of, a hazardous substance(s) will immediately notify their supervisor. The shift supervisor will take actions to evaluate the situation and initiate containment and/or clean-up actions. The shift supervisor will also make contact with the SEC (Robert Hilbert). If the SEC is unavailable, the alternate SEC (Mark Doughty) will be contacted.

4.2 Immediate Action Plan

Upon notification, the SEC will immediately take the following actions:

1. Conduct an initial assessment to identify the character, exact source, amount, and extent of any potential or actual discharge. The following information will be gathered during this assessment for notification and reporting purposes to the NJDEP:
   a. A description of the release and the release location;
   b. Quantity of the discharge substance;
   c. Steps taken, being taken, or will be taken, to stop, control, cleanup, and or remove the discharge substance; and
   d. Steps being taken to determine the cause of the discharge.

2. Assess possible hazards to human health or the environment that may result from the spill or discharge. If the spill or discharge warrants assistance from the ERT, the SEC will activate the Facility alarm system, where applicable, to notify the ERT.

3. If necessary, contact off-site responders and mutual air responders.

4. Provide notifications to regulatory authorities and agencies (Refer to Part III, Section 5, Notification to Authorities).

Note: N.J.A.C. 7:1E-5.3 requires that NJDEP be notified (at 609-292-7172 or 800-WARNDEP) of any discharges of hazardous substances within 15 minutes of discovery. In the event the NJDEP hotline is inoperable, the NJ State Police should be notified (at 609-882-2000).

4.3 Summary Response Action Plan

The following is a summary description of response actions to specific types of discharges that could potentially occur at the Facility. The response actions described will be initiated as soon as possible by the SEC following procedures as outlined here and in the ERP. The primary objective of all response actions is to initially prevent a spill or leak from developing into a discharge.

4.3.1 Discharges Onto the Ground

If a hazardous material is discharged onto the lands of the State (e.g. soil, grass, stones or other permeable surfaces), excavation of the contaminated area will begin as soon as practical under the direction of the SEC. Discharges onto the ground (See Part III, Section 1.1, Reportable Discharges) will be reported as described in Part III, Section 5, Notification to Authorities, of this part of the DPCC/DCR Plan.

4.3.2 Discharges Into Groundwater

If a hazardous material is discharged onto soil, grass, stones or other permeable surfaces there is a potential for the material to enter the groundwater. If a discharge to groundwater occurs, site characterization and site remediation will be in accordance with appropriate State regulations, such as NJDEP rules for site remediation and clean-up.

4.3.3 Discharges to Surface Water

In the unlikely event of a discharge of a hazardous material onto surface water, response will be done in accordance with Sections 4.3 and 4.4 of Part IV: Environmentally Sensitive Area Protection Plan (ESAPP).

4.3.4 Fires and Explosions

Response to fires will be in accordance with this DCR and the Facility ERP. Any fire larger than that which can be handled by one extinguisher is handled by the local fire department.

4.3.5 Discharges to Air

Response to a discharge of ammonia vapor to the air will be in accordance with the ERP.

4.4 Emergency Drills (N.J.A.C. 7:1E-4.3(a)4)

The facility sponsors an emergency drill on an annual basis. The drill is changed from year-to-year and includes variations on the equipment and hazardous substances involved.

4.4.1 Objectives

Emergency drills have the following objectives:

1. To test the adequacy of and the effectiveness, timing, and content of the DPCC/DCR Plan, SPCC Plan, and other emergency response procedures;
2. To test emergency equipment;
3. To ensure that emergency organization personnel are familiar with their duties and responsibilities by demonstration; and
4. To comply with local, State, and federal regulations.

4.4.2 Performance

The drills can be combined with other emergency response drills (e.g., OSHA and hazardous waste). Planning for drills will include:

1. Basic objectives;
2. Dates, times, and places;
3. Participating organizations;
4. Development of drill scenario;
5. Approximate schedule of events;
6. Pre-drill briefing conference;
7. Arrangements for qualified observers; and
8. Appropriate critique of drills/exercises with participants.

Drills will be performed as planned and scheduled according to the pre-developed scenario. Observers will maintain a written list of comments and observations. If possible, drills will be video- or audio-taped to provide an accurate account of drill events for those performing the critique.

4.4.3 Critique

The Emergency Response Committee will hold a critique meeting following each drill or actual emergency. Observers and participants will discuss any deficiencies in the DCR Plan and in its implementation. A list of follow-up actions will be developed by a committee designated by the SEC. An action plan will be distributed to ensure that all deficiencies are corrected.

SECTION 5: NOTIFICATION TO AUTHORITIES (N.J.A.C. 7:1E-5.3)

Discharges require immediate notification to the NJDEP Hotline at (609) 292-7172 or (800) 927-6337 within 15 minutes. If the NJDEP Hotline is unavailable, the State Police at (609) 882-2000 will be notified. A discharge that involves a release of a hazardous substance in excess of its respective RQ, listed in the Reportable Quantities Tab, will also require immediate notification to the Local Management Coordinator for the City of Newark (including any individuals instructed by him) and the Essex County Hazmat. Telephone numbers of these organizations are provided in the Emergency Telephone Numbers Tab.

5.1 Notification Protocol (N.J.A.C. 7:1E-5.3(c))

When making the required 15 minute notification, the following information will be provided:

1. The name, title, affiliation, address and telephone number of the person reporting the discharge;
2. The specific location of the discharge, providing enough information to allow the NJDEP to direct personnel to the scene;
    - For discharges on land, provide the name of the facility and the address, municipality and county.
    - For discharges to water, provide the name of the water body , location of the discharge with reference to a fixed point, and a description of the area which the discharge may reach.
3. The common name of the hazardous substance discharged and a best estimate of the quantity discharged;
4. Date and time at which the discharge began, date and time at which the discharge was discovered, and if the discharge has ended, date and time at which it ended;
5. Actions the person reporting the incident or discharge proposes to take to contain, clean up, and remove the substance(s) discharged; and
6. The name and address of any person responsible for the discharge.

The SEC shall place a second call to the NJDEP within 15 minutes of the first notification and provide an update that will include the following information.

Whenever the SEC notifies a federal, State, or local agency, appropriate entries summarizing the sequence of events including the date, time, and person contacted shall be included in the Plant Operations Log. Notations in the Log must also be made of unsuccessful attempts to contact such agencies.

5.2 Follow-up Reports (N.J.A.C. 7:1E-5.8)

In the event of a reportable discharge of a hazardous substance, or a discharge detection system malfunction, a follow-up report must be submitted to the NJDEP within 30 days in accordance with the requirements of N.J.A.C. 7:1E-5.8. The SEC will ensure that appropriate follow-up reports are submitted to the NJDEP.

5.3 Exemption from the NJDEP Reporting

If the accidental release does not present a potential for off-site impact, on-site injuries or fatalities, or activate the emergency response plan, the accident shall be exempt from these reporting procedures. However, the accident will be subjected to investigation procedures.

5.4 Off Site Emergency Notification

Newark Boxboard is the closest surrounding business and will be contacted via telephone, advising them of the emergency and whether or not a site evacuation is required. Any other businesses, residences, or schools will be notified by the LEPC. Calpine Newark, Inc. has submitted a Name and Ownership Change letter to be reflected in the current LEPC emergency response plan, and has submitted an updated summary of the facility response plan for their use. The letter is contained in Appendix C.

SECTION 6: ACTIONS AFTER EMERGENCIES

6.1 Re-entry and Site Recovery

Following an emergency, the SEC will coordinate the re-entry procedures with all personnel. Based upon the seriousness of the incident, the recovery may involve only plant personnel, or it may require assistance from an outside contractor.

Re-entry can not be accomplished without proper personnel protective equipment based on the type of spilled material and the concentrations present on the site. The survey team will inspect the site of the leak and all surrounding areas and make reports to the SEC. The SEC will use this information to decide when it is safe to re-enter all or portions of the plant.

6.2 Recovered Material (N.J.A.C. 7:1E-4.3(a)8)

After an emergency, the SEC will provide for the treatment, storage, disposal, and recycling of recovered hazardous waste, contaminated soil or surface water, and any other material resulting from a spill or discharge at the Station. All hazardous waste will be managed in accordance with the provisions of applicable regulations. All contaminated soils, stone, etc. associated with discharges that occur onto land will be cleaned up and placed in drums or larger containers, as appropriate. Hazardous substances discharged to waters of the State will be recovered using suitable sorbent booms, vacuum trucks, skimmers, or other applicable equipment. Contaminated clean-up material will be accumulated along with spill material and packaged for removal to an authorized off-site disposal facility. The SEC will coordinate activities associated with selecting off-site disposal and/or recycling of recovered materials.

Where practicable, spilled materials will be recycled. Where a quantity of spilled fuel oil can be recovered, it will be returned to the bulk storage tank for reuse. If the spilled fuel oil is contaminated such that it cannot be reused on-site, it will be manifested and targeted for disposal as an alternative fuel by a licensed fuel oil broker. Oil contaminated soils are typically manifested and targeted for reuse at aggregate production facilities (e.g. asphalting).

Non-petroleum hazardous materials are recycled in various ways when spilled. Neutralized water will be re-used as process water if feasible. Water will be used to wash down the entire area of such a spill. Containment basins will be drained to the chemical sump and neutralized in the Facility's neutralization tank before being re-used as process water or disposed of properly.

A list of information resources that may be utilized when responding to a hazardous incident is provided in Appendix I.

6.3 Emergency Equipment and Systems

The SEC will ensure that all emergency response equipment and systems are cleaned, recharged, reactivated, and fit for their intended purposes and inspected prior to the storage of the equipment.

Part IV: The Environmentally Sensitive Areas Protection Plan has not undergone any changes during this Revision 4 dated April, 2000. The only changes would be references to the facility which has changed from O'Brien (Newark) Cogeneration to NRG Generating (Newark) Cogeneration to CogenAmerica Newark, Inc. to Calpine Newark, Inc. Since no changes to the content of the plan was needed, this section has not been revised. Please disregard all references to the O'Brien facility.

APPENDIX A
DISCHARGE REPORTS

THERE HAVE BEEN NO REPORTABLE SPILL INCIDENTS SINCE THE LAST PLAN APPROVAL

APPENDIX B
FINANCIAL RESPONSIBILITY DOCUMENTS

CERTIFICATE OF INSURANCE

NAME:	Calpine Newark, Inc.
ADDRESS:	35 Blanchard St. Newark, NJ 07065
POLICY NUMBER:	PLS - 4761906
PERIOD OF COVERAGE:	12:00 a.m. April 12, 2000 12:00 a.m. April 12, 2003
NAME OF INSURER:	American International Surplus Line Insurance Company
ADDRESS OF INSURER:	70 Pine Street New York, New York 10270
NAME OF INSURED:	Calpine Corporation
ADDRESS OF INSURED:	50 W. San Fernando Street San Jose, CA 95113-0000

1) American International Surplus Line Insurance Company, (the "Insurer"), as identified above, hereby certifies that it has issued liability insurance, subject to public policy considerations, covering the following facility: Calpine Newark, Inc., 35 Blanchard St., Newark, NJ 07065, for cleanup and removal activities arising from operating the facility identified above.

The limits of liability are $2,000,000 Per Occurrence and $2,000,000 annual Aggregate, exclusive of legal defense costs. This coverage is provided under policy number PLS - 4761906. The effective date of said policy is April 12, 2000.

2) American International Surplus Line Insurance Company further certifies the following with respect to the insurance described in paragraph 1:

(A) Bankruptcy or insolvency of the insured shall not relieve American International Surplus Line Insurance Company of its obligations under the policy to which this certificate applies.

(B) American International Surplus Line Insurance Company is liable for the payment of amounts within any deductible applicable to the policy to the provider of cleanup and removal activities with a right of reimbursement by the insured for any such payment made by American International Surplus Line Insurance Company. This provision does not apply with respect to that amount of any deductible for which coverage is demonstrated under another mechanism or combination of mechanisms.

(C) Whenever requested by the Department, American International Surplus Line Insurance Company agrees to furnish to the Department a signed duplicate original of the policy and all endorsements.

(D) Cancellation or any other termination of the insurance by American International Surplus Line Insurance Company except for nonpayment of premium or material misrepresentation by the insured, will be effective only upon written notice and only after the expiration of 60 days after the date on which the insured receives the written notice or 60 days after the date on which the Department receives the written notice, whichever is

later. Cancellation for nonpayment of premium or material misrepresentation by the insured will be effective only upon written notice and only after the expiration of a minimum of 10 days after the date on which the insured receives the written notice or 10 days after the date on which the Department receives the written notice, whichever is later.

(E) The insurance covers claims otherwise covered by the policy that are reported to the American International Surplus Insurance Company within six months of the effective date of the cancellation or nonrenewal of the policy, except where the new or renewed policy has the same retroactive date or a retroactive date earlier than that of the prior policy, and that arise out of any covered occurrence that Commenced after the policy retroactive date, if applicable, and prior to such policy renewal or termination date.

I hereby certify that the wording of this instrument is identical to the wording in Appendix B of N.J.A.C. 7:1E and that American International Surplus Line Insurance Company is licensed to transact the business of insurance in the State of New Jersey.

(Signature of authorized representative of American International Surplus Lines Insurance Company)

Jeffrey Clarke
(Type Name)

Senior Risk Analyst
(Title) Authorized representative of American International Surplus Lines Insurance Company)

(Address of Representative) Two Rincon Center
121 Spear Street
San Francisco, CA 94105

APPENDIX C
LEPC LETTER

CALPINE

NEWARK COGENERATION
35 BLANCHARD STREET
NEWARK, NEW JERSEY 07105
973.817.7936
973.817.8051 (FAX)

April 26, 2000

Mr. Robert Swales, Deputy
Office of Emergency Management
1 Lincoln Avenue, Room 206A
Newark, New Jersey 07105

Subject: Name and Ownership Change for reflection into the LEPC Emergency Response Plan

Dear Mr. Swales:

The purpose of this letter is to notify you of revised name and ownership changes for the facility (formerly known as CogenAmerica Newark, Inc.) from those previously specified in the attached November 13th, 1998 letter. The facility has been renamed as Calpine Newark, Inc. The facility owner is now Calpine Newark, Inc. (formerly Cogeneration Corporation of America). These changes were effective March 30, 2000.

Calpine Newark, Inc., is formally requesting via this letter, inclusion of our facility emergency response plan into the LEPC Emergency Response Plan. As a part of the facility Discharge Prevention Containment and Countermeasure (DPCC) and Discharge Cleanup and Removal (DCR) plans, the New Jersey Department of Environmental Protection (NJDEP) requires an agreement of participation with the LEPC. This letter provides you with a summary of the facility and key elements of our in-house emergency response plan to facilitate the inclusion process and also to comply with the NJDEP requirement.

Facility Description

The Newark cogeneration facility generates 60 MW of electrical power and process steam via the operation of a steam turbine generator and a combustion turbine generator. Steam for the steam turbine is supplied from a heat recovery steam generator and is exported to the Newark Boxboard Company, while the combustion turbine generator fires natural gas from a pipeline or kerosene from two aboveground storage tanks. The facility operates as a base-load facility and is permitted with the New Jersey Department of Environmental Protection (NJDEP) to run 24 hours per day, 365 days per year. Emissions of nitrogen oxides are controlled via steam injection of the combustion turbine, ammonia injection and selective catalytic reduction (SCR) to meet air emission limits specified in the facility=s air permit issued by the NJDEP.

Our facility contains several large bulk storage vessels, numerous smaller containers, and a tanker truck unloading area for caustic, sulfuric acid, kerosene and ammonia transfer. Bulk materials storage support routine facility operations including fuel for the combustion units, ammonia for the SCR, lubricants, water treatment for the cooling tower, and process water treatment in support of combustion.

The Newark facility is approximately 10 years old, however, major reconstruction occurred after a serious fire in December 1992. The reconstructed facility resumed operations in October 1993. Since state and federal regulations governing spills and spill and accident prevention were in place at the time of facility planning, state of the art measures were incorporated into the original design and reconstruction. Such measures include, but are not limited to, bulk storage secondary containment, a system of drains that lead to an oil water separator, another system of drains that lead to a chemical sump, overflow protection and alarms, and fire suppression.

Operationally, the Newark facility has in place a system where daily, weekly and monthly visual inspections of key equipment is carried out to as part of a maintenance program that seeks to correct minor problem areas before they can develop into accident causing failures. Tank integrity testing follows NJDEP requirements per API-653 and is current. Ongoing employee training in health and safety and emergency response is another element of our effort to prevent accidents.

The Facility has implemented DPCC/DCR and Spill Prevention Control and Countermeasure (SPCC) plans which was developed and approved by the NJDEP. A Plan Approval Modification addressing the Facility's name/ownership change and financial assurance documentation is being sent to the NJDEP for their review and formal approval. A full copy of the plans are available at the facility and at the NJDEP and can be reviewed at the facility upon request. Key elements of the plans, specifically contact information for the facility SEC and alternate SEC and the chain of command that is followed in responding to an emergency, are attached. The facility has a contract with Clean Harbors to act as first responder in the event that an incident cannot be handled by in-house staff.

If there is any additional information that you need, or there is any assistance required on our part to assist the LEPC in emergency planning or in your reorganization process, please do not hesitate to contact me at (973) 817-7936. Please feel free to stop by. A quick tour of the facility and review of our emergency plans will underscore our commitment in this effort. Thank you very much for your assistance.

Sincerely,

Robert Hilbert
Plant Manager

Attachment

cc: Mark Doughty, Operations & Maintenance Manager/Alternate SEC
Robert Alff, Calpine Eastern Corporation
Robert J. Golden Jr., TRC Environmental Corporation

ATTACHMENT

EMERGENCY RESPONSE COORDINATORS - CONTACT NUMBERS

	NAME	TELEPHONE NUMBER
SEC:	Robert Hilbert Plant Manager	(973) 817-7936 (work) (800) 514-0321 (beeper) (609) 728-8499 (home)
Alternative SEC:		
	Mark Doughty Operations & Maintenance Manager	(973) 817-7936 (work) (973) 205-2058 (beeper)

CALPINE NEWARK, INC.
SPILL INCIDENT CHAIN OF COMMAND

1. Any employee who discovers the potential for, or an actual discharge of, a hazardous substance or substances, will immediately notify their shift supervisor.
2. The shift supervisor will contact the SEC (Robert Hilbert).
3. If the SEC is unavailable, the shift supervisor will contact the alternate SEC (Mark Doughty).
4. While contact is being made with the SEC or alternate SEC, the shift supervisor and supporting staff will initiate actions to stop the leak, contain the spill and clean-up any contamination (as required).
5. The SEC or alternate SEC, upon arrival, will assume control of the incident and assist responding personnel.
6. The SEC or alternate SEC will determine the severity of the incident and whether off-site emergency assistance is required.
7. The SEC or alternate SEC will determine if the incident is reportable and whether outside assistance will be required for clean-up.

NRG Power Operations, Inc.
Newark Cogeneration Facility
35 Blanchard Street
Newark, NJ 07105

Telephone (973) 817-7936
Fax (973) 817-8051

November 13, 1998

(Previous Letter)

Mr. Robert Swales, Deputy
Office of Emergency Management
1 Lincoln Avenue, Room 206A
Newark, New Jersey 07105

Subject: Formal Request for Inclusion into the LEPC Emergency Response Plan

Dear Mr. Swales:

As a result of a field inspection and technical review by the New Jersey Department of Environmental Protection (NJDEP) Bureau of Discharge Prevention, CogenAmerica Newark, Inc., is formally requesting via this letter, inclusion of our facility emergency response plan into the LEPC Emergency Response Plan. As part of their review of the facility Discharge Prevention Containment and Countermeasure (DPCC) and Discharge Cleanup and Removal (DCR) plans, the NJDEP is requiring an agreement of participation with the LEPC. This letter provides you with a summary of the facility and key elements of our in-house emergency response plan to facilitate the inclusion process and also to comply with the NJDEP requirement.

Facility Description

The Newark cogeneration facility generates 60 MW of electrical power and process steam via the operation of a steam turbine generator and a combustion turbine generator. Steam for the steam turbine is supplied from a heat recovery steam generator and is exported to the Newark Boxboard Company, while the combustion turbine generator fires natural gas from a pipeline or kerosene from two aboveground storage tanks. The facility operates as a base-load facility and is permitted with the New Jersey Department of Environmental Protection (NJDEP) to run 24 hours per day, 365 days per year. Emissions of nitrogen oxides are controlled via steam injection of the combustion turbine, ammonia injection and selective catalytic reduction (SCR) to meet air emission limits specified in the facility's air permit issued by the NJDEP.

Our facility contains several large bulk storage vessels, numerous smaller containers, and a tanker truck unloading area for caustic, sulfuric acid, kerosene and ammonia transfer. Bulk materials storage support routine facility operations including fuel for the combustion units, ammonia for the SCR, lubricants, water treatment for the cooling tower, and process water treatment in support of combustion.

The Newark facility is approximately 8 years old, however, major reconstruction occurred after a

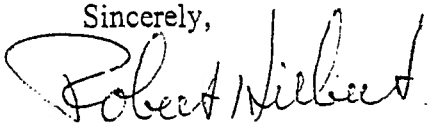
serious fire in December 1992. The reconstructed facility resumed operations in October 1993. Since state and federal regulations governing spills and spill and accident prevention were in place at the time of facility planning, state of the art measures were incorporated into the original design and reconstruction. Such measures include, but are not limited to, bulk storage secondary containment, a system of drains that lead to an oil water separator, another system of drains that lead to a chemical sump, overflow protection and alarms, and fire suppression.

Operationally, the Newark facility has in place a system where daily, weekly and monthly visual inspections of key equipment is carried out to as part of a maintenance program that seeks to correct minor problem areas before they can develop into accident causing failures. Tank integrity testing follows NJDEP requirements per API-653 and is current. Ongoing employee training in health and safety and emergency response is another element of our effort to prevent accidents.

DPCC/DCR and Spill Prevention Control and Countermeasure(SPCC) plans have been developed, are current with the regulations and have been approved by the NJDEP. A full copy of the plans are available at the facility and at the NJDEP and can be reviewed at the facility upon request. Key elements of the plans, specifically contact information for the facility SEC and alternate SEC and the chain of command that is followed in responding to an emergency, are attached. The facility has a contract with Clean Harbors to act as first responder in the event that an incident cannot be handled by in-house staff.

If there is any additional information that you need, or there is any assistance required on our part to assist the LEPC in emergency planning or in your reorganization process, please do not hesitate to contact me at (973) 817-7936. Please feel free to stop by. A quick tour of the facility and review of our emergency plans will underscore our commitment in this effort. Thank you very much for your assistance.

Sincerely,



Robert Hilbert
Plant Manager

Attachment

cc: Ted Hofbauer, Maintenance Manager & Alternate SEC
Michael Brady, Cogeneration Corporation of America
Robert J. Golden Jr., TRC Environmental Corporation

ATTACHMENT

EMERGENCY RESPONSE COORDINATORS - CONTACT NUMBERS

	NAME	TELEPHONE NUMBER
SEC:	Robert Hilbert Plant Manager	(973) 817-7936 (work) (800) 514-0321 (beeper) (609) 728-8499 (home)
Alternative SEC:		
	Ted Hofbauer Maintenance Manager	(732) 238-8633 (work) (908) 222-9333 (home) (908) 962-8244 (beeper/cell)

COGENAMERICA NEWARK, INC.
SPILL INCIDENT CHAIN OF COMMAND

1. Any employee who discovers the potential for, or an actual discharge of, a hazardous substance or substances, will immediately notify their shift supervisor.
2. The shift supervisor will contact the SEC (Robert Hilbert).
3. If the SEC is unavailable, the shift supervisor will contact the alternate SEC (Ted Hofbauer).
4. While contact is being made with the SEC or alternate SEC, the shift supervisor and supporting staff will initiate actions to stop the leak, contain the spill and clean-up any contamination (as required).
5. The SEC or alternate SEC, upon arrival, will assume control of the incident and assist responding personnel.
6. The SEC or alternate SEC will determine the severity of the incident and whether off-site emergency assistance is required.
7. The SEC or alternate SEC will determine if the incident is reportable and whether outside assistance will be required for clean-up.

APPENDIX D
PROTECTION AND CLEAN-UP METHODS

APPENDIX D
PROTECTION AND CLEAN-UP METHODS

PROTECTION AND CLEAN-UP METHODS[0]

1. CONTAINMENT AND DIVERSION

1.1 Booms

Booms are used for containment of spilled petroleum products in open waters and protection of shoreline. They are also used to direct petroleum from high velocity water to low-velocity areas, where it can be held for recovery equipment. Different types of booms have differing stability, and horizontal floatation collars are the best (2, p. 800-21).

1.1.1 Deflection Booming

This technique is effective only if breaking waves are less than 12 in. in height. Deflection booming is most effective on the larger waterbodies because of the high current velocity (5, p. 56). Deflection booming is used on inland streams where currents are greater than 1 knot, across small bays and inlets where currents exceed 1 knot, and along straight coastline. This method causes minor shoreline disturbance at anchor points and heavy shoreline contamination on downstream end. Booms should be deployed at an angle from the shore closest to the leading edge of the slick. Two or more lengths 100 to 500 ft. should be cascaded. The leading edge of each boom should be 20 to 30 ft. behind the trailing edge of the previous boom (2, pp. 800-34 to 800-41). The use of multiple layers of booms increases the efficiency of diversion (See Table I-1).

TABLE I-1
DIVERSION BOOMING:
LOGISTICAL REQUIREMENTS FOR DEFLECTION IN A 1.5 KNOT CURRENT (p. 800-46)*

	Single Boom (50 ft.)	*Cascading Booms (150 ft.)*
Total Boom Length	200 ft.	600 ft.
Anchors	1	6-9
Personnel	3-4	4-6
Workboat (18 -27 ft.)	1 plus crew	1 plus crew
Recovery Units	1	1-2

* Deflection is the lateral displacement across a current between the upstream and downstream ends of a boom or series of booms

1.1.2 Exclusion Booming

Exclusion booming is used across small bays, harbors entrances, and creek mouths if currents are less than 1 knot and breaking waves are less than 12 in. in height. Exclusion booming may cause minor shoreline disturbance at anchor points. The boom for harbors should be placed landward in the quieter parts of a harbor. Boom should be deployed at an angle to the shoreline (preferably in the direction of the wind) to guide oil. A boat may have to be deployed upstream to open the boom for boat traffic. Sand bars in estuaries can cause deployment problems. Boom should be deployed landward of sand bars (the bars can be located by ripples and boils). The boom may have to be anchored at several points in high velocity areas. Boom should be placed seaward of the low tide line, or the mid-intertidal if this is not possible (2, p. 800-35). Logistical requirements for exclusion booming are given in Table I-2.

TABLE I-2
EXCLUSION BOOMING:
EQUIPMENT REQUIRED PER 1000 FT. OF BOOM (2, p. 800-40)

	Calm/Light Seas Boom	Rough Seas/ Heavy Boom
Personnel	3	5
Support	1 work boat (20-30 ft.) plus crew	1 work boat (40-50 ft.) plus crew
Material	6 anchors, lines, and buoys	12 anchors, lines, and buoys

1.1.3 Containment Booming

Containment booming should be used on open water to surround an approaching substance and to protect the shoreline. Waves higher than 12 in. will wash oil over the booms. Containment booming is most effective inland when currents are less than 1 knot and if the slick is not too large. It causes minor shoreline disturbance at inland anchor points (2, p. 800-34).

1.1.4 Sorbent Booming

Particulate sorbent is encased in plastic mesh and formed into a boom. This type of boom is set along shoreline to prevent petroleum from washing up on the shore or to block petroleum from leaching off a contaminated shoreline into the water. These relatively low-strength booms cannot be used in fast moving water; even at low speed oil often seeps underneath (1, p. 41). Refer to the description of sorption Section 3.2.2, Removal and Recovery Options.

1.2 Water Jets

A stream of water is directed at a shallow angle to move oil or prevent further spreading. The water jets can be used to push oil towards a skimmer, wash oil out from under a dock, or hold a slick at the surface (1, p. 41).

1.3 Air Jets

The rotor wash from a helicopter or an air boat propeller is used to push the petroleum product across the surface or corral it in a specific area. The pollutant will move at about 3 percent of the wind speed (1, p. 41).

1.4 Air Barriers

Bubbles of air from a submerged manifold are used to contain a petroleum product or direct it to a skimmer. The ambient current must be low for this method to work, and heavy oils may raft and pass through the barrier, but this method does not interfere with vessel traffic (1, p. 41).

1.5 Herding

Herding consists of the application of chemicals to maintain the slick and keep it from dispersing. Skimmers then are used more effectively, and the slick is controlled more easily (1, p. 41).

1.6 Beach Berms

This method is used on sandy, low-energy beaches to protect the upper intertidal zone. It disturbs the upper 24 inches of the mid-intertidal zone (2, p. 800-34).

1.7 Berms and Dams

Berms and dams are used on shallow streams or rivers where booms are not available or cannot be deployed, or if dams are part of the hydrologic control system (2, p. 800-34).

2. REMOVAL AND RECOVERY

2.1 Skimming

Skimmers can be weir, vortex, or sorbent surface removal mechanisms in an advancing or stationary operating mode (1, p. 41). The effectiveness of skimmers is limited by contact with the oil and fouling by debris. (3, pp. 141 to 145).

2.2 Sorption

Sorbents are used to protect the shoreline or to clean up after an area has been contaminated. They can be placed on a water surface or on the shore. Sorbents are classified into four categories:

- Inorganic - Naturally occurring minerals (perlite, vermiculite, glass wool);
- Natural organic - Straw, peat moss, sawdust. These have moderate sorption capacity and recovery of oil-soaked sorbent can be a problem;
- Polymeric - Synthetics, such as polyurethane and polyethylene, available in bags, pads, sheets, chips, and/or booms that have the highest sorption capability; and
- Miscellaneous - Combinations, cellulose fiber, and perlite (1, p. 41).

Sorbent materials come as squares and strips (pads), rolls and sweeps, booms, pillows, and loose material.

> *"Pads are used in confined spaces to pick up small quantities of oil. Rolls are much like pads but can be cut into convenient lengths. Rolls are very effective at protecting walkways, boat decks, working areas, and previously uncontaminated areas. They can be used to cover sites for temporary storage of oily material."*
>
> *"Booms are tightly compacted and absorb best if oil is driven into them, or they are rotated and moved around in the oil. They work only in quiet water but can be used to shelter protected areas and be deployed behind skimmers to pick up excess. Loose materials should not be used on spills into water because the oily material can not be easily recovered. Loose material is used for small pools that have formed in depressions on land." (2, p. 800-122)*

2.3 Vacuum Pumping

This method cannot remove oil completely, but can play an integral part in the clean-up (1,p. 41).

> *"Vacuum pumping is best used to pick up petroleum product which has collected in pools on the shoreline, but can also be used to skim relatively thick layers of oil off the surface of the water. The second method is more inefficient because large amounts of water are also picked up. This method is invaluable in the absence of skimming equipment.*
>
> *"Vacuum trucks are backed up to the oil and suction hoses are maneuvered manually until the oil is removed. A screen over the suction nozzle will prohibit debris from entering the truck where it could cause major damage. Finer mesh screen should be used for light oil like kerosene, and coarse screen for heavy oils. Booms or other means of concentrating oil on the water surface increase efficiency on water" (2, p. 800-129).*

2.4 Vegetation Cropping

Predicted efficiency and effectiveness of oil removal are low. The technique may be practical for aquatic macrophytes (1, p. 41). (2, p. 800-123) (13)

2.5 Flushing

A stream of water can be used to remove stranded oil from the intertidal zone. The efficiency and potential for environmental damage is directly related to the pressure and temperature of the water. Ambient seawater is usually used to avoid extensive biological damage and is usually applied to solid structures or consolidated sediment (1, p. 41). Low-pressure flushing is used for non-sticky oils on lightly contaminated areas. *"It will not disturb the substrate to any great extent .... Direct application of water stream is not necessarily desired as erosion and damage to flora and fauna may result. Bathing the substrate will generally float the oil off the surface without any adverse effects. It can then be channeled into collection areas for removal. Containment booms should be anchored just past the surf zone if there is the possibility of oil re-entering the water. Flushing should be completed at low tide to prevent re-contamination at high tide."* (2, p. 800-111) (13)

2.6 Beach Cleaning

A mobile beach cleaner is used to pick up tar balls or patches on a rotating sorbent belt. This type of equipment is used for sand or gravel beaches with light oil or discrete patches of oil. These machines disrupt only the top layer of the sediment (1, p. 41)(13).

Another form of beach cleaning involves putting sand into a tank filled with water. Agitation removes the oil and the clean sand is returned to the beach. Mud does not work well (1, p. 41). (2, p. 800-16)(13)

2.7 Substrate Removal

Heavy equipment is used to remove oiled sediment. The potential for environmental disturbance and subsequent erosion is high (1, p. 41). Detailed information on pushing substrate into the surf is given in (2, p. 800-30) and (13).

2.8 Sand Blasting

A projectile of sand is used to remove oil from hard surfaces (docks). It is best for thin accumulations or hard oil. There is often a problem with removing the blasted material (1, p. 1) (13).

2.9 Steam Cleaning

This method is used mostly for cleaning boulders, rocks, and other hard surfaces. It is moderately labor intensive, and the oil taken from the boulders still needs to be removed from the area (1, p. 41) (13).

2.10 Burning

Burning involves combusting volatile fractions by igniting a slick. Controlled burns are difficult to maintain. Burning is practical mainly in cold environments where oil slicks are thick and lighter fractions will not evaporate. Incineration can be used for contaminated equipment, and oiled debris (1, p. 41). (2, p. 800-123) (13)

2.11 Manual Removal

This method is very labor intensive but often can be used in some form (1, p. 41) (13).

2.12 Enhanced Biodegradation

Enhanced biodegradation can be accomplished through seeding, fertilization, or a combination of both. Often the products are washed away and become ineffective (1, p. 41) (13).

3. NATURAL CLEANSING

All forms of clean-up and removal except natural cleansing cause some disturbance or destruction of the environment. Often the clean-up effort is more destructive than the oil itself. Thus natural cleansing should be the first clean-up option considered.

Natural cleansing has been identified as the preferred clean-up option in the following situations:

- Exposed habitats where oil persistence is relatively short;
- Other available clean-up options would aggravate chemical contamination, i.e., by mixing oil deeper into sediment;

- Other available clean-up techniques would cause severe physical damage for biological communities; and

- Other options are limited by impracticality or inefficiency (1, p. 2).

- Natural cleansing sometimes becomes a necessity if there is no access or where clean-up operations would be environmentally hazardous (2, p. 800-143) (13).

4. WILDLIFE DETERRENCE

Visual, auditory, tactile, olfactory, and physiological effects may be used to try to keep animals away from a contaminated area (1, p. 41) (13).

> *"Bird warning systems can be used in nesting, feeding, and flyway stopover areas. Bird warning systems are used to deter birds from entering a contaminated area. These methods may have limited effectiveness but "it is far better to keep birds out of a spill area than to try to rehabilitate them once they have become oiled." Warning methods are electronic sound devices to produce distress calls, pyrotechnics, gas exploders, and aircraft. "The most consistently successful method is strategically placed human activity."*
>
> *"In a discharge situation several units should be moved into place quickly. A warning device may be placed in a raft and allowed to drift with the oil slick. Stationary units should be moved as the oil spill moves. Workers in the area must wear ear protective devices, since the noise level of some devices is very loud."*
>
> *"Propane cannons with shotguns using blank shells and/or crackers and abstract sound systems are effective on shorelines. Positions should be rotated since habituation will occur. Propane cannons must be placed muzzle to the wind, so excess air will mix with the propane and prevent explosion in the cannon."*

During a spill situation, the first efforts should be used to determine which methods are most effective and to reorganize resources. The activity of people, boats, and machinery involved in clean-up will usually cause the greatest disturbance to waterfowl (2, p. 800-63). Logistical requirements for wildlife deterrence are given in Table I-3.

TABLE I-3
LOGISTICAL REQUIREMENTS FOR BIRD WARNING SYSTEMS (2, p. 800-64)

	Number/20 hectares of contaminated area	*Number/kilometer of shoreline*
People	50-75*	25-50.
Sound Devices	1-2	3-4
Pyrotechnics	1	2-3
Gas Exploders	1-2	3-4
Aircraft	1	1
(1 small boat or raft needed per waterborne warning device)		

* Includes clean-up crew

5. WILDLIFE REHABILITATION

Birds and mammals can be rehabilitated, but methods are expensive and do not always work (1, p.41)

APPENDIX E
STANDARD OPERATING PROCEDURES

CATALOG LIST OF SOPS

SOPs Contained Herein

Name	Last Revision Date
Scheduled Visual Inspection Log	August, 1998
Tanker Truck Unloading	August, 1998
Monthly API 653 Inspection Log	April, 2000
Spill/Discharge Response	April, 2000
Weekly Tank Inspection Log	August, 1997

SOPs Maintained On-Site in Indexed Book

Name	Tab Letter	Last Revision
Complete Plant Start-Up	A	August, 1998
Complete Plant Shut-Down	B	August, 1998
Complete Plant Shut-Down to Warm Conditions	C	August, 1998
Complete Plant Shut-Down to Cold Conditions	D	August, 1998
Auxiliary Boiler Operation	E	August, 1998
Gas Turbine Start-Up	F	August, 1998
Steam Turbine Start-Up	G	August, 1998
Cooling Water System Start-Up	H	August, 1998
Circulating Water System Start-Up	I	August, 1998
Duct Burner Operation	J	August, 1998
HP Boiler Feed Pump Operation	K	August, 1998
IP/LP Boiler Feed Pump Operation	L	August, 1998
Hotwell Pump Operation	M	August, 1998
Circulating Water Pump Operation	Mc	August, 1998
Cooling Water Pump Operation	N	August, 1998
GT Liquid Fuel System operation	O	August, 1998
GT Fuel Switching Procedure	P	August, 1998
Tanker Truck Unloading	Q	August, 1998
GT Off-Line Crank Wash Procedure	R	August, 1998
Sewer PH Probe Calibration	S	August, 1998
Spill Discharge Response	T	September, 1998
Fire Protection Systems Impairment Reporting Procedure	U	August, 1998

SCHEDULED VISUAL INSPECTION LOG - N.J.A.C. 7:1E - 2.10(a) 1-6 [DPCC/DCR]

The following visual inspections are required to be performed to lessen chances of an accidental discharge of petroleum distillate, hazardous material, or other regulated bulk stored product or to provide safe and adequate containment in the event of a discharge. The inspector is to enter the date of inspection, and indicate whether Item 1) no actions are needed, Item 2) additional, follow-up observation is needed, or Item 3) a work-order repair is needed. If items 2 & 3 are indicated, they are to be carried onto the following sheet(s) until either additional observations indicate no cause for concern (Item 2) or the work order is completed (Item 3).

***** SEE REVERSE SIDE FOR SPECIFIC LIST OF ITEMS TO BE INSPECTED *****

I DAILY INSPECTIONS

- D.1 Liquid precipitation within containment area is less than 6 inches
- D.2 Debris has not accumulated within containment area
- D.3 No evidence of staining, discoloration, puddling on containment floor or tank walls
- D.4 Precipitation drain valve in closed position, ice or snow not clogging drain

II WEEKLY INSPECTIONS

- W.1 No cracks in secondary containment walls or curbing
- W.2 No droplets of stored products from process areas (seals, valves, etc.)
- W.3 No droplets of stored product, discoloration or corrosion on/from aboveground pipes
- W.4 No bowing between pipe supports
- W.5 No vegetation (dead or alive) in containment or near tank

III MONTHLY INSPECTIONS

- M.1 Check tank shell for paint failure, corrosion, pitting
- M.2 Check tank ring for product leakage, standing water
- M.3 Perimeter fencing around site is secure
- M.4 Locks and gates protecting loading points/tanks/process areas are secure
- M.5 Clean-up material inventory is adequate
- M.6 High and high-high level alarms are functional
- M.7 Tank gauge cables are not bound, frayed or worn
- M.8 Test of deluge system, fire hose water supply check

IV QUARTERLY INSPECTIONS

- Q.1 Tank gauge test - reconciliation against inventory records
- Q.2 Drip inspection of valves, pumps, flanges
- Q.3 Corrosion inspection of valves, pumps, flanges

Date: _____ Type of Inspection: _____ Signature: _____

Action Item(s) From Previous Inspections: Print Name: _____

Code: _____ Location: _____ Action Item: _____

Results of current inspection indicate: _____ No Problems _____ Need for Follow-up (listed below)...

Action Item(s) From Current Inspection:

Code: _____ Location: _____ Action Item: _____

Resolution of Action Items: _____

INSPECTION MATRIX

(See Previous Page For Inspection Itineraries)

Item	Type Of Inspection
A - Primary Storage Tanks (Oil, Ammonia, Caustic, Acid)	
Containment	*Daily & Weekly*
Piping	*Weekly*
Shell	*Monthly*
Gauges	*Monthly*
Inventory Reconciliation	*Monthly & After Each Delivery*
Product Unload Area	*Prior To Delivery (See Unload SOP)*
B - Secondary Storage Tanks (Cooling Tower Additive, Boiler Water Additives, Lube Oil Dispensing Skid, Oil Water Separator, Neutralization Tank	
Containment	*Daily & Weekly*
Piping	*Weekly*
Shell	*Monthly*
C - Processes (Steam/Gas Turbine Reservoirs, Main & Auxiliary Transformers)	
Leakage (Valves, Seals, Etc.)	*Weekly*
Piping & Support	*Weekly*
D - Miscellaneous Storage (Drum Storage, Sulfuric Acid Storage)	
Containment	*Daily & Weekly*

STANDARD OPERATION PROCEDURE NO. 13
TANKER TRUCK UNLOADING

I. PURPOSE

A. This procedure is a uniform guideline for tank truck off loading of liquid acid, caustic, ammonia, or kerosene.

The receipt and handling of liquid sulfuric acid, caustic soda, ammonia, or kerosene is a potentially dangerous evolution. It is imperative that all persons involved follow all applicable safety precautions and use this standard procedure as a guide every time. In addition, proper implementation of this SOP requires that all spill control/prevention equipment (deluge system, overflow alarms, cleanup sorbents, secondary containment) are functional/available. Strict adherence to the routine check-list inspections will allow for proper implementation in the event of an emergency.

II. SAFETY EQUIPMENT (For Participating Operators)

A. Minimum requirements - long sleeve shirt, long pants, gloves and goggles.
B. For acid, caustic or ammonia - Full face respirator with appropriate cartridges, acid/caustic suit, and self contained breathing apparatus (SCBA).
C. 2-Way Radio.

III. PRE - UNLOAD PROCEDURES

A. Prior to truck arrival, inspect unload area to ensure site is clear of any obstructions or materials that could impede tanker or personnel access.
B. Instruct tanker driver, via security intercom, to await arrival of plant personnel who will accompany driver and truck to appropriate unload area.
C. Inspect truck bill of lading to ensure proper contents and specifications.
D. Have the driver set the truck brakes and set chocks on drive or trailer wheels on one side. Erect any traffic warning signs or barriers.
E. Evaluate wind direction and locate potential downwind impact areas in the event of a caustic, acid or ammonia discharge. The operator's SCBA must be available for use in an upwind location.
F. Remove locks from unloading point and vapor balancing valves (if applicable).

Approved By (Print Name): _____
Signature: _____ Date: _____

G. Inspect unloading and vapor recovery hoses and connectors for cracks, bulges, worn gaskets or any other signs of weakness. The tank truck driver is to perform all connecting and disconnecting of liquid transfer and vapor recovery hoses and couplings. Hoses should be positioned to be out of facility traffic and not stretched, strained or kinked. All connections must be securely tightened.

H. Ensure a nozzle and 100 feet of fire hose are available and have neutralization material available for the product being transferred.

I. Ensure tank drain valves are shut and blanked.

J. Ensure that a true indication of tank level is known prior to the filling operation.

K. Verify that all connections have been properly made. Have the operator radio the control room and ask the Shift Supervisor for permission to commence filling.

L. Instruct the driver to remain present at the pump controls at all times - sitting in the truck cab during delivery is not allowed. The operator must observe the delivery from an upwind area.

IV. MATERIAL LOADING PROCEDURE

A. Open inside blocking valve on storage tank on ammonia tank. Open outside blocking valve on ammonia, acid, caustic or kerosene storage tank.

B. Slowly place the truck pump into operation, checking liquid delivery line for signs of any product leakage. If there is any leakage immediately shut down pump, otherwise, gradually increase pump to full operation.

C. Check the receiving storage tanks gauges frequently during unloading to avoid overfilling. Slow or no response of the gauges may indicate a constriction or blockage in the product flow. Stay in communication with the control room in the event that the high-level alarm is activated.

D. When transfer of liquids is complete, driver will blow down the transfer hose. Prior to the disconnecting of any hoses or breaking of any connections by the driver, operator will ensure all blocking valves are shut and vapor equalization valves (for the ammonia system) are closed.

V. POST UNLOAD PROCEDURES

A. Drain any residual liquid within hose into appropriate containers. Replace all

protective caps on couplings, hoses and blocking valves (if applicable).

B. Return locks to unloading point and vapor balancing valves.

C. Remove protective apparel and return non-expendable equipment to proper locations. Replace any spent material in kind.

D. Remove chock blocks and any traffic warning signs/barriers.

E. Notify Shift Supervisor that truck is departing facility.

F. Ensure the transfer is recorded in the log book. Reconcile the pre and post tank delivery volumes (as indicated by the tank gauges) against the volume of liquid just delivered. Large differences must be investigated.

VI. SPILL CONTAINMENT

Oil Leakage or Spill - Notify Shift Supervisor, contain with sorbents where possible - for larger spills allow to drain to secondary containment then to oil-water separator. Initiate clean-up action.

Ammonia, Acid or Caustic Leak or Spill - Notify Shift Supervisor, don protective gear in an upwind location, using appropriate neutralizing agent to neutralize small spills; for large spills, ensure that liquid goes to secondary containment and is properly routed to the chemical sump. Initiate clean-up action.

Approved By (Print Name): _____
Signature: _____ Date: _____

MONTHLY API 653 INSPECTION LOG - N.J.A.C. 7:1E - [DPCC/DCR]

In lieu of the 5-year integrity testing requirements of the facility kerosene, ammonia, caustic and acid tanks, monthly inspections, following an API 653 inspection program, are to be performed. This SOP describes the API requirements for monthly testing. The monthly inspection is one of four components in the API 653 inspection program. Other components include scheduled external visual inspection by an API 653-certified inspector, in service ultrasound testing for thickness measurement and internal inspection. The scheduled dates for these other three components are listed in Table II-3 of the DPCC/DCR Plan.

To properly complete this form, the inspector is to enter the date of inspection, and indicate whether Item 1) no actions are needed, Item 2) additional, follow-up observation is needed, or Item 3) a work-order repair is needed. If items 2 & 3 are indicated, the form is left uncompleted until additional observations indicate no cause for concern (Item 2) or the work order is completed (Item 3). At that time entry of resolution must be made where provided.

I FOUNDATION

F.1 Inspect for broken concrete, spalling, and cracks, particularly under backup bars used in welding butt welded annular rings under the shell.
F.2 Inspect drain openings in ring, back of waterdraw basins and top surface of ring for indication of bottom leakage.
F.3 Inspect for cavities under foundation and vegetation against bottom of tank.
F.4 Check that runoff rainwater from the shell drains away from the tank.
F.5 Check for settlement around perimeter of tank.
F.6 Check site for drainage away from tank and associated piping and manifolds.
F.7 Check operating condition of dike drains.
F.8 Inspect area for buildup of trash, vegetation, and other inflammables.

II EXTERNAL VISUAL

X.1 Visually inspect for paint failures, pitting, and corrosion.
X.2 Clean off the bottom angle area and inspect for corrosion and thinning on plate and weld.

III SHELL APPURTENANCES

S.1 Inspect for cracks or signs of leakage on weld joint at nozzles, manways, and reinforcing plates.
S.2 Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection.
S.3 Inspect for flange leaks and leaks around bolting.

CONTINUED ON NEXT PAGE

MONTHLY API 653 INSPECTION LOG - N.J.A.C. 7:1E - [DPCC/DCR]

III SHELL APPURTENANCES (Continued)

S.4 Inspect sealing of insulation around manways and nozzles.
S.5 Inspect for wet insulation under the weather coat.
S.6 Inspect manifold piping, flanges, and valves for leaks.
S.7 Inspect firefighting/deluge components (not applicable for kerosene, acid or caustic tanks).
S.8 Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movement.
S.9 Check for adequate thermal pressure relief of piping to the tank.
S.10 Check for damage and test the accuracy of temperature indicators (if applicable).
S.11 Check welds on shell-mounted davit clips above valves 6 inches and larger.
S.12 Inspect condition of board and legibility of board-type autogauges.
S.13 Test freedom of movement of marker and float.
S.14 Compare actual product level to the reading on the autogauge (maximum variation is 2 inches).

IV ROOF

R.1 Visually inspect for paint failure, holes, pitting, and corrosion on roof deck.

V ROOF APPURTENANCES

RA.1 Check autogauge inspection hatch for corrosion and missing bolts.
RA.2 Inspect for corrosion on the tape guide's and float guide's wire anchors.

Date: _____ Type of Inspection: _____ Signature: _____
Action Item(s) From Previous Inspections: Printed Name: _____
Code: _____ Location: _____ Action Item: _____

Results of current inspection indicate: _____ No Problems _____ Need for Follow-up (listed below)...
Action Item(s) From Current Inspection:
Code: _____ Location: _____ Action Item: _____

Resolution of Action Items: _____

SPILL/DISCHARGE RESPONSE SOP

The following SOP describes measures to be taken in response to a materials spill (leak) or discharge event. The SOP was developed on the basis that outside contractors have been retained as event First Responders. ANY CHANGE IN THE POLICY, WHERE FACILITY PERSONNEL ARE TO ACT IN A FIRST RESPONDER ROLE, WILL REQUIRE IMMEDIATE REVISION TO THIS SOP. IN ADDITION, THE NOTIFICATION LIST PROVIDED WITH THIS SOP SHOULD BE REVIEWED AND UPDATED PERIODICALLY.

A key element in executing this SOP is the understanding of the difference between a "Spill (Leak)" event and a "Discharge" event as defined by NJDEP.

Spill (Leak) - means any escape of a hazardous substance from the ordinary containers employed in the normal course of storage, transfer, processing or use into a secondary containment or diversion system or onto a surface from which it is cleaned up and removed prior to its escape into the waters or onto the lands of the State. A spill (leak) is not a reportable event, although records of the spill and subsequent clean-up should be maintained.

Discharge - means any intentional or unintentional action or omission resulting in the releasing, spilling, pumping, pouring, emitting, emptying, or dumping of a hazardous substance into the waters or onto the lands of the State or into the waters outside the jurisdiction of the State, when damage may result to the lands, waters, or natural resources within the jurisdiction of the State. Note: any discharge onto soil that is cleaned up within 24-hours is not considered a reportable event, however, records of the spill and clean-up action must be kept on file. Otherwise, the event is reportable pursuant to DPCC/DCR regulations.

A. SPILL (LEAK)

1. Upon discovery of a hazardous material spill, the Shift Supervisor is to be immediately notified.
2. The material will be identified and appropriate safety information obtained from the Material Safety Data Sheet. Safety information will include the level of personnel protection needed.
3. Only those employees who are certified, via appropriate training, are authorized to respond to the spill. Those authorized are to dress in appropriate personnel protection including coveralls, rubbers boots and gloves, and splash protecting eye-wear for events involving kerosene, and enhanced protection for events involving ammonia, acid, caustic or unknown materials (i.e., acid/caustic suits, ammonia respirator cartridges). Constant Two-way radio contact shall be maintained with the Shift Supervisor at all times.
4. Upwind and downwind locations shall be identified on the basis of current wind direction, as provided by the Shift Supervisor.
5. Upon arrival at the scene, the status of the event shall be established; if the spill is continuing, evaluate the opportunity for stopping further discharge through closure of an upstream valve or any other appropriate action. All staging/command post areas must be established in upwind locations.
6. If the spill occurred within a contained area, ensure containment drain lines are aligned for proper treatment (to oil/water separator for kerosene, to chemical sump for all other).
7. If spill occurred outside of a containment area, slow or stop further spread using sorbent material and pillows/blankets or appropriate neutralizing agent. Protect storm water and sewer drains first and foremost.

Approved By (Print Name): _____

Signature: _____ Date: _____

NOTE: IF SPILL EXTENDS BEYOND FACILITY PROPERTY, PROCEED TO "SECTION B - DISCHARGE"

A SPILL (LEAK) (CONTINUED)

8 Initiate clean-up, pack all spent sorbents into an appropriate hazardous waste drum.

9 All surfaces contaminated with the hazardous waste must be cleaned using appropriate methods (steam cleaning, high pressure detergent wash, or other appropriate agent).

10 Prepare a spill report, including cause and clean-up actions, and copy to file.

B. DISCHARGE

8 If spill spreads beyond property line, or enters the storm water or sanitary discharge (sewer) lines, the event becomes a discharge. At this point attempt to control the discharge from further spread using appropriate sorbent material or neutralizing agent. Contact must be made with the First Responder Contractor listed in the Notification List (attached).

9 The Shift Supervisor must notify the people or agencies listed in the DPCC/DCR Plan "Notification to Authorities" section of the event. The list of contacts is replicated in this SOP. When contacting these people, be prepared to provide:

1. your name, title, affiliation, address and telephone number,
2. location of the discharge (municipality, affected water bodies),
3. the common name of the substance that was discharged, start (and if applicable) end time of the event,
4. actions taken to contain the discharge, and
5. name of the person responsible for the discharge (if applicable).

The NJDEP should be called first and foremost, preferably within the first 15 minutes of the event. Follow-up calls must be placed every 15 minutes, or as indicated by NJDEP. If the NJDEP Hotline is inoperable or unresponsive, the State Police should be notified. Additional calls should be place to other authorities, depending on the extent of the discharge (i.e., Coast Guard if a water body is involved, police and fire is offsite property is involved or material presents an airborne hazard).

10 If contamination associated with the discharge is limited to soils, and the clean-up is completed within 24-hours of the discharge, a written DCR report need not be filed with the NJDEP, however, a record of the event must be maintained. If discharge contamination extends beyond the soil, or contaminated soil is not cleaned-up within 24-hours, a DCR Discharge report must be filed.

Approved By (Print Name): _____
Signature: _____ Date: _____

SPILL/DISCHARGE RESPONSE SOP

Notification Sheet - Contact Numbers (Newark)

NAME		TELEPHONE NUMBER
Facility Contacts		
SEC: Robert Hilbert		(973) 817 - 7936 (work) 856 ~~(609)~~ 728 - 8499 (home) (800) 514 - 0321 (beeper)
Alternative SEC: Mark Doughty Operations & Maintenance Manager		(973) 817 - 7936 (work) (973) 205-2058 (beeper)
Calpine Eastern Region		(617) 723 - 7200
Newark Boxboard (Security)		(973) 589 - 6846
Shift Supervisor (will act as SEC if necessary)		(973) 730 - 3546
Outside Contacts		
LEPC		(973) 733 - 3660 (day) (973) 733 - 7400 (night)
Police (Newark Police Department)		911
Fire (Newark Fire Department)		(973) 733 - 7400
EMS/Medical Transport		(973) 733 - 3660
Melrose Hose Company		(732) 721 - 0762
NJDEP	(1-800-WARNDEP)	(800) 927 - 6337
	or	(609) 292 - 7172
State Police		(609) 882 - 2000
National Response Center		(800) 424 - 8802
Chemtrec		(800) 424 - 9300
United States Coast Guard (Port of New York)		(212) 668 - 7909 (212) 668 - 7936
Environmental Protection Agency Region II Hotline		(732) 548 - 8730
First Responder Contractor		
Clean Harbors (Edison, NJ)		(732) 248-1997 (phone) (732) 248-4414 (fax)

Page Revised April, 2000

Approved By (Print Name): _____

Signature: _____ Date: _____

Calpine Newark, Inc.
Weekly Tank Inspection Log

Date of Inspection: _____ **Signature of Inspector:** _____

The following visual inspections are required to be performed to lessen chances of an accidental discharge of petroleum distallate, hazardous material, or other regulated bulk stored product or to provide safe and adequate containment in the event of a discharge. The inspector will record whether A.) No actions are needed, B.) additional, follow-up observation is needed, or C.) a work order repair is needed. If items B or C are indicated, they are to recorded on the tank inspection work order index log sheet(s) until either additional observations indicate no cause for concern (item B) or the work order is completed (item C).

Weekly Inspections

Action Codes: (circle appropriate code letter)

		Acid			Caustic			Ammonia		
W.1	No cracks in secondary containment walls or curbing.	A	B	C	A	B	C	A	B	C
W.2	No droplets of stored products from aboveground pipes.	A	B	C	A	B	C	A	B	C
W.3	No discoloration or corrosion on aboveground pipes.	A	B	C	A	B	C	A	B	C
W.4	No bowing between pipe supports.	A	B	C	A	B	C	A	B	C
W.5	No vegetation (dead or alive) in containment or near tank	A	B	C	A	B	C	A	B	C

Record action(s) taken for all B & C codes circled above: _____

_____

_____

_____

_____

Weekly Inspections

Action Codes: (circle appropriate code letter)

		Kero Tank "A"			Kero Tank "B"		
W.1	No cracks in secondary containment walls or curbing.	A	B	C	A	B	C
W.2	No droplets of stored products from aboveground pipes.	A	B	C	A	B	C
W.3	No discoloration or corrosion on aboveground pipes.	A	B	C	A	B	C
W.4	No bowing between pipe supports.	A	B	C	A	B	C
W.5	No vegetation (dead or alive) in containment or near tank	A	B	C	A	B	C

Record action(s) taken for all B & C codes circled above: _____

_____

_____

_____

_____

APPENDIX H

INVENTORY OF ON-SITE CONTAINMENT AND CLEAN-UP EQUIPMENT

INVENTORY OF ON-SITE
CONTAINMENT AND CLEAN-UP EQUIPMENT

Quantity	Item
30	Socks/Booms 3" by 4"
30	Pillows, Two-Liter
24	Disposable Bags
4 Pair	Gloves
4 Pair	Tyvek Coveralls
1	Non-Sparking Shovel
1	Floor Stand Spill Sign
1	PH Test Kit

Two kits are maintained on-site and are located inside the Turbine Hall under the HRSG inlet breaching.

Clean Harbors Environmental Services, Inc.

Equipment List
By
Service Center

Metro Service Center
3 Sutton Place
Edison, NJ 08817

24 Hr. # (732) 248-1997
24 Hr. # (800) 782-8805
Fax # (732) 248-4414

Fred Olivari, General Manager

Personnel authorized to release equipment/materials/manpower/etc.

Name:	Car Phone #	Beeper/Pager #	After Hours #
Rob Miller	N/A	(201) 237-6704	(513) 755-6517
Craig Malloy	N/A	(201) 237-2738	(212) 517-5910
Larry Pedersen	N/A	(201) 237-1871	(732) 727-1548
John Stefanik	N/A	(201) 237-3342	(732) 830-8630
Tom Willis	N/A	(201) 346-2625	(732) 264-6687

EQUIPMENT LIST

Item Description	Location	Capacity/Size/Model	# of Units
(1) Marine Support Equipment			
22' Aquasport w/ Trailer	Metro	120 hp outboard (NJ4967FR)	1
20' Privateer w/ Trailer	Metro	100 hp outboard (NJ4393FR)	1
12' Loweline	Metro	20 hp (NJ9809FW)	1
(2) Motor Vehicles			
Vacuum Trailer	Metro	5000 gal	2
Vactor	Metro	12 cubic yards	1
Vacuum Truck	Metro	2500 gal	2
High Powered Vacuum Loader	Metro	Cusco 3,000 gallons	2
Utility Vehicles	Metro	Pick-Up Trucks	18
Emergency Response Van	Metro	Cube Vans (Manholes)	2
Spill Boom Trailer	Metro	---	2
Skid Vacuum	Metro	750 gal.	1
E/R Trailer	Metro	Oil Spill	2
Frac Tank	Metro	20,000 gal	1
(3) Pumps and Pressure Equipment			
1.5" Electric Pump	Metro	Viking Electric	1
Diaphragm Pump	Metro	2" (1-Poly)	3
Submersible Pump	Metro	Electric	3
2" Centrifugal Pump	Metro	Gasoline (Not for Flam.)	2
Hotsy	Metro	2500 psi, hot water, trailer mounted	2
(4) Oil Spill Containment Booms			
Containment Boom	Metro	American Marine 18"	2400'
Absorbents	Metro	Various types and amounts	

Item Description	Location	Capacity/Size/Model	# of Units
(5) Environmental Monitoring Equipment			
Explosion meter	Metro	---	2
MSA Gas & O2 Passport	Metro	---	3
PID	Metro	1-Photon, 1-HNU	2
Jerome Meter	Metro		1
Personal Air Sampling Pumps	Metro		5
Draegar Kits	Metro		2
HCN Meter	Metro	23 Tubes	1
(6) Recovery Equipment			
Suction & Discharge Hoses	Metro	2,000 ft.-2",3" and 4"	---
Swiss Skimmer	Metro	Olea II	1
Slurp Skimmer	Metro	---	1
Drums	Metro	55 and 85 gal	100
(7) Generators/Compressors/Light Towers			
Generator	Metro	---	4
Portable Light Set	Metro	---	2
Trailerized Air Compressor	Metro	175 CFM	2
Light Tower	Metro	---	1
Drum Loading Vacuum Unit	Metro	55 gal. drum	1
(8) Health and Safety Equipment			
S.C.B.A	Metro	Survivair	9
4 Man Cascade System	Metro	Airline Resp.	2
MSA Cartridge Mask	Metro	Mine Safety	30
MSA Full Face Mask	Metro	---	5
Tank Truck Entry Safety Harness	Metro		2
Mechanical Extraction Devices	Metro	w/Tripods	3
(9) Communications			
Radio System	Metro	Motorola/Nextel	1
(10) Miscellaneous			
Electric Blower	Metro	3,000 CFM	3
Air Driven Blower	Metro	11,000 CFM	2
Steam Cleaner / Hotsy	Metro		2
Pressure Washers	Metro		3

Clean Harbors Environmental Services, Inc.

Equipment List
By
Service Center

New Hampshire Service Center
20 Dunklee Road
Bow, NH 03304

24 Hr. # (603) 224-6626
24 Hr. # (603) 224-6640
Fax # (603) 224-6778

Dennis DiMambro, Operations Manager

Personnel authorized to release equipment/manpower/material/etc.

Name:	Car Phone #	Beeper/Pager #	After Hours #
Dennis DiMambro	(508) 494-4187	(800) 347-2574 #63816	(207) 384-6289
Dean Crosby	(603) 848-0161	(603) 385-0067 #1142714	(603) 776-2215
Scott Chambers	(603) 848-0160	(603) 564-7686 #225265	(603) 426-5142
Mike Gendron	N/A	(207) 870-4758	(603) 645-5896

*** If you are paging outside of NH dial 1-800-444-4835 then enter pager #.

EQUIPMENT LIST

Item Description	Location	Capacity/Size/Model	# of Units
(1) Marine Support Equipment			
'86 Mirrocraft 12'	Bow, NH	V-Hull	1
(2) Motor Vehicles			
Vacuum Truck	Bow, NH	3000 gal S.S.	1
Rack Truck	Bow, NH	11,000 87 Ford, 94 Ford	1
Box Truck	Bow, NH	93 Ford	1
Pickup	Bow, NH	86 , 87,& 93 Fords	4
Rangers	Bow, NH	88 & 89 Ford	2
(3) Pumps and Pressure Equipment			
Wilden Diaphragm Pump	Bow, NH	M-15 3"	2
Wilden Diaphragm Pump	Bow, NH	M-8 2"	2
Wilden Pump	Bow, NH	M-8 Chemical 2"	1
Pneumatic Drum Loader	Bow, NH	2	
Compressor	Bow, NH	2	
Hale Pump	Bow, NH	1.5"	1
Hotsy	Bow, NH	3000 psi, hot water, trailer mounted	1
(4) Oil Spill Containment Booms			
Oil Containment Boom	Bow, NH	18" American Marine	1000'
Oil Containment Boom	Bow, NH	18" Langerman	200'
(5) Environmental Monitoring Equipment			
Explosion meter	Bow, NH	Minigard II	2
HNU	Bow, NH	PI101	2
Draeger Pump	Bow, NH	2	
Personal Pump	Bow, NH	2	
Passport Exp Meter	Bow, NH	Passport	2

Item Description	Location	Capacity/Size/Model	# of Units
(6) Beach or Earth Cleaning and Excavating Equipment			
Bobcat Loader	Bow, NH	753	1
(7) Health and Safety Equipment			
30 Minute Airline	Bow, NH	30 Minute	1
Hip Air Breathing Appar.	Bow, NH	5 Min. Escape	3
Air Work Mask 30 Min.	Bow, NH	MSA	3

Clean Harbors Environmental Services, Inc.

Equipment List
By
Service Center

Mid-Atlantic Service Center (Philadelphia)
2301 Pennsylvania Avenue
Deptford, NJ 08096

24 Hr. # (609) 589-5000
24 Hr. # (800) 544-3128
Fax # (609) 227-9350

Fred Olivari, General Manager

Personnel authorized to release equipment/materials/manpower/etc.

Name:	Car Phone #	Beeper/Pager #	After Hours #
Fred Olivari	(609) 335-6321	(800) 366-2337 #11791	(610) 891-9659
Mike Golden	(609) 352-2471	(800) 366-2337 #10875	(609) 939-9637
George Johnson	(609) 330-0173	(800) 366-2337 #16082	(609) 939-6653
Andy Enzman	(609) 352-2473	(800) 366-2337 #25968	(609) 965-7442
Bill Eckstein	(609) 352-2466	(800) 366-2337 #16174	(609) 845-4793

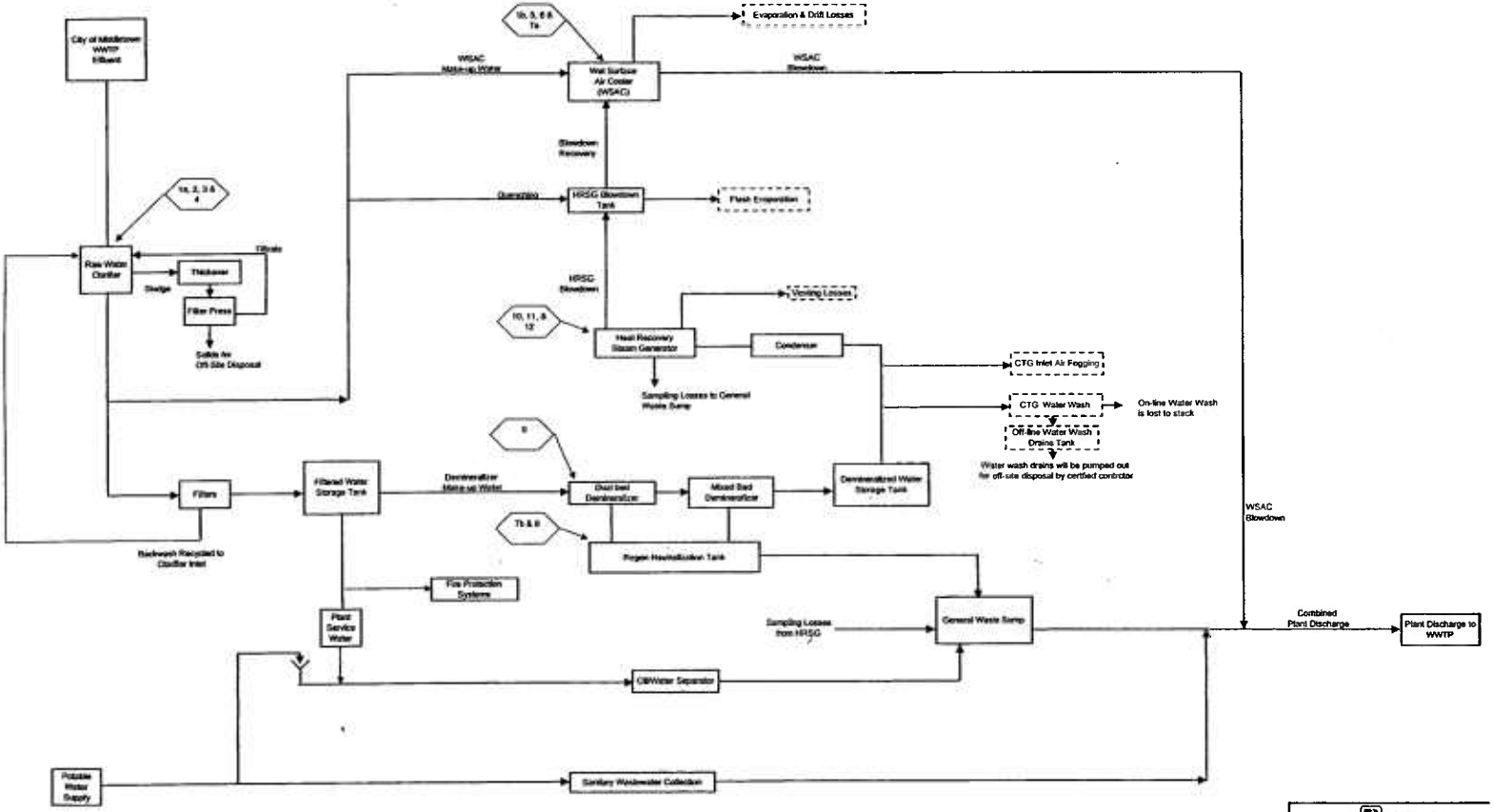
EQUIPMENT LIST

Item Description	Location	Capacity/Size/Model	# of Units
(1) Marine Support Equipment			
Eldia	Deptford	32Ft.-Twin/150 HP Motors	1
Pointer	Deptford	21Ft.-125 HP Motor	1
Monark	Deptford	18 Ft./Aluminum	1
Starcraft	Deptford	16 Ft./Aluminum	3
Crestline	Deptford	16Ft./Aluminum	1
Johnson/Watercraft	Deptford	150 HP	2
Johnson/Pointer	Deptford	120 HP	1
Mercury	Deptford	15 HP	3
Mercury	Deptford	9.9 HP	1
NRC Aluminum Barge System	Deptford	(2) 8' x 40' sectional barges	1
(2) Motor Vehicles			
Vacuum Truck	Deptford	3,000 galllon	2
Vac Trailer	Deptford	5,000 gallon	1
Roll Off Trailer	Deptford		1
Vactor	Deptford	2,500 gallon/12cu. yd.	1
Tractor	Deptford		2
Roll Off Containers	Deptford		4
Vacuum Unit	Deptford	Skid Mount 750gal	1
Pickup Trucks	Deptford		5
Crew Cab Pickups	Deptford		3
Rack Trucks	Deptford		2
Emergency Response Van	Deptford		1
Emergency Response Trailer	Deptford		2
Drum Trailer	Deptford		1
Boom Trailer	Deptford		3
Boat Stack Trailer	Deptford		1
Frac Tank	Deptford	20,000 gal	1

Item Description	Location	Capacity/Size/Model	# of Units
(3) Pumps and Pressure Equipment			
Double Diaphragm Pump	Deptford	1" - Pneumatic- Poly	1
Double Diaphragm Pump	Deptford	2" - Pneumatic - Poly	1
Double Diaphragm Pump	Deptford	2" - Pneumatic - S.S.	1
Double Diaphragm Pump	Deptford	2" - Pneumatic - Steel	5
Double Diaphragm Pump	Deptford	3" - Pneumatic - Steel	4
(3) Pumps and Pressure Equipment (Con't)			
Submersible Pump	Deptford	2.5" Electric	3
Trash Pump	Deptford	2" Gasoline	2
Cold Water Pressure Washers	Deptford	Gasoline	1
Hot Water Pressure Washer	Deptford	Gasoline	3
Hot Water Pressure Washer	Deptford	Trailer Mounted	1
Venturi Blower Tubes	Deptford	Pneumatic	3
Ventilation Fans (Copus)	Deptford	Pneumatic	2
Ventilation Fans (Electric)	Deptford		3
Firemans Fan	Deptford	Gasoline	1
Firemans Fan	Deptford	Electric	1
(4) Oil Spill Containment Booms			
American Marine	Deptford	18" Harbor Boom	4,200'
Absorbents	Deptford	Assortment	
(5) Environmental Monitoring Equipment			
MSA	Deptford	Passport/LEL	5
MSA	Deptford	PID	2
Photo Ionization Detector	Deptford	HNU	2
Draegar Pump	Deptford		2
Air Monitoring Pumps	Deptford	Personal	5
Jerome Meter	Deptford	Mercury	1
(6) Recovery Equipment			
Skimmer	Deptford	Skimpac 18000 Series	1
Skimmer	Deptford	Skimpac	1
Skimmer (NRC)	Deptford	Vikoma Fasflo	1
Skimmer (NRC)	Deptford	4 Band Vertical Mop Wringer	1
(7) Bench / Earth Cleaning / Excavating Equipment / Drum Handling			
Forklift (Level B Equiped)	Deptford	TCM	1
Drum Scale	Deptford	Portable	2
(8) Generators/Compressors/Light Towers/Lights			
Compressor	Deptford	175 CFM	1
Compressor	Deptford	185 CFM	1
Portable Generator	Deptford		4
Lighted Sign Board	Deptford	Diesel	1
Explosion Proof Lights	Deptford	Tank Lights	4
Explosion Proof Lights	Deptford	300 watt Spot Light	3
(9) Health and Safety Equipment			
MSA Supplied Air Systems	Deptford	Cascade	4
MSA SCBA	Deptford	30 minute setup	3
MSA SCBA	Deptford	60 minute setup	2
MSA Air Bottles	Deptford	30 minute	8
Hip-Air Egress Systems	Deptford	MSA - 15 minute	12
Hip-Air Bottles	Deptford	15 minute	4
Respirator Cartridges	Deptford	Assortment	
Personal Protective Clothing	Deptford	Assortment	
Level A Suits	Deptford	Lifeguard Responder	4
Level B Suits	Deptford	Responder	6

Item Description	Location	Capacity/Size/Model	# of Units
Portable Decon Showers	Deptford	Self-contained	2
Portable Storage Tank	Deptford	Poly Tank 4,000 gallon	1
Portable Storage Tank	Deptford	Poly Tank 500 gallon	1
Portable Storage Tank	Deptford	Poly Tank 350 gallon	1
HEPA Ventalators	Deptford	Microtrapps	2
HEPA Vaccums	Deptford	Hako	2
Mercury Vaccum	Deptford	Hako	1
Pathological Response Kit	Deptford		1
Confined Space Retreval Device	Deptford	Various	5
Cooling Vests	Deptford	Ice Pack	4
Portable Emergency Fencing	Deptford	500 Ft.	1
Full Body Harness	Deptford		10
(10) Communication Equipment			
Portable Radios	Deptford	Motorola	7
Mobile Radios	Deptford	Motorola	15
Marine Band Transceivers	Deptford	Icom M-11 Portable VHF	4
Cellular Phones	Deptford	Motorola	5
(11) Miscellaneous Equipment			
Anchors	Deptford		5
Line 3/8"	Deptford	Stock	1000'
Personal Flotation Devices	Deptford	Stock	20
Survival Suits	Deptford	Stock	8
Hard Hose	Deptford	2"	800'
Hard Hose	Deptford	3"	800'
Hard Hose	Deptford	4"	250'
Lay Flat Hose	Deptford	4"	50'
Vactor Hose	Deptford		800'
Air Hose	Deptford	3/4"	500'
Drum Vacuums	Deptford	Pneumatic	4
Ladders	Deptford	Various - Fiberglass	4
Ladders	Deptford	Tank - Fiberglass	1
Ladder	Deptford	Rope/100'	1
Portable Heaters - Space	Deptford	Diesel & Electric	2
Oxygen/Acetyne Cutting Torches	Deptford	Complete Sets	1
Sawzall	Deptford	Pneumatic/Electric	4
Carbide Cutoff Saw	Deptford	Electric	1
Metal Nibbler	Deptford	Pneumatic/Electric	2
Hole Saw	Deptford	Pneumatic	1

E-4: PRELIMINARY WATER TREATMENT INFORMATION



PARSONS

Calpine Wawayanda

"2 on 1" Combined Cycle Plant

Preliminary Chemical Additions Diagram

2 x 1 - GE 7251 FB, Natural gas Fired

Water Source: Middletown WWTP Effluent

DWG No:	Rev:	Date:
WAWA-1-SK-040-0001	A	8/1

PARSONS

Calpine - Wawayanda Energy Center

Revision: A
Date: August 10, 2001

CHEMICAL ADDITION FOR WATER TREATMENT

Refer to Water Balance Diagrams - WAWA-1-DB-022-0001, Rev.C

Make-up Water Pre-Treatment

Ref. No.	Generic Chemical Product Name	Chemical Name	Purpose	% Chemical in Product	Typical Daily Usage	Typical On-site Storage
1a	Bleach	Sodium Hypochlorite	Biological Control	12.50%	6 gal/day	10,000 gal bulk tank
2	Alum (dry basis)	Aluminum Sulfate	Coagulant	40%	40 lb/day	<2000 lbs
3	NALCO 8103	Polymer, water	Coagulant	--	0.5 gal/day	400 gal totes
4	NALCO 8110	Polymer	Flocculant	--	1 lb/day	< 200 lbs

WSAC Spray Water Treatment

Ref. No.	Generic Chemical Product Name	Chemical Name	Purpose	% Chemical in Product	Typical Daily Usage	Typical On-site Storage
5	NALCO 23289	Water, Phosphonate, Anionic polymer	Corrosion / Scale Inhibitor	--	.25 gal/day	Returnable Drums
6	Strabrex ST70		Oxidizer	--	0.75 gal/day	400 gal totes
7a	Sulfuric Acid	H2SO4 66 Be'	pH Control	--	4 gal/day	200 gal day tank (fed from 7b)
1b	Bleach	Sodium Hypochlorite	Biological Control	12.5%		10,000 gal bulk tank (same as 1a)

Dual - Mixed Bed Demineralizer

Ref. No.	Generic Chemical Product Name	Chemical Name	Purpose	% Chemical in Product	Typical Daily Usage	Typical On-site Storage
7b	Sulfuric Acid	H2SO4 66 Be'	pH Control	--	170 gal/day	10,000 gal bulk tank
8	Caustic	Caustic Soda (liquid 50%)	pH Control	50%	200 gal/day	10,000 gal bulk tank
9	NALCO 7408	Sodium Bisulfite	Chlorine Scavenging	--	0.5 gal/day	400 gal totes

Steam Cycle Treatment

Ref. No.	Generic Chemical Product Name	Chemical Name	Purpose	% Chemical in Product	Typical Daily Usage	Typical On-site Storage
10	NALCO BT3000	Phosphate, Caustic, Water	pH Control (Phosphate treatment)	--	2 gal/day	400 gal totes
11	NALCO Elimin-Ox	Carbohydrazide Solution	Oxygen Scavenger	--	3 gal/day	400 gal totes
12	NALCO 352	Amines, water	Corrosion Inhibitor	--	1.5 gal/day	400 gal totes

SCR System

Ref. No.	Generic Chemical Product Name	Chemical Name	Purpose	% Chemical in Product	Typical Daily Usage	Typical On-site Storage
13	Aqueous Amonia	Aqua Ammonia	NOx Reducing agent	19.5%	0.55 gal/day	(2) 15,000 gal tanks

Note 1: Pending final design and actual operating experience, some modification to the chemcial treatment programs are listed but not limited to:
- Make-up Water Pretreatment may require iron salts addition and pH balancing
- Steam Cycle Treatment systems may use an All-Volatile Treatment (AVT) plan.
- Alternative or additional biocide chemicals may be required in the Water Pre-Treatment or WSAC Spray Water treatment systems.

E-5: GROUNDWATER INVESTIGATION DATA

Summary of Seasonal High Groundwater Elevations (April 5, 2001)
Wawayanda Energy Center
Wawayanda, Orange County, New York

Well I.D.	Ground Elevation	Height of Sick-up	TOC-TIC	M. P. Elevation	Northing	Easting	Total Depth (ft. BGS)	April 5, 2001	
								Depth to Water (ft. BMP)	Groundwater Elevation
B-1	501.5	2.93	0.19	503.99	5542.8	4737.7	58.86	5.57	498.42
B-3	491.6	1.77	0.23	493.43	6172.1	5232.6	41.64	15.81	477.62
B-8	453.6	2.13	0.08	456.33	5489.9	5457.8	40.93	4.88	451.45
DP-1	446.3	2.72	NA	450.22	5536.2	6098.4	1.19	1.91	448.31
OBW-1S	450.2	2.10	0.06	452.17	5761.3	5907.6	17.45	2.95	449.22
OBW-2D	450.8	1.76	0.01	452.50	5771.4	5906.2	NM	1.20	451.30
OBW-3D	448.5	2.54	0.08	451.35	5278.3	5908.4	NM	1.45	449.90
BRW-1	448.5	1.50	NA	450.22	5409.3	6019.1	---	flowing 1.33 gpm @top	
BRW-2	452.7	2.30	NA	454.91	5965.2	5763.3	---	flowing 0.5 gpm @top	
BRW-3	449.1	1.38	NA	450.49	5578.1	6020.3	---	flowing 1.33 gpm @top	
SG-1	446.8	4.70	NA	451.99	5362.5	5884.9	NA	3.95	448.04

Summary of Stratigraphy
Wawayanda Energy Center
Wawayanda, Orange County, New York

			Overburden Deposits			Bedrock	
Well I.D.	Ground Elevation	Total Depth (ft. BGS) [Elevation]	Glaciolacustrine [Elevation]	Glaciofluvial [Elevation]	Glacial Till [Elevation]	Bedrock [Elevation]	Comments
B-1	501.5	60.7 [440.8]	---	---	0.8 - >60.7 [500.7 - <440.8]	>60.7 [<440.8]	50.7 - 60.7 (unweathered glacial till)
B-2	500.8	30.5 [470.3]	---	---	0.5 - >30.5 [500.3 - <470.3]	>30.5 [<470.3]	
B-3	491.6	41.9 [449.7]	---	---	0.5 - 36.1 [491.1 - 455.5]	36.1 - <41.9 [455.5 - <449.7]	31.9 - 41.9 (unweathered glacial till / upper bedrock)
B-4	477.7	36.5 [441.2]	---	---	0.7 - >36.5 [477.0 - <441.2]	>36.5 [<441.2]	
B-5	472.5	61.5 [411.0]	---	---	0.5 - >61.5 [472.0 - <411.0]	>61.5 <411.0]	
B-6	465.8	35.5 [430.3]	---	---	0.7 - >35.5 [465.1 - <430.3]	>35.5 [<430.3]	
B-7	457.7	26.5 [431.2]	---	---	1.0 - >26.5 [456.7 - <431.2]	>26.5 [<431.2]	
B-8	453.6	49.8 [403.8]	---	---	0.5 - 44.8 [453.1 - 408.8]	44.8 - <49.8 [408.8 - <403.8]	39.8 - 49.8 (unweathered glacial till / upper portion of bedrock)
B-9	450.8	32 [418.8]	0.8 - 10.0 [450.0 - 440.8]	10.0 - 15.0 [440.8 - 435.8]	15 - >32 [435.8 - <418.8]	<32 [<418.8]	
DP-1	446.3	4 [442.3]	---	---	---	---	
OBW-1S	450.2	19.5 [431.2]	0.5 - 19.0 [449.7 - 431.2]	---	19.0+ [<431.2]	--- [<431.2]	
OBW-2D	450.8	74 [376.8]	0.5 - 10.0 [450.3 - 440.8]	10 - 24 [440.8 - 426.8]	24 - 74 [426.8 - 376.8]	--- [<376.8]	
OBW-3D	448.5	42 [406.5]	0.5 - 20 [448.0 - 428.5]	---	20 - 42 [428.5 - 406.5]	--- [<406.5]	
BRW-1	448.5	445 [3.5]	0.5 - 19.5 [448.0 - 429.0]	---	19.5 - 32 [429.0 - 416.5]	32 - 445+ [416.5 - <3.5]	Fracture at 157 - 158' (10-12 gpm), large chips; Fracture at 280 - 282' (85 - 90 gpm), air hammer drops rapidly;at end of drilling well yields 175 - 200 gpm); low turbidity and hydrogen sulfide odor)
BRW-2	452.7	423 [29.7]	3 - 7 [449.7 - 445.7]	---	7 - 73 [445.7 - 379.7]	73 - 423+ [379.7 - <29.7]	Fracture @ 150 - 152' (5 gpm); numerous fractures at 360 - 370' (air lift yield of 125 - 140 gpm); at end of drilling well yields 125 to 140 gpm; low turbidity and hydrogen sulfide odor)
BRW-3	449.1	460 [-10.9]	2.5 - 14 [446.6 - 435.1]	---	14 - 48 [435.1 - 401.1]	48 - 460+ [401.1 - < -10.9]	Soft zone at 118 - 121' 91 gpm); fracture at 162 - 163' (5 gpm); Fracture at 211 - 215' (30 gpm); soft zone at 251 - 253' (35 gpm) air hammer drops rapidly; Fracture at 308 - 311' (150+ gpm) air hammer drops rapidly; at end of drilling well yields 175 - 200 gpm); low turbidity and hydrogen sulfide odor)

EARTH TECH 196 Baker Avenue Concord, Massachusetts 01742	PROJECT: Calpine Electric Middletown, NY	BORING NUMBER DP-1 SHEET 1 OF 1 DATE 02/02/01 FILE 39668.03

BORING COMPANY	Layne Christiansen Co.	SITE	Middletown, NY
FOREMAN	Jesse	GROUND ELEVATION	NS
EARTH TECH GEOLOGIST	Peter Wilson	CASING ELEVATION	NS
		DATE STARTED	1/23/01
		DATE ENDED	1/23/01

DRILLING

TYPE	Drive Point
CASING DIAMETER	2-inch
SAMPLER	None

WELL INFORMATION

WELL	DIAMETER	DEPTH	SCREEN INTERVAL	DEPTH TO WATER (TOC)	PVC ELEVATION
DP-1	2 inches	4'	1-4' bgs	NM	NS

DEPTH (FEET)	SAMPLE INTERVAL	SAMPLE DESCRIPTION	STRATA CHANGE	FIELD TESTING PID (ppm)	2" WELL
0		No samples collected		Not performed	
5'					
10'					
15'					
20'					

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

WELL CONSTRUCTION LEGEND

WELL SCREEN | SILICA SAND | BENTONITE | NATURAL BACKFILL | GROUT | BEDROCK

EARTH TECH 196 Baker Avenue Concord, Massachusetts 01742	PROJECT: Calpine Electric Middletown, NY	BORING NUMBER OBW-1S SHEET 1 OF 1 DATE 01/29/01 FILE 39668.03

BORING COMPANY	Layne Christiansen Co.	SITE	Middletown, NY
FOREMAN	Jesse	GROUND ELEVATION	Not Surveyed
EARTH TECH GEOLOGIST	Peter Wilson	CASING ELEVATION	Not Surveyed
		DATE STARTED	1/24/01 DATE ENDED 1/24/01

DRILLING	
TYPE	Dual Rotary
CASING DIAMETER	8-inch
SAMPLER	Cyclone/2" diameter split spoon

WELL INFORMATION

WELL	DIAMETER	DEPTH	SCREEN INTERVAL	DEPTH TO WATER (TOC)	PVC ELEVATION
OBW-1S	2-inches	19.5' bgs	14.5-19.5 bgs	NM	Not Surveyed

DEPTH (FEET)	SAMPLE INTERVAL	SAMPLE DESCRIPTION	STRATA CHANGE	FIELD TESTING PID (ppm)	2" WELL
0	0-0.5'	TOP SOIL	TOP SOIL	Not performed	
	0.5-2.5	Brown/gray, SILT and CLAY, dense, plastic, with little fine gravel, fine sand, moist	SILT and CLAY		
5'	5-7'	Brown/black, SILT and CLAY and fine to coarse gravel			
10'	10-12'	Brown/black, very coarse GRAVEL, little silt, clay, dense	GRAVEL, little silt, clay		
15'					
	19'	Brown/black/gray SILT, SAND and GRAVEL,	Till		
20'		Refusal encountered at 19.5' bgs			

PROPORTIONS USED		WELL CONSTRUCTION LEGEND			
TRACE	0 TO 10%	WELL SCREEN	SILICA SAND	BENTONITE	GROUT
LITTLE	10 TO 20%			NATURAL BACKFILL	BEDROCK
SOME	20 TO 35%				
AND	35 TO 50%				

EARTH TECH 196 Baker Avenue Concord, Massachusetts 01742	PROJECT: Calpine Electric Middletown, NY	BORING NUMBER OBW-2D SHEET 1 OF 3 DATE 01/29/01 FILE 39668.03

BORING COMPANY	Layne Christiansen Co.	SITE	Middletown, NY
FOREMAN	Jesse	GROUND ELEVATION	NS
EARTH TECH GEOLOGIST	Peter Wilson	CASING ELEVATION	NS
		DATE STARTED	1/24/01 DATE ENDED 1/24/01

DRILLING	
TYPE	Dual Rotary
CASING DIAMETER	8-inch
SAMPLER	Cyclone/2" diameter split spoon

WELL INFORMATION

WELL	DIAMETER	DEPTH	SCREEN INTERVAL	DEPTH TO WATER (TOC)	PVC ELEVATION
OBW-2D	2 inches	74' bgs	69-74' bgs	NM	NS

DEPTH (FEET)	SAMPLE INTERVAL	SAMPLE DESCRIPTION	STRATA CHANGE	FIELD TESTING PID (ppm)	2" WELL
0	0-0.5'	TOP SOIL	TOP SOIL	Not performed	
	0.5-2.5	Brown/gray, SILT and CLAY, dense, plastic, with little fine gravel, fine sand, moist	SILT and CLAY		
5'	5-7'	Brown/black, SILT and CLAY, with trace fine to coarse gravel			
10'	10-12	Brown/black, very coarse GRAVEL, little silt and clay	Coarse GRAVEL, little silt, clay		
15'	15-17'				
20'	20-24'	Brown/gray, SAND and GRAVEL, trace silt	SAND and GRAVEL, trace silt		
	24-26'	Gray, SANDY SILTY CLAY, trace fine gravel, dense	Till		

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

WELL CONSTRUCTION LEGEND

WELL SCREEN | SILICA SAND | BENTONITE | NATURAL BACKFILL | GROUT | BEDROCK

EARTH TECH 196 Baker Avenue Concord, Massachusetts 01742	PROJECT: Calpine Electric Middletown, NY	BORING NUMBER OBW-2D SHEET 2 OF 3 DATE 01/29/01 FILE 39668.03

DEPTH (FEET)	SAMPLE INTERVAL	SAMPLE DESCRIPTION	STRATA CHANGE	FIELD TESTING PID (ppm)				2" WELL		
25'										
	26-40	Gray, SAND, SILT and CLAY, some gravel, very dense								
30'										
35'										
40'	40-60	Gray/black, SILT, coarse SAND and fine GRAVEL, very dense, dry								
45'										
50'										
55'										

EARTH TECH 196 Baker Avenue Concord, Massachusetts 01742	PROJECT: Calpine Electric Middletown, NY	BORING NUMBER OBW-2D SHEET 3 OF 3 DATE 01/29/01 FILE 39668.03

DEPTH (FEET)	SAMPLE INTERVAL	SAMPLE DESCRIPTION	STRATA CHANGE	FIELD TESTING PID (ppm)	2" WELL
60'	60-74	Gray/black, SILT, fine to coarse SAND, fine GRAVEL, very dense, dry			
65'					
70'					
	74'	Weathered SHALE	Bedrock		
75'		End of boring at 75bgs			
80'					
85'					
90'					

EARTH TECH 196 Baker Avenue Concord, Massachusetts 01742	PROJECT: Calpine Electric Middletown, NY	BORING NUMBER OBW-3D SHEET 1 OF 2 DATE 01/29/01 FILE 39668.03

BORING COMPANY	Layne Christiansen Co.	SITE	Middletown, NY
FOREMAN	Jesse	GROUND ELEVATION	NS
EARTH TECH GEOLOGIST	Peter Wilson	CASING ELEVATION	NS
		DATE STARTED	1/24/01 DATE ENDED 1/24/01

DRILLING	
TYPE	Dual Rotary
CASING DIAMETER	8-inch
SAMPLER	Cyclone/2" diameter split spoon

WELL INFORMATION

WELL	DIAMETER	DEPTH	SCREEN INTERVAL	DEPTH TO WATER (TOC)	PVC ELEVATION
OBW-3D	2 inches	42' bgs	37-42' bgs	NM	NS

DEPTH (FEET)	SAMPLE INTERVAL	SAMPLE DESCRIPTION	STRATA CHANGE	FIELD TESTING PID (ppm)	2" WELL
0	0-0.5'	TOP SOIL	TOP SOIL	Not performed	
	0.5-2.5	Brown/gray/black, SILT and CLAY, dense, with little fine Sand & Gravel.	SILT and CLAY, with little fine sand and gravel		
5'	5-10'	Brown/black, SILTY, SANDY CLAY	SILTY, SANDY CLAY		
10'	10-15	Same as above			
15'	15-20'	Gray/black, SILT and CLAY	SILT and CLAY		
20'	20-30'	Gray/black, SILT and GRAVEL, little clay	SILT and GRAVEL, little clay		

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

WELL CONSTRUCTION LEGEND

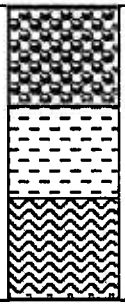
WELL SCREEN, SILICA SAND, BENTONITE, NATURAL BACKFILL, GROUT, BEDROCK

EARTH TECH 196 Baker Avenue Concord, Massachusetts 01742	PROJECT: Calpine Electric Middletown, NY	BORING NUMBER OBW-3D SHEET 2 OF 2 DATE 01/29/01 FILE 39668.03

DEPTH (FEET)	SAMPLE INTERVAL	SAMPLE DESCRIPTION	STRATA CHANGE	FIELD TESTING PID (ppm)	2" WELL
25'					
30'	30'	Same as above			
35'					
40'					
	42-43.7'	Weathered SHALE	BEDROCK		
		End of boring at 43.7' bgs			
45'					
50'					
55'					

Drilling Log Legend

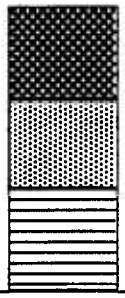
Key to symbols used in graphic log



Silty/Clayey Sand and Gravel

Gray Clay

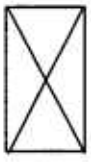
Black Shale



Gray Mudstone

Tan Sandstone

Light Gray Limestone



Sample collection interval (grab sample).

The number of rock fragments in a sample is:

Mostly: Greater than 50%
Some: 35% to 50%
Little: 10% to 35%
Trace: 1% to 10%

Hardness of individual samples is classified as follows:

Hard: Can be scratched with knife of pick only with difficulty. Hard blows of hammer required to detach hand specimen.

Moderately Hard: Can be scratched with knife of pick. Gouges or grooves to 1/16-inch deep can be incised by hand blow of point of geologist's pick. Hand specimens can be detached by moderate blow.

Moderately Soft: Can be grooved or gouged 1/4-inch deep by firm pressureon knife or pick point. Can be excavated in small chips to pieces about 1 inch maximum size by hard blows of the point of a geologist's pick.

Weathering of individual samples is classified as follows:

Fresh: Rock looks fresh. Crystals look bright. A few joints may show slight staining. Rock rings under hammer, if crystallines.

Slight: Rock generally looks fresh. Joints stained and discoloration extends into rock up to 1 inch. May show thin clay coatings. If open, joints may contain clay. In granitioid rocks, some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer blows

Moderate: Significant portions of rock show discoloration and weathering effects. In granitioid rocks, most feldspars are dull and discolored, some appear like clay. Rock has dull sound under hammer blows and shows significant loss of strength compared to fresh rock.

Moderately Severe: All rock material except quartz mineral discolored or stained. In granitoid rocks all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. Rock gives "clunk" sound when struck by hammer.

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
28-Nov-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-1

8 inch Casing (24.7lb/ft) Grouted From 5 to 53.5' Below Ground Surface

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
10		Gray CLAY, trace black Shale			CLAY
20		Dense brown SAND & GRAVEL, little gray Clay	Choppy drilling with roller cone bit		CLAYEY SAND & GRAVEL (TILL)
30					
40		Moderately weathered black SHALE, kaolinite on fractures	Smooth drilling with roller cone bit		
50		Fresh black SHALE	Casing set @ 52-5' Rapid drilling with air-hammer bit		BLACK SHALE
60		Fresh black SHALE, interlayered with Orthoquartzite			
70			No water		
80		Fresh black SHALE, trace Calcite			
90		Fresh black SHALE, trace Calcite			BLACK SHALE
100		Fresh black SHALE			
110					

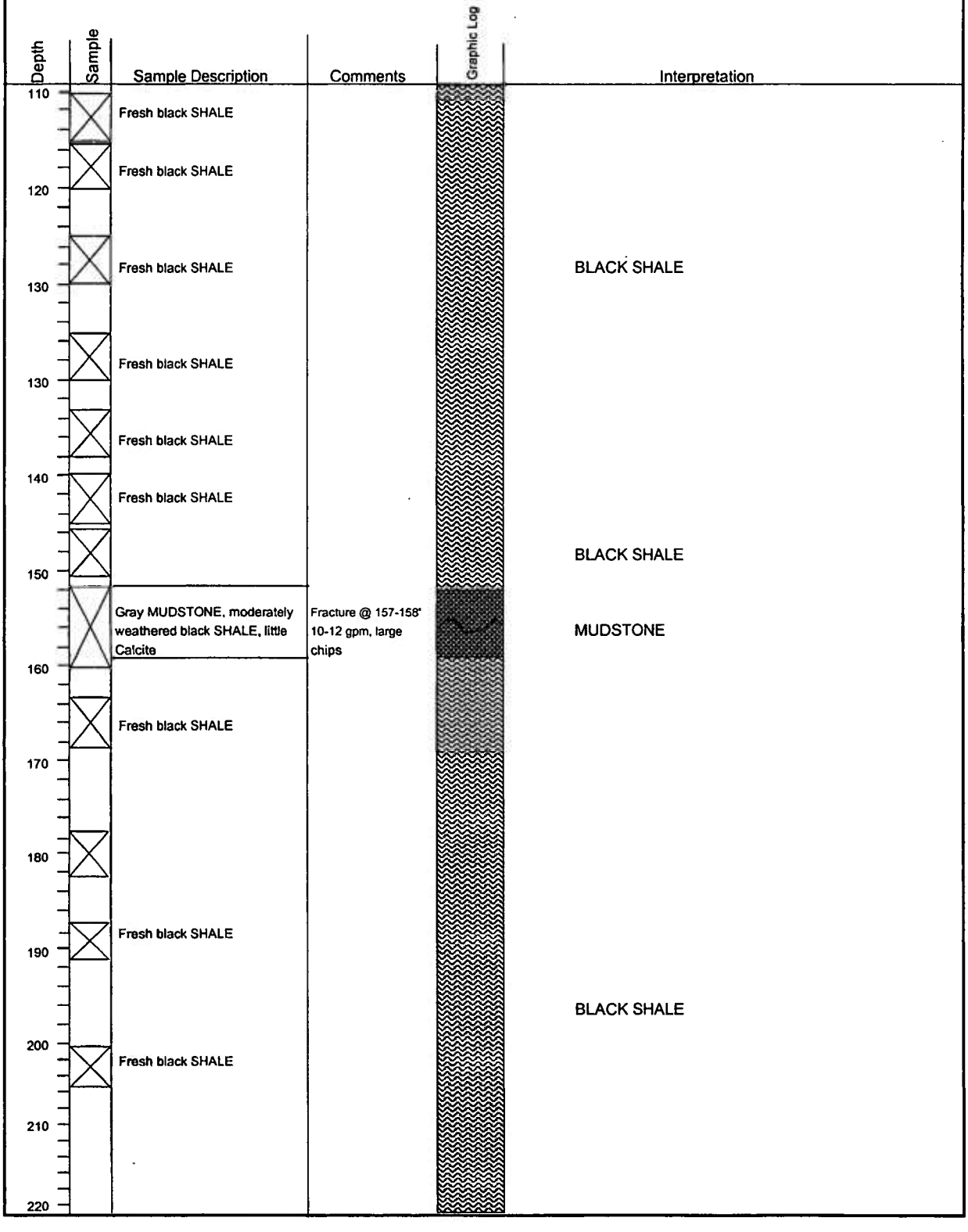
DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
28-Nov-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-1



Sample Description	Comments	Interpretation
Fresh black SHALE		
Fresh black SHALE		
Fresh black SHALE		BLACK SHALE
Fresh black SHALE		
Fresh black SHALE		
Fresh black SHALE		BLACK SHALE
Gray MUDSTONE, moderately weathered black SHALE, little Calcite	Fracture @ 157-158' 10-12 gpm, large chips	MUDSTONE
Fresh black SHALE		
Fresh black SHALE		BLACK SHALE
Fresh black SHALE		

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY- Calpine Corporation
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Dia 8"
28-Nov-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-1

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
220		Fresh black SHALE			
230		Fresh black SHALE			
240		Fresh black SHALE			
250		Fresh black SHALE			BLACK SHALE
260		Fresh black SHALE			
270		Fresh black SHALE			
		Slightly weathered black SHALE, increasing amount of Pyrite on facies			BLACK SHALE
280		Gray MUDSTONE, moderately weathered black SHALE, little Calcite, Pyrite on facies, limonite,drusy Quartz	Fracture @ 280- 282' 85-90 gpm, Air hammerdrops rapidly		MUDSTONE
290		Light brown SANDSTONE, fine-grain			SANDSTONE
300		Fresh black SHALE			
310					BLACK SHALE
320		Fresh black SHALE			
330		Fresh black SHALE			BLACK SHALE
340					

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY- Calpine Corporation
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
28-Nov-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-1

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
340					
		Fresh black SHALE			BLACK SHALE
350		Fresh black SHALE			
360		Fresh black SHALE			
		Fresh black SHALE			
370		Fresh black SHALE			
380		Fresh black SHALE			
390		Fresh black SHALE			BLACK SHALE
400		Fresh black SHALE			
410		Fresh black SHALE			BLACK SHALE
420		Fresh black SHALE			
430		Fresh black SHALE	Well making 85-90 gpm at end of drilling, cleared up nicely. Bottom of 8" Hole 445' Hydrogen Sulfide Odor		BLACK SHALE
440		Fresh black SHALE			
450					
460					

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
15-Dec-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-2

8 inch Casing (24.7lb/ft) Grouted From 5 to 88' Below Ground Surface

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
		Topsoil			
		Gray CLAY,Cobbles, trace black Shale			CLAY
10					
20					
		Dense brown SAND & GRAVEL, Cobbles, little gray Clay	Choppy drilling with roller cone bit, no loss of of drilling mud		CLAYEY SAND & GRAVEL (TILL)
30					
40					
50					
		Very dense brown SAND, fine-coarse GRAVEL, some Clay (Clay can be rolled to 1/16" thread diameter)	Very choppy drilling with roller cone bit, no loss of drilling mud		CLAYEY SAND & GRAVEL (TILL)
60					
70					
			Choppy drilling with roller cone bit Taking drilling mud		
		Dense gray fine-coarse SAND & GRAVEL, little Clay & Silt			
80		Gray fine-coarse GRAVEL angular, little fine-coarse Sand, little Silt	Choppy drilling with roller cone bit		
		Moderately weathered black SHALE, trace Calcite	Set casing @ 88'		
90		Slightly weathered black SHALE, trace Calcite			
					BLACK SHALE
100		Fresh black SHALE			
110					
		Fresh black SHALE			
120					

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
15-Dec-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-2

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
120		Fresh black SHALE			
		Fresh black SHALE			
130					
		Fresh black SHALE			BLACK SHALE
140					
		Fresh black SHALE			
150			Fracture @ 150'-152'		
		Moderately weathered black shale	5 gpm		
		Fresh black SHALE			
160		Fresh black SHALE			
					BLACK SHALE
170					
180					
		Fresh black SHALE			
190					
200					
		Fresh black SHALE			
210					BLACK SHALE
220		Fresh black SHALE			
230					
		Fresh black SHALE			
240					

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY- Calpine Corporation
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Dia 8"
15-Dec-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-2

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
240		Fresh black SHALE			BLACK SHALE
		Slightly weathered black SHALE, increasing amount of Pyrite			
250		Gray MUDSTONE, moderately weathered black SHALE, little Calcite, Pyrite on facies,	Fracture @ 250-252' 25-30 gpm, Air hammer drops rapidly		MUDSTONE
		Fresh black SHALE			
260					
270					BLACK SHALE
280		Fresh black SHALE			
290					BLACK SHALE
300		Fresh black SHALE			
310					
		Fresh black SHALE			
320					
330		Fresh black SHALE			
		Slightly weathered black SHALE, increasing amount of Pyrite on facies			
340			Fracture @ 340-341' 75-80 gpm, Air hammer drops rapidly		
350		Gray MUDSTONE, moderately to severly weathered black SHALE, Calcite, Pyrite on facies, interbeded layers of brown sandstone,	Numerous fractures between 345-360' Kaolinite on fracture surfaces		MUDSTONE, SHALE, interlayered SANDSTONE
360					

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY- Calpine Corporation
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
15-Dec-00	Air Hammer Rotary	William Stothoff Co.	Well No. BRW-2

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
360		Light gray LIMESTONE, vugs on some chips	Numerous fractures between 360-370' Estimated air-lift 125-140 gpm		LIMESTONE
370		Light brown SANDSTONE, fine-grained			SANDSTONE
380		Fresh black SHALE			
390		Fresh black SHALE			
400		Fresh black SHALE			
410		Fresh black SHALE			BLACK SHALE
420		Fresh black SHALE	Well making 125-140 gpm at the end of drilling cleared up nicely nicely. Bottom of 8" hole 423',Hydrogen Sulfide Odor		
430					
440					
450					
460					
470					
480					

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
17-Jan-01	Dual Air Hammer Rotary	Layne Christensen Co.	Well No. BRW-3

8 inch Casing (0.322" wall) Grouted From 5 to 59' Below Ground Surface

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
		Topsoil			
10		Gray CLAY, some fine-medium Sand & Gravel			CLAY
20		Very dense brown fine-coarse SAND & GRAVEL, some Clay (Clay can be rolled to 1/16" thread diameter)	Choppy drilling with air- hammer bit, no water		CLAYEY SAND & GRAVEL (TILL)
30					
40					
50		Moderately weathered black SHALE,Calcite on fractures 1-2" rock chips			
60		Slightly weathered black SHALE, trace Calcite			BLACK SHALE
70					
80		Fresh black SHALE			
90			Set casing @ 88'		
100					BLACK SHALE
110		Fresh black SHALE			
120		Slightly weathered black SHALE	Soft zone 118-121' 1 gpm		

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
17-Jan-01	Dual Air Hammer Rotary	Layne Christensen Co.	Well No. BRW-3

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
120		Fresh black SHALE			
		Fresh black SHALE			
130					
		Fresh black SHALE			BLACK SHALE
140					
		Fresh black SHALE			
150					
		Fresh black SHALE			
160		Slightly weathered black shale	Fracture @ 162-163' 5 gpm		
					BLACK SHALE
170					
180					
		Fresh black SHALE			
190					
					BLACK SHALE
200					
210		Gray MUDSTONE, moderately weathered black SHALE, Calcite	Fracture @ 211-215' 30 gpm		MUDSTONE
220		Fresh black SHALE			BLACK SHALE
230					
		Fresh black SHALE			
240					

DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY- Calpine Corporation
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
17-Jan-01	Dual Air Hammer Rotary	Layne Christensen Co.	Well No. BRW-3

Depth	Sample	Sample Description	Comments	Graphic Log	Interpretation
240		Fresh black SHALE			BLACK SHALE
250		Slightly weathered black SHALE, Kaolinite, Calcite	Soft zone @ 251-253' 35 gpm, Air hammer drops rapidly		MUDSTONE
260		Fresh black SHALE			
270		Fresh black SHALE			BLACK SHALE
280		Fresh black SHALE			
290		Fresh black SHALE			BLACK SHALE
300		Slightly weathered black SHALE, Increasing amount of Pyrite on facies			
310		Gray MUDSTONE, moderately to severly weathered black SHALE,Calcite, Pyrite on facies, Limonite	Fracture @ 308-311' 150+ gpm, Air hammer drops rapidly		MUDSTONE
		Slightly weathered black SHALE			
320		Fresh black SHALE			
330		Fresh black SHALE			
340		Fresh black SHALE			
350		Fresh black SHALE			BLACK SHALE
360		Fresh black SHALE			

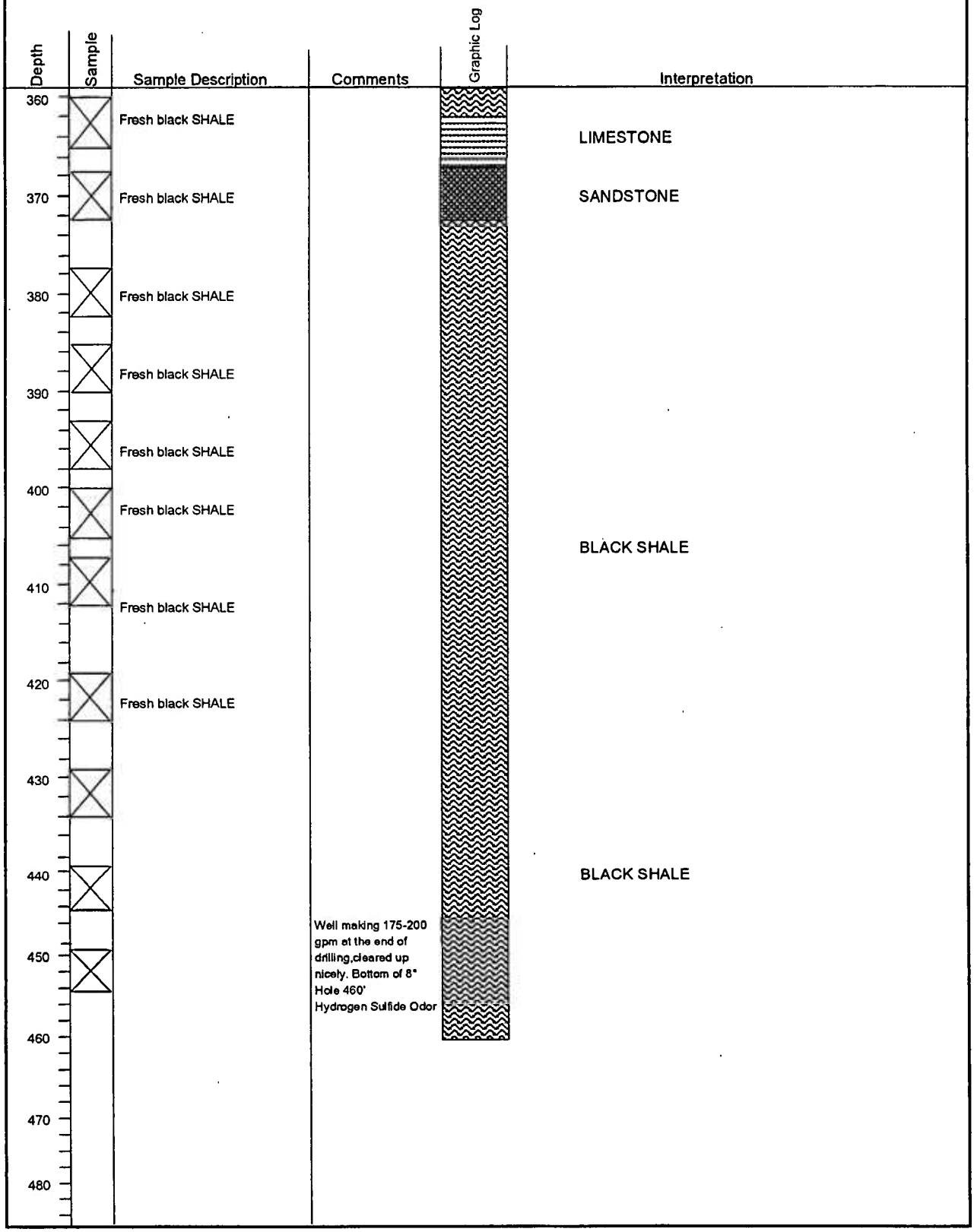
DRILL LOG

Prepared by: Gary L. Smith

Earth Tech, Concord, Massachusetts

Site: Wawayanda Energy Center, Wawayanda, NY- Calpine Corporation
Calpine Corporation

DATES	Drilling Method	Driller:	Borehole Diameter 8"
17-Jan-01	Dual Air Hammer Rotary	Layne Christensen Co.	Well No. BRW-3



APPENDIX F FAA DETERMINATIONS

Federal Aviation Administration
Eastern Region, AEA-520
1 Aviation Plaza
Jamaica, NY 11434-4809

AERONAUTICAL STUDY
No: 01-AEA-0885-OE

ISSUED DATE: 04/16/01

TRC ENVIRONMENTAL CORPORATION
CALPINE
FOOT OF JOHN STREET
LOWELL, MA 01852

** DETERMINATION OF NO HAZARD TO AIR NAVIGATION **

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Description: EXHAUST STACKS
NORTH STACK
Location: MIDDLETOWN NY
Latitude: 41-25-27.37 NAD 83
Longitude: 074-24-54.83
Heights: 225 feet above ground level (AGL)
685 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

-As a condition to this determination, the structure should be marked and/or lighted in accordance with FAA Advisory Circular 70/7460-1K Change 1, Obstruction Marking and Lighting, Chapters 3(Marked), 4, 5(Red), & 12.

-It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

X At least 10 days prior to start of construction (7460-2, Part I)

X Within 5 days after construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/16/02 unless:

(a) extended, revised or terminated by the issuing office or
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case the determination expires on the date prescribed by the FCC for completion of construction or on the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

-As a result of this structure being critical to flight safety, it is

Federal Aviation Administration
Eastern Region, AEA-520
1 Aviation Plaza
Jamaica, NY 11434-4809

AERONAUTICAL STUDY
No: 01-AEA-0886-OE

ISSUED DATE: 04/16/01

TRC ENVIRONMENTAL CORPORATION
CALPINE
FOOT OF JOHN STREET
LOWELL, MA 01852

** DETERMINATION OF NO HAZARD TO AIR NAVIGATION **

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Description: EXHAUSTS STACK
SOUTH STACK
Location: MIDDLETOWN NY
Latitude: 41-25-26.14 NAD 83
Longitude: 074-24-55.27
Heights: 225 feet above ground level (AGL)
685 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

-As a condition to this determination, the structure should be marked and/or lighted in accordance with FAA Advisory Circular 70/7460-1K Change Obstruction Marking and Lighting, Chapters 3(Marked), 4, 5(Red), & 12.

-It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

Y At least 10 days prior to start of construction (7460-2, Part I)

Y Within 5 days after construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/16/02 unless:

(a) extended, revised or terminated by the issuing office or
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case the determination expires on the date prescribed by the FCC for completion of construction or on the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

-As a result of this structure being critical to flight safety, it is

required that the FAA be kept apprised as to the status of this project. Failure to respond to periodic FAA inquiries could invalidate this determination.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, frequency(ies) or use of greater power will void this determination. Any future construction or alteration, including increase in heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at 718-553-4546. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 01-AEA-0885-OE.

Robert P. Alexander
Specialist, Airspace Branch

(DNE)

7460-2 Attached

required that the FAA be kept apprised as to the status of this project. Failure to respond to periodic FAA inquiries could invalidate this determination.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, frequency(ies) or use of greater power will void this determination. Any future construction or alteration, including increase in heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at 718-553-4546. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 01-AEA-0886-OE.

Robert P Alexander

Robert P. Alexander (DNE)
Specialist, Airspace Branch

7460-2 Attached

Federal Aviation Administration
Eastern Region, AEA-520
1 Aviation Plaza
Jamaica, NY 11434-4809

AERONAUTICAL STUDY
No: 01-AEA-0887-OE

ISSUED DATE: 04/16/01

TRC ENVIRONMENTAL CORPORATION
CALPINE
BOOTT MILLS SOUTH FOOT OF JOHN ST.
LOWELL, MA 01852

** DETERMINATION OF NO HAZARD TO AIR NAVIGATION **

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Description: TEMPORARY CRANE

Location: MIDDLETOWN NY
Latitude: 41-25-26.33 NAD 83
Longitude: 074-24-54.56
Heights: 300 feet above ground level (AGL)
760 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does exceed obstruction standards but would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

-As a condition to this determination, the structure should be marked and/or lighted in accordance with FAA Advisory Circular 70/7460-1K, Obstruction Marking and Lighting, Chapters 3(Marked), 4, 5(Red), & 12.

-It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

X At least 10 days prior to start of construction (7460-2, Part I)

X Within 5 days after construction reaches its greatest height (7460-2, Part II)

-As a condition to this determination, the temporary structure must be lowered to the ground when not in use and during the hours between sunset and sunrise.

This determination expires on 10/16/02 unless:

(a) extended, revised or terminated by the issuing office or
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case the determination expires on the date prescribed by the FCC for completion of construction or on the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

-As a result of this structure being critical to flight safety, it is required that the FAA be kept apprised as to the status of this project. Failure to respond to periodic FAA inquiries could invalidate this determination.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, frequency(ies) or use of greater power will void this determination. Any future construction or alteration, including increase in heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at 718-553-4546. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 01-AEA-0887-OE.

Robert P. Alexander (EBO)
Specialist, Airspace Branch

7460-2 Attached

Federal Aviation Administration
Eastern Region, AEA-520
1 Aviation Plaza
Jamaica, NY 11434-4809

AERONAUTICAL STUDY
No: 01-AEA-0888-OE
PRIOR STUDY
No: 01-AEA-0887-OE

ISSUED DATE: 04/16/01

TRC ENVIRONMENTAL CORPORATION
CALPINE
BOOTT MILLS SOUTH FOOT OF JOHN ST.
LOWELL, MA 01852

** DETERMINATION OF NO HAZARD TO AIR NAVIGATION **

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Description: TEMPORARY CRANE
7 DAYS
Location: MIDDLETOWN NY
Latitude: 41-25-26.33 NAD 83
Longitude: 074-24-54.56
Heights: 225 feet above ground level (AGL)
685 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

-As a condition to this determination, the structure should be marked and/or lighted in accordance with FAA Advisory Circular 70/7460-1K Change 1, Obstruction Marking and Lighting, Chapters 3(Marked), 4, 5(Red), & 12.

-It is required that the enclosed FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

X At least 10 days prior to start of construction (7460-2, Part I)

X Within 5 days after construction reaches its greatest height (7460-2, Part II)

This determination expires on 10/16/02 unless:

(a) extended, revised or terminated by the issuing office or
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case the determination expires on the date prescribed by the FCC for completion of construction or on the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

-As a result of this structure being critical to flight safety, it is

required that the FAA be kept apprised as to the status of this project. Failure to respond to periodic FAA inquiries could invalidate this determination.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, frequency(ies) or use of greater power will void this determination. Any future construction or alteration, including increase in heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

If we can be of further assistance, please contact our office at 718-553-4546. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 01-AEA-0888-OE.

Robert P. Alexander
Specialist, Airspace Branch

(DNE)

7460-2 Attached

APPENDIX G NATURAL GAS DOCUMENTATION

Tennessee Gas Pipeline
an El Paso company

'01 AUG July 27, 2001 11 07

Calpine Eastern
The Pilot House, 2nd Floor
Lewis Wharf
Boston, MA 02110

Ref: Calpine Wawayanda Energy Center

Attn: Mr. Robert Howard

Dear Mr. Howard:

Pursuant to our Agreement dated January 15, 2001, Tennessee Gas Pipeline Company ("Tennessee") has been conducting preliminary evaluations regarding the construction of certain pipeline facilities to provide natural gas transportation service between Calpine's proposed Wawayanda Energy Center located in Orange County, NY and Tennessee's mainline system at or near milepost 325-1 +3.25 in Sussex County, NJ.

This letter shall serve as notice to Calpine that Tennessee stands ready to prepare, file and seek approval of the necessary applications with the Federal Energy Regulatory Commission (FERC) for these pipeline facilities, provided that prior to such activities, Tennessee and Calpine execute agreements reflecting mutually agreeable commercial terms for this project.

However, Calpine should understand that nothing herein shall be construed as a representation or warranty by Tennessee as to the receipt and acceptance of all and any regulatory authorizations necessary for Tennessee to construct the referenced facilities or to render service thereon.

Tennessee looks forward to our continued discussions leading to those commercial terms.

Sincerely,

Andrew E. Levine
Manager, Business Development
Tennessee Gas Pipeline Company

Tennessee Gas Pipeline
1001 Louisiana Street Houston, Texas 77002
PO Box 2511 Houston, Texas 77252.2511
tel 713.420.2131 .

STATE OF NEW YORK
DEPARTMENT OF AGRICULTURE AND MARKETS
1 WINNERS CIRCLE
ALBANY, NEW YORK 12235

)f Agricultural Protection
evelopment Services

518 457-7076
ix: 518 457-2716

July 31, 2000

David Devine, Project Development Manager
Calpine
The Pilot House 2nd Floor
Lewis Wharf
Boston, MA 02110

Dear Mr. Devine:

The Department received a copy of the Preliminary Scoping Statement for the Wawayanda Energy Center.

After reviewing the information, the Department is particular concerned with the potential routing of the natural gas pipeline. The Department would like to be involved in the early planning stages of the pipeline in an effort to limit agricultural impacts.

If you have any questions, please give me a call at (518) 457-2713.

Sincerely,

Matthew J. Brower

Matthew J. Brower
Agricultural Resource Specialist

mjb

cc: Tina Palmero, NYS Dept. of Public Service

CALPINE

EASTERN REGIONAL OFFICE
THE PILOT HOUSE, 2ND FLOOR
LEWIS WHARF
BOSTON, MASSACHUSETTS 02110
617.723.7200
617.723.7635 (MAIN FAX)

August 24, 2000

Mr. Matthew Brower
State of New York
Department of Agriculture and Markets
1 Winners Circle
Albany, NY 12235

RE: Article X Preliminary Scoping Statement
Wawawayanda Energy Center
DPS Case 00-F-1256

Dear Mr. Brower:

Thank you for your comments on the Wawayanda Energy Center Preliminary Scoping Statement. We appreciate your particular concern with the potential routing of the natural gas pipeline and desire to be involved in the early planning stages of the pipeline in order to limit agricultural impacts.

As we discussed at our meeting on August 9, 2000, the pipeline could be built either by Calpine or a third party. In either case, the preferred interconnection is with El Paso's 300 line in Sussex, New Jersey. As such, it would be an Interstate pipeline permitted under the FERC 7C process.

Calpine's Article X Application will contain map level analyses of the potential pipeline route including evaluations of impacts to soils, land use, and agricultural areas. The Article X Application will also provide more information on the owner and operator of the pipeline. We look forward to your participation in the Article X and FERC 7C processes.

Please do not hesitate to call Ann Hueston, TRC Project Manager, at 978-656-3648 or me at 617-557-5323 if you have any questions. Thank you.

Sincerely,

David Devine HM

David A. Devine
Project Development Manager

196 Baker Avenue, Concord, Massachusetts 01742

L:\WORK\39668\PROJ\Article X\T&E\Wawayanda FWS-NY.doc

November 15, 2000

David A. Stilwell
U.S. Department of Interior
Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13045

Subject: Federally-listed or Proposed Endangered or Threatened Species Review for a Potential Natural Gas Pipeline Interconnect Route, Wawayanda Energy Facility, Orange County, NY

Dear Mr. Stilwell:

Telephone
978.371.4000
Facsimile
978.371.2468

On behalf of Calpine Eastern, Earth Tech is in the process of collecting environmental resource data to be used in siting a natural gas pipeline interconnect route for the proposed Wawayanda Energy Facility, Wawayanda, Orange County, New York (see attached figures). The proposed gas pipeline interconnect route begins at an interconnection with El Paso Energy's existing pipeline in the Wantage Township, Sussex County, New Jersey and extends approximately 20 miles northward to the proposed facility site. The pipeline would be aligned adjacent to or within existing utility rights-of-way or transportation corridors, wherever possible.

We are requesting information on the potential presence of federally-listed or proposed threatened or endangered species within ½ mile of the proposed pipeline corridor in New York. We also request information ion any significant habitats that may be near the pipeline corridor.

If you require any additional information, please contact me at (978) 371-4182. Thank you for your time and consideration in this matter.

Sincerely,

Earth Tech, Inc.

Darrell Oakley

Darrell Oakley
Environmental Scientist

Enclosures

cc: Don Neal, Calpine Eastern
Ann Hueston, TRC
Trish Gabriel, Earth Tech

Faxed 12/14/00

United States Department of the Interior

FISH AND WILDLIFE SERVICE
3817 LUKER ROAD
CORTLAND, NY 13045

December 13, 2000

Mr. Darrell Oakley
Environmental Scientist
Earth Tech
196 Baker Avenue
Concord, MA 01742

Dear Mr. Oakley:

This responds to your letter of November 15, 2000, requesting information on the presence of Federally listed or proposed endangered or threatened species in the vicinity of the proposed Calpine Eastern natural gas pipeline interconnect route for the Wawayanda Energy Facility in the Towns of Minisink and Wawayanda, Orange County, New York.

Except for occasional transient individuals, no Federally listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project impact area. In addition, no habitat in the project impact area is currently designated or proposed "critical habitat" in accordance with provisions of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Therefore, no Biological Assessment or further Section 7 consultation under the Endangered Species Act is required with the U.S. Fish and Wildlife Service (Service). Should project plans change, or if additional information on listed or proposed species or critical habitat becomes available, this determination may be reconsidered.

The above comments pertaining to endangered species under our jurisdiction are provided pursuant to the Endangered Species Act. This response does not preclude additional Service comments under the Fish and Wildlife Coordination Act or other legislation.

For additional information on fish and wildlife resources or State-listed species, we suggest you contact:

New York State Department
of Environmental Conservation
Region 3
21 South Putt Corners Road
New Paltz, NY 12561-1676
(845) 256-3000

New York State Department
of Environmental Conservation
Wildlife Resources Center - Information Services
New York Natural Heritage Program
700 Troy-Schenectady Road
Latham, NY 12110-2400
(518) 783-3932

National Wetlands Inventory (NWI) maps may or may not be available for the project area. However, while the NWI maps are reasonably accurate, they should not be used in lieu of field

surveys for determining the presence of wetlands or delineating wetland boundaries for Federal regulatory purposes. Copies of specific NWI maps can be obtained from:

Cornell Institute for Resource Information Systems
302 Rice Hall
Cornell University
Ithaca, NY 14853
(607) 255-4864

Work in certain waters and wetlands of the United States may require a permit from the U.S. Army Corps of Engineers (Corps). If a permit is required, in reviewing the application pursuant to the Fish and Wildlife Coordination Act, the Service may concur, with or without stipulations, or recommend denial of the permit depending upon the potential adverse impacts on fish and wildlife resources associated with project implementation. The need for a Corps permit may be determined by contacting Mr. Joseph Seebode, Chief, Regulatory Branch, U.S. Army Corps of Engineers, 26 Federal Plaza, New York, NY 10278 (telephone: [212] 264-3996).

If you require additional information please contact Michael Stoll at (607) 753-9334.

Sincerely,

Mark W. Clough

for

David A. Stilwell
Field Supervisor

cc: NYSDEC, New Paltz, NY (Environmental Permits)
NYSDEC, Latham, NY
COE, New York, NY

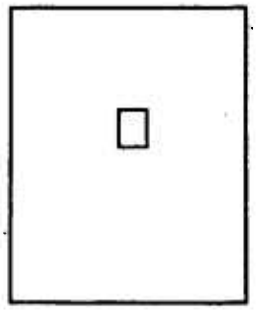
U.S. Fish and Wildlife Service
New York Field Office
3817 Luker Road
Cortland, NY 13045

Providing the following information will assist us in responding to your request for endangered species comments:

1. A concise description of the proposed project/action and where it will occur, including the name of the hamlet/village/city/town/county where the proposed project/action is in New York.

2. A map showing the proposed project/action location. The map should be a U.S. Geological Survey quadrangle map (USGS Quad). Please provide the name(s) of the USGS Quads involved.

   If only providing a portion of the quadrangle, indicate where the portion would be on the full quadrangle, i.e.

   Whole Quadrangle -  -Portion shown

3. The latitude and longitude of the proposed project/action (i.e. 42° 13' 28"/76° 56' 30"). If the proposed project/action is linear, provide coordinates for the beginning and ending points.

If you require additional information please contact Michael Stoll at (607) 753-9334.

196 Baker Avenue, Concord, Massachusetts 01742

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November 15, 2000

U.S. Fish and Wildlife Service
New Jersey Field Office
927 N. Main Street, Building D
Pleasantville, New Jersey 08232

Subject: Federally-listed or Proposed Endangered or Threatened Species Review for a Potential Natural Gas Pipeline Interconnect Route, Wawayanda Energy Facility, Sussex County, NJ

Dear Sir or Madam:

Telephone
978.371.4000
Facsimile
978.371.2468

On behalf of Calpine Eastern, Earth Tech is in the process of collecting environmental resource data to be used in siting a natural gas pipeline interconnect route for the proposed Wawayanda Energy Facility, Wawayanda, Orange County, New York (see attached figures). The proposed gas pipeline interconnect route begins at an interconnection with El Paso Energy's existing pipeline in the Wantage Township, Sussex County, New Jersey and extends approximately 20 miles northward to the proposed facility site. The pipeline would be aligned adjacent to or within existing utility rights-of-way or transportation corridors, wherever possible.

We are requesting information on the potential presence of federally-listed or proposed threatened or endangered species within ½ mile of the proposed pipeline corridor in New Jersey. We also request information on any significant habitats that may be near the pipeline corridor.

If you require any additional information, please contact me at (978) 371-4182. Thank you for your time and consideration in this matter.

Sincerely,

Earth Tech, Inc.

Darrell Oakley

Darrell Oakley
Environmental Scientist

Enclosures

cc: Don Neal, Calpine Eastern
Ann Hueston, TRC
Trish Gabriel, Earth Tech

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
927 North Main Street (Bldg. D1)
Pleasantville, New Jersey 08232

Tel: 609-646-9310
FAX: 609-646-0352

IN REPLY REFER TO:

ES-00/584

January 9, 2001

Darrell Oakley, Environmental Scientist
Earth Tech
196 Baker Avenue
Concord, Massachusetts 01742

Dear Mr. Oakley:

This responds to your November 15, 2000 request to the U.S. Fish and Wildlife Service (Service) for information on the presence of federally listed endangered and threatened species within the vicinity of the New Jersey portion of the proposed Wawayanda Energy Facility located in Sussex County, New Jersey.

AUTHORITY

This response is provided pursuant to Section 7 of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of federally listed endangered and threatened species. These comments do not address all Service concerns for fish and wildlife resources and do not preclude separate review and comments by the Service pursuant to the December 22, 1993 Memorandum of Agreement among the U.S. Environmental Protection Agency, NJDEP, and the Service, if project implementation requires a permit from the NJDEP pursuant to the New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B *et seq.*); nor do they preclude comments on any forthcoming environmental documents pursuant to the National Environmental Policy Act of 1969 as amended (83 Stat. 852; 42 U.S.C. 4321 *et seq.*).

FEDERALLY LISTED SPECIES

There is a known occurrence of the federally listed (threatened) bog turtle (*Clemmys muhlenbergii*) located adjacent to the project area. Also, two potentially suitable bog turtle habitats occur within and adjacent to the project area. Bog turtles inhabit open, wet meadows and bogs with standing or slow-moving shallow water over a mucky substrate. Bog turtles also occur in emergent and scrub/shrub wetlands and spring-fed fens, and have been found within forested wetlands that contain areas of emergent or scrub/shrub wetland habitat. Bog turtles prefer areas with good sunlight, high evaporation rates, high humidity in the near-ground

microclimate, and perennial saturation of portions of the ground. Threats to bog turtles include habitat loss from wetland alteration, development, natural vegetation succession, and illegal collection for the commercial pet trade (Bourg, 1992). Bog turtles in the vicinity of the project site may be adversely affected if project implementation results in direct or indirect modification of scrub/shrub or emergent wetlands.

Also, the subject project is located within the summer habitat range of the federally listed (threatened) Indiana bat (*Myotis sodalis*). Indiana bats hibernate in caves and abandoned mine shafts from October through April. Between April and August, Indiana bats inhabit flood plain, riparian, and upland forests, roosting under loose tree bark during the day, and foraging for flying insects in and around the tree canopy at night. During these summer months, numerous females roost together in maternity colonies. Maternity colonies use multiple roosts in both living and dead trees. From late August to mid-November, Indiana bats congregate in the vicinity of their hibernacula, building up fat reserves for hibernation (Harvey, 1992). Protection of Indiana bats during all phases of their annual life cycle is essential to preserving this species. Threats to the Indiana bat include disturbance or killing of hibernating and maternity colonies; vandalism and improper gating of hibernacula; fragmentation, degradation, and destruction of forested summer habitats; and use of pesticides and other environmental contaminants.

Aerial photographs show forested areas within the project area, which may provide suitable Indiana bat summer roosting and foraging habitat. Therefore, Indiana bats may be present on the project site during summer months. Tree clearing could adversely affect this species by killing, injuring or disturbing breeding or roosting bats. Therefore, the Service recommends a seasonal restriction on any tree clearing between April 1 and October 31. If project implementation will involve tree clearing, please forward a construction schedule to this office for review. If no tree clearing will be necessary for project implementation, please provide this office with documentation to that effect.

Threatened and endangered species and their habitats are afforded protection under Section 7(a)(2) of the Endangered Species Act (ESA), which requires every federal agency, in consultation with the Service, to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. An assessment of potential direct, indirect, and cumulative impacts is required for all federal actions that may affect listed species. Therefore, if the proposed Wawayanda Energy Facility will require any federal licenses or permits, or if any federal funds will be used in project implementation, further consultation pursuant to Section 7 of the ESA will be required.

In addition, Section 9 of the ESA includes prohibitions on unauthorized taking of listed species, which also applies to non-federal activities. Section 9 of the ESA prohibits any person from harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting listed wildlife species; attempting to engage in such conduct; or, soliciting or causing such acts to be committed. Section 3 of the ESA defines "person" to mean "an individual,

corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the federal government, of any State, municipality, or political subdivision of a State; or any other entity subject to the jurisdiction of the United States." Regulations implementing the ESA (50 CFR 17.3) further define "harm" to include significant habitat modification or degradation that results in the killing or injury of wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. "Harass" means an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include but are not limited to, breeding, feeding, or sheltering.

The Service requests that you provide detailed project plans of the proposed project to this office for review. Plans should show proposed activities in relation to wetlands and forested areas, and should include photographs of the project site and any wetlands within 300 feet. Please also provide a written description of any proposed impacts to wetlands and forested areas. Through the informal consultation process, the Service will provide site-specific recommendations to avoid adversely affecting federally listed species as a result of project implementation.

Except for the above-mentioned species and an occasional transient bald eagle (*Haliaeetus leucocephalus*), no other federally listed or proposed endangered or threatened flora or fauna under Service jurisdiction are known to occur within the vicinity of the New Jersey portion of the proposed project site. If additional information on federally listed species becomes available, or if project plans change, this determination may be reconsidered.

Current information regarding federally listed and candidate species occurring in New Jersey is enclosed, as well as addresses of State agencies that may be contacted for current site-specific information regarding federal candidate and State-listed species. The Service encourages federal agencies and other planners to consider federal candidate species in project planning. Information is also enclosed regarding permit requirements for activities in wetlands.

Please contact Lisa Arroyo of my staff at (609) 646-9310, extension 49 if you have any questions about the enclosed material or require further assistance regarding federally listed endangered or threatened species.

Sincerely,

John C. Staples
Assistant Supervisor

Enclosures

REFERENCE

Bourg, N.A. 1992. Status of the bog turtle (*Clemmys muhlenbergii*) in North America. Eastern Heritage Task Force of the Nature Conservancy, Middletown, Pennsylvania. Report to the U.S. Fish and Wildlife Service. 33 pp.

196 Baker Avenue, Concord, Massachusetts 01742

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November 15, 2000

Mr. Ted Kerpez
Senior Wildlife Biologist
New York State Department of Environmental Conservation
Region 3
21 South Putt Corners Road
New Paltz, NY 12561-1676

Subject: State-listed Rare, Threatened or Endangered Species, Significant Habitats and Natural Communities Review for a Potential Natural Gas Pipeline Interconnect Route, Wawayanda Energy Facility, Orange County, NY

Telephone
978.371.4000
Facsimile
978.371.2468

Dear Mr. Kerpez:

On behalf of Calpine Eastern, Earth Tech is in the process of collecting environmental resource data to be used in siting a natural gas pipeline interconnect route for the proposed Wawayanda Energy Facility, Wawayanda, Orange County, New York (see attached figures). The proposed gas interconnect route begins at an interconnection with El Paso Energy's existing pipeline in the Wantage Township, Sussex County, New Jersey and extends approximately 20 miles northward to the proposed facility site. The pipeline would be aligned adjacent to or within existing utility rights-of-way or transportation corridors, wherever possible.

We are requesting information on the potential presence of state listed threatened, endangered, or species of concern within ½ mile of the proposed pipeline corridor. We also request information on any significant habitats that may be near the pipeline corridor.

If you require any additional information, please contact me at (978) 371-4182. Thank you for your time and consideration in this matter.

Sincerely,

Earth Tech, Inc.

Darrell Oakley

Darrell Oakley
Environmental Scientist

Enclosures

cc: Don Neal, Calpine Eastern
Ann Hueston, TRC
Trish Gabriel, Earth Tech

196 Baker Avenue, Concord, Massachusetts 01742

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November 15, 2000

Betty A. Ketcham
New York State Department of Environmental Conservation
Wildlife Resources Center - Information Services
New York Natural Heritage Program
700 Troy-Schenectady Road
Latham, New York 12110-2400

Subject: Rare or State-listed Animal or Plants, Significant Habitats and Significant Natural Communities Review for a Potential Natural Gas Pipeline Interconnect Route, Wawayanda Energy Facility, Orange County, NY

Dear Ms. Ketcham:

Telephone
978.371.4000
Facsimile
978.371.2468

On behalf of Calpine Eastern, Earth Tech is in the process of collecting environmental resource data to be used in siting a natural gas pipeline interconnect route for the proposed Wawayanda Energy Facility, Wawayanda, Orange County, New York (see attached figures). The proposed gas interconnect route begins at an interconnection with El Paso Energy's existing pipeline in the Wantage Township, Sussex County, New Jersey and extends approximately 20 miles northward to the proposed facility site. The pipeline would be aligned adjacent to or within existing utility rights-of-way or transportation corridors, wherever possible.

We are requesting information on the potential presence of state-listed rare, threatened; endangered, or species of concern within ½ mile of the proposed pipeline corridor. We also request information on any significant habitats or significant natural communities that may be near the pipeline corridor. In New York, the proposed pipeline crosses the Towns of Minisink and Wawayanda. The route is located on the following USGS Quadrangles: Middletown, Pine Island, and Unionville, NY.

If you require any additional information, please contact me at (978) 371-4182. Thank you for your time and consideration in this matter.

Sincerely,

Earth Tech, Inc.

Darrell Oakley

Darrell Oakley
Environmental Scientist

Enclosures

cc: Don Neal, Calpine Eastern
Ann Hueston, TRC
Trish Gabriel, Earth Tech

New York State Department of Environmental Conservation
Division of Fish, Wildlife & Marine Resources
Wildlife Resources Center – New York Natural Heritage Program
700 Troy-Schenectady Road, Latham, New York 12110-2400
Phone: (518) 783-3932 FAX: (518) 783-3916

John P. Cahill
Commissioner

January 3, 2001

Darrell Oakley
Earth Tech
196 Baker Ave
Concord, MA 01742

Dear Mr. Oakley:

In response to your recent request, we have reviewed the New York Natural Heritage Program databases with respect to the proposed potential Natural Gas Pipeline Interconnect Route, Wawayanda Energy Facility, area as indicated on the map you provided, located in the Orange County.

> We have no records of known occurrences of rare or state-listed animals or plants, significant natural communities, or other significant habitats, on or in the immediate vicinity of your site.

The absence of data does not mean, however, that rare or state-listed species, natural communities or other significant habitats do not exist on or adjacent to the proposed site, but rather that our files currently do not contain any information which indicates their presence. For most sites, comprehensive field surveys have not been conducted. For these reasons, we cannot provide a definitive statement on the presence or absence of rare or state-listed species, or of significant natural communities. This information should not be substituted for on-site surveys that may be required for environmental assessment.

Our databases are continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

This response applies only to known occurrences of rare or state-listed animals and plants, significant natural communities, and other significant habitats maintained in the Natural Heritage Databases. Your project may require additional review or permits; for information regarding other permits that may be required under state law for regulated areas or activities (e.g., regulated wetlands), please contact the appropriate NYS DEC Regional Office, Division of Environmental Permits, at the enclosed address.

Sincerely,

Betty Ketcham gp

Betty A. Ketcham, Information Services
NY Natural Heritage Program

Encs.
cc: Reg. 3, Wildlife Mgr.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DIVISION OF ENVIRONMENTAL PERMITS REGIONAL OFFICES

REGION	COUNTIES	NAME	ADDRESS AND PHONE NO.
Region 1	Nassau Suffolk	John Pavacic Permit Administrator	Loop Road, Bldg. 40 SUNY Stony Brook, NY 11790-2356 (516) 444-0365
Region 2	New York City	Charles deQuillfeldt Permit Administrator	Hunters Point Plaza 4740 21st Street Long Island City, NY 11101-5407 (718) 482-4997
Region 3	Dutchess Orange Putnam Rockland, Sullivan Ulster, Westchester	Margaret Duke Permit Administrator	21 South Putt Corners Road New Paltz, NY 12561-1696 (914) 256-3059
Region 4	Albany Columbia Delaware Greene, Montgomery, Otsego Rensselaer, Schenectady, Schoharie	William J. Clarke Permit Administrator	1150 N. Westcott Road Schenectady, NY 12306-2014 (518) 357-2234
Region 5	Clinton Essex Franklin Fulton, Hamilton Saratoga, Warren, Washington	Richard Wild Permit Administrator	Route 86 Ray Brook, NY 12977 (518) 897-1234
Region 6	Herkimer Jefferson Lewis Oneida, St. Lawrence	Randy Vaas Permit Administrator	State Office Building 317 Washington Street Watertown, NY 13601 (315) 785-2246
Region 7	Broome Cayuga Chenango Cortland, Madison, Onondaga Oswego, Tioga, Tompkins	Ralph Manna, Jr. Permit Administrator	615 Erie Blvd. West Syracuse, NY 13204-2400 (315) 426-7439
Region 8	Chemung Genesee Livingston Monroe, Ontario, Orleans Schuyler, Seneca, Steuben Wayne, Yates	Albert Butkas Permit Administrator	6274 East Avon-Lima Road Avon, NY 14414 (716) 226-2466
Region 9	Allegany Cattaraugus Chautauqua Erie, Niagara, Wyoming	Steven Doleski Permit Administrator	270 Michigan Avenue Buffalo, NY 14203-2999 (716) 851-7165

1/2000

Earth Tech, Inc.
300 Baker Avenue, Suite 300
Concord, MA 01742
(978) 371-4000

PHONE CALL REPORT

Date: April 18, 2001

Project No.: 39668

THIS CONVERSATION TOOK PLACE BETWEEN:

Client / Agency Contact		Earth Tech Contact	
Name / Title:	Libby Herland/Manager	Name:	Darrell Oakley
Company:	Wallkill River National Wildlife Refuge	Project Name:	Wawayanda-Pipeline
Address:	1547 County Route 565 Sussex, NJ 07461	Subject of Call:	Pipeline Impacts on National Wildlife Refuge
Phone:	973.702.7266		

THE FOLLOWING WAS DISCUSSED:

Ms. Herland was contacted to follow-up on the letter that we sent her on November 15, 2000 in regards to potential impacts on the Wildlife Refuge from the proposed pipeline project. She did not reply to the letter request because she did not have any concerns. She stated that the project is not in proximity to the refuge to have an impact. She requested that we accept her verbal reply because she is quite busy.

Copies to: File

Actions to be taken:

196 Baker Avenue, Concord, Massachusetts 01742

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November 15, 2000

Office of Natural Lands Management
Natural Heritage Program
PO Box 404
22 South Clinton Avenue
Trenton, NJ 08625-0404

Subject: Rare or Endangered Species and Natural Communities Review for a Potential Natural Gas Pipeline Interconnect Route, Sussex County, NJ

Telephone
978.371.4000
Facsimile
978.371.2468

Dear Sir or Madam:

On behalf of Calpine Eastern, Earth Tech is in the process of collecting environmental resource data to be used in siting a natural gas interconnect route for the proposed Wawayanda Energy Facility, Wawayanda, Orange County, New York (see attached figures). The proposed gas interconnect route begins at an interconnection with El Paso Energy's existing pipeline in the Wantage Township, Sussex County New Jersey and extends approximately 20 miles northward to the proposed energy facility site. The pipeline would be aligned adjacent to or within existing utility rights-of-way or transportation corridors, wherever possible.

We are requesting information on the potential presence of rare or endangered species and natural communities within ½ mile of the proposed pipeline corridor in New Jersey. If you require any additional information, please contact me at (978) 371-4182. Thank you for your time and consideration in this matter.

Sincerely,

Earth Tech, Inc.

Darrell Oakley

Darrell Oakley
Environmental Scientist

Enclosures

cc: Don Neal, Calpine
Ann Hueston, TRC
Trish Gabriel, Earth Tech

:istine Todd Whitman
vernor

State of New Jersey
Department of Environmental Protection
Division of Parks and Forestry
Office of Natural Lands Management
Natural Heritage Program
P.O. Box 404
Trenton, NJ 08625-0404
Tel. #609-984-1339
Fax. #609-984-1427

Robert C. Shinn, Jr.
Commissioner

November 29, 2000

Darrell Oakley
Earth Tech
300 Baker Avenue, Suite 300
Concord, MA 01742-2167

Re: Natural Gas Pipeline Interconnect Route

Dear Mr. Oakley:

Thank you for your data request regarding rare species information for the above referenced project site in Wantage Township, Sussex County.

The Natural Heritage Data Base has records for occurrences of bog turtle, grasshopper sparrow, bobolink, savannah sparrow and vesper sparrow that may be on the site, for vesper sparrow, savannah sparrow and bobolink that may be on or in the immediate vicinity of the site, and for upland sandpiper, alder flycatcher, cliff swallow and bobolink that may be in the immediate vicinity of the site. The attached lists provide more information about these occurrences. **Because some species are sensitive to disturbance or sought by collectors, this information is provided to you on the condition that no specific locational data are released to the general public. This is not intended to preclude your submission of this information to regulatory agencies from which you are seeking permits.**

Also attached is a list of rare species and natural communities that have been documented from Sussex County. This county list can be used as a master species list for directing further inventory work. If suitable habitat is present at the project site, these species have potential to be present. If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend you contact the Division of Fish and Wildlife, Endangered and Nongame Species Program.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and natural communities. Two of these sites are located within or near the areas you have outlined. Please refer to the enclosed Natural Heritage Priority Site Maps for the locations and boundaries of these sites. On the back of each Priority Site Map is a report describing the significance of the site. You may find the site biodiversity significance rating to be useful if you need to prioritize among the sites in your environmental assessment.

PLEASE SEE THE ATTACHED 'CAUTIONS AND RESTRICTIONS ON NHP DATA'.

Thank you for consulting the Natural Heritage Program. The attached invoice details the

payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Thomas F. Breden
Supervisor

cc: Lawrence Niles
Thomas Hampton
NHP File No. 00-4107435

NATURAL LANDS MANAGEMENT

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the data base. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.

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POSSIBLY ON PROJECT SITE
RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN
THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK	DATE OBSERVED	IDENT.	LOCATION
*** Vertebrates									
AMMODRAMUS SAVANNARUM	GRASSHOPPER SPARROW		T/S		G5	S2B	1996-06-17	Y	ALONG UNIONVILLE ROAD, 0.3 MILE NORTH OF ITS INTERSECTION WITH WOLFPIT ROAD.
CLEMMYS MUHLENBERGII	BOG TURTLE	LT	E		G3	S2	1999-06-??	Y	WETLANDS NORTH-NORTHWEST OF LIBERTYVILLE, WANTAGE TOWNSHIP.
DOLICHONYX ORYZIVORUS	BOBOLINK		T/T		G5	S2B	1996-06-17	Y	ALONG UNIONVILLE ROAD, 0.3 MILE NORTH OF ITS INTERSECTION WITH WOLFPIT ROAD.
PASSERCULUS SANDWICHENSIS	SAVANNAH SPARROW		T/T		G5	S2B,S4N	1996-06-17	Y	ALONG UNIONVILLE ROAD, 0.3 MILE NORTH OF ITS INTERSECTION WITH WOLFPIT ROAD.
POOECETES GRAMINEUS	VESPER SPARROW		E		G5	S1B,S2N	1996-06-17	Y	ALONG UNIONVILLE ROAD, 0.3 MILE NORTH OF ITS INTERSECTION WITH WOLFPIT ROAD.

5 Records Processed

27 NOV 2000

ON OR IN IMMEDIATE VICINITY OF PROJECT SITE
RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN
THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK	DATE OBSERVED	IDENT.	LOCATION
*** Vertebrates									
DOLICHONYX ORYZIVORUS	BOBOLINK		T/T		G5	S2B	1996-06-17	Y	ALONG WOLFPIT ROAD, 0.2 MILE SOUTHEAST OF UNIONVILLE ROAD.
PASSERCULUS SANDWICHENSIS	SAVANNAH SPARROW		T/T		G5	S2B,S4N	1996-06-17	Y	ALONG CLOVE ROAD, 0.2 MILE NORTH OF ITS INTERSECTION WITH ROUTE 651 (UNIONVILLE ROAD).
POOECETES GRAMINEUS	VESPER SPARROW		E		G5	S1B,S2N	1996-06-17	Y	ALONG WOLFPIT ROAD, 0.2 MILE SOUTHEAST OF UNIONVILLE ROAD.

3 Records Processed

27 NOV 2000

IMMEDIATE VICINITY OF PROJECT SITE
RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN
THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK	DATE OBSERVED	IDENT.	LOCATION
*** Vertebrates									
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER		E		G5	S1B	1996-06-17	Y	ALONG QUARRY ROAD, APPROXIMATELY 0.85 MILE NORTH OF THE WOLFPIT ROAD INTERSECTION.
DOLICHONYX ORYZIVORUS	BOBOLINK		T/T		G5	S2B	1996-06-10	Y	ALONG QUARRY ROAD, APPROXIMATELY 0.85 MILE NORTH OF THE WOLFPIT ROAD INTERSECTION.
EMPIDONAX ALNORUM	ALDER FLYCATCHER		S/S		G5	S2B	1996-06-17		ALONG QUARRY ROAD, APPROXIMATELY 0.75 MILE NORTH OF THE WOLFPIT ROAD INTERSECTION.
PETROCHELIDON PYRRHONOTA	CLIFF SWALLOW		S/S		G5	S2B	1996-06-17	Y	ALONG QUARRY ROAD, APPROXIMATELY 0.85 MILE NORTH OF THE WOLFPIT ROAD INTERSECTION.

4 Records Processed

agencies, federal, county or municipal governments or nonprofit conservation organizations. This GIS coverage is constantly being updated, and therefore future editions of the maps will likely contain additional public lands that are not currently mapped as such.

What is the biodiversity significance rank and how is it used?

Each site is ranked according to its significance for biological diversity using a scale developed by The Nature Conservancy and the network of Natural Heritage Programs. The ranks can be used to distinguish between sites that are of global significance for conservation of biological diversity vs. those that are of state significance. The scale ranges from B1 to B5 with sites ranked B1-B3 generally being of global significance and sites ranked B4-B5 being of state significance. The specific definitions for each rank are as follows:

B1 - Outstanding significance, generally the "last of the least" in the world, such as the only known occurrence of any element (species or natural community), the best or an excellent occurrence of an element ranked critically imperiled globally, or a concentration (4+) of good or excellent occurrences of elements that are imperiled or critically imperiled globally. The site should be viable and defensible for the elements or ecological processes contained.

B2 - Very high significance, such as the most outstanding occurrence of any natural community. Also includes areas containing other occurrences of elements that are critically imperiled globally, a good or excellent occurrence of an element that is imperiled globally, an excellent occurrence of an element that is rare globally, or a concentration (4+) of good occurrences of globally rare elements or viable occurrences of globally imperiled elements.

B3 - High significance, such as any other viable occurrence of an element that is globally imperiled, a good occurrence of a globally rare element, an excellent occurrence of any natural community, or a concentration (4+) of good or excellent occurrences of elements that are critically imperiled in the State.

B4 - Moderate significance, such as a viable occurrence of a globally rare element, a good occurrence of any natural community, a good or excellent occurrence or only viable state occurrence of an element that is critically imperiled in the State, an excellent occurrence of an element that is imperiled in the State, or a concentration (4+) of good occurrences of elements that are imperiled in the State or excellent occurrences of elements that are rare in the State.

B5 - Of general biodiversity interest.

How can I obtain Natural Heritage Priority Site maps for an area of interest to me?

Natural Heritage Priority Site hard copy maps can be obtained by submitting a written request accompanied by a check or money order made payable to the Office of Natural Lands Management at the following address:

Office of Natural Lands Management
P.O. Box 404
Trenton, NJ 08625-0404
Phone: 609-984-1339; Fax: 609-984-1427; Email: ONLM@dep.state.nj.us

Individual 8.5" X 11" maps are available at the following rate:

1 - 10 site maps & reports:	$1.50/site
11 - 20 site maps & reports:	$1.00/site
> 20 sites:	$0.50/site

Full sets of the June 1999 atlas (389 sites) are available for $40

Digital GIS Coverage of Natural Heritage Priority Sites

A final digital version of the ArcView GIS file of the Natural Heritage Priority Sites will be available in the near future. Until then, a beta test version of the digital files can be obtained on the internet at the following address: *http://www.state.nj.us/dep/gis/* -Click on "GIS Data Downloads" and then "Select a data layer" and then "statewide". There is no charge for downloading the GIS data.

How often are the maps updated?

The Natural Heritage Priority Site information is constantly being updated in the Natural Heritage Database. New sites will be added and some of the boundaries will be revised in the next edition of the maps, to be made available in October 1999.

August 13, 1999

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

Frequently Asked Questions
About Natural Heritage Priority Sites

What are Natural Heritage Priority Sites?

Through its Natural Heritage Database, the Office of Natural Lands Management (ONLM) identifies critically important areas to conserve New Jersey's biological diversity. The database provides detailed, up-to-date information on rare species and natural communities to planners, developers, and conservation agencies for use in resource management, environmental impact assessment, and both public and private land protection efforts.

Using the database, ONLM has identified Natural Heritage Priority Sites that represent some of the best remaining habitat for rare species and exemplary natural communities in the state. These areas should be considered to be top priorities for the preservation of biological diversity in New Jersey. If these sites become degraded or destroyed, we may lose some of the unique components of our natural heritage.

ONLM has identified 389 priority sites over the course of more than 10 years. We have received assistance from many partner individuals and agencies over this time. The Nature Conservancy and the DEP Endangered and Nongame Species Program have provided key information or assisted with the delineation of a number of the sites.

How are Natural Heritage Priority Site maps used in conservation of biological diversity?

Natural Heritage Priority Site maps are used by individuals and agencies concerned with the protection and management of land. The maps have been used by municipalities preparing natural resource inventories; public and private conservation organizations preparing open space acquisition goals; land developers and consultants identifying environmentally sensitive lands; and public and private landowners developing land management plans.

Natural Heritage Priority Sites contain some of the best and most viable occurrences of endangered and threatened species and natural communities, but they do not cover all known habitat for endangered and threatened species in New Jersey. If information is needed on whether or not endangered or threatened species have been documented from a particular piece of land, a Natural Heritage Database search can be requested by contacting the Office of Natural Lands Management at the address below.

What do the boundaries of the sites contain?

The boundaries of each Natural Heritage Priority Site are drawn to encompass critical habitat for the rare species or natural communities. Often the boundaries extend to include additional buffer lands that should be managed to protect the habitat. A justification for the boundary is provided for each site. The term "primary bounds" is sometimes used to refer to boundaries enclosing critical habitat. The term "secondary bounds" is sometimes used to refer to boundaries enclosing additional buffer. In maps where both primary and secondary boundaries are described, only the outermost boundary is provided in the mapping.

What is the background map that the sites are drawn upon?

The sites are portrayed on background maps produced from a digital copy of the U.S. Geological Survey 7.5 minute topographic maps. The background maps contain topographic lines as well as streams, lakes, roads, towns and place names. These background maps do not always reflect recent changes in land development. Some may be more than 20 years old. Some sites appear to be shifted in position against this topo map. This shift is due to the fact that most sites have been digitized against a background of rectified aerial photography, and some of the digitized USGS topo maps do not align with this photography.

What do "public lands" depict on the maps?

The "public lands" shaded on these maps are state-owned open space lands that have been digitized as a GIS coverage by the state Green Acres Program. This information is provided to show patterns of State land ownership in the vicinity of the Priority Site. The public lands are areas such as State Parks and Forests, Wildlife Management Areas, and Natural Lands Trust preserves. They do not currently include lands owned by other state

EXPLANATIONS OF CODES USED IN NATURAL HERITAGE REPORTS

DERAL STATUS CODES

e following U.S. Fish and Wildlife Service categories and their definitions of endangered and threatened plants and animals have been modified from the S. Fish and Wildlife Service (F.R. Vol. 50 No. 188; Vol. 61, No. 40; F.R. 50 CFR Part 17). Federal Status codes reported for species follow the most ent listing.

LE	Taxa formally listed as endangered.
LT	Taxa formally listed as threatened.
PE	Taxa already proposed to be formally listed as endangered.
PT	Taxa already proposed to be formally listed as threatened.
C	Taxa for which the Service currently has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.
S/A	Similarity of appearance species.

ATE STATUS CODES

o animal lists provide state status codes after the Endangered and Nongame Species Conservation Act of 1973 (NSSA 23:2A-13 et. seq.): the list of dangered species (N.J.A.C. 7:25-4.13) and the list defining status of indigenous, nongame wildlife species of New Jersey (N.J.A.C. 7:25-4.17(a)). The tus of animal species is determined by the Nongame and Endangered Species Program (ENSP). The state status codes and definitions provided reflect most recent lists that were revised in the New Jersey Register, Monday, June 3, 1991.

D	Declining species-a species which has exhibited a continued decline in population numbers over the years.
E	Endangered species-an endangered species is one whose prospects for survival within the state are in immediate danger due to one or many factors - a loss of habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.
EX	Extirpated species-a species that formerly occurred in New Jersey, but is not now known to exist within the state.
I	Introduced species-a species not native to New Jersey that could not have established itself here without the assistance of man.
INC	Increasing species-a species whose population has exhibited a significant increase, beyond the normal range of its life cycle, over a long term period.
T	Threatened species-a species that may become endangered if conditions surrounding the species begin to or continue to deteriorate.
P	Peripheral species-a species whose occurrence in New Jersey is at the extreme edge of its present natural range.
S	Stable species-a species whose population is not undergoing any long-term increase/decrease within its natural cycle.
U	Undetermined species-a species about which there is not enough information available to determine the status.

Status for animals separated by a slash(/) indicate a duel status. First status refers to the state breeding population, and the second status refers to the migratory or winter population.

Plant taxa listed as endangered are from New Jersey's official Endangered Plant Species List N.J.S.A. 131B-15.151 et seq.

E Native New Jersey plant species whose survival in the State or nation is in jeopardy.

REGIONAL STATUS CODES FOR PLANTS

LP Indicates taxa listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. Not all species currer tracked by the Pinelands Commission are tracked by the Natural Heritage Program. A complete list of endangered and threatened Pineland species is included in the New Jersey Pinelands Comprehensive Management Plan.

EXPLANATION OF GLOBAL AND STATE ELEMENT RANKS

The Nature Conservancy has developed a ranking system for use in identifying elements (rare species and natural communities) of natural diversity mos endangered with extinction. Each element is ranked according to its global, national, and state (or subnational in other countries) rarity. These ranks are used to prioritize conservation work so that the most endangered elements receive attention first. Definitions for element ranks are after The Nature Conservancy (1982: Chapter 4, 4.1-1 through 4.4.1.3-3).

GLOBAL ELEMENT RANKS

G1 Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because some factor(s) making it especially vulnerable to extinction.

G2 Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making very vulnerable to extinction throughout its range.

G3 Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout it's range; with the number of occurrences in the range of 21 to 100.

G4 Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.

G5 Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.

GH Of historical occurrence throughout its range i.e., formerly part of the established biota, with the expectation that it may be rediscove

GU Possibly in peril range-wide but status uncertain; more information needed.

GX Believed to be extinct throughout range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? Species has not yet been ranked.

STATE ELEMENT RANKS

S1 Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres).

Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered.

S2 Imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences.

S3 Rare in state with 21 to 100 occurrences (plant species in this category have only 21 to 50 occurrences). Includes elements which are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.

S4 Apparently secure in state, with many occurrences.

S5 Demonstrably secure in state and essentially ineradicable under present conditions.

SA Accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range; a few of these species may even have bred on the one or two occasions they were recorded; examples include European strays or western birds on the East Coast and vice-versa.

SE Elements that are clearly exotic in New Jersey including those taxa not native to North America (introduced taxa) or taxa deliberately or accidentally introduced into the State from other parts of North America (adventive taxa). Taxa ranked SE are not a conservation priority (viable introduced occurrences of G1 or G2 elements may be exceptions).

SH Elements of historical occurrence in New Jersey. Despite some searching of historical occurrences and/or potential habitat, no extant occurrences are known. Since not all of the historical occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work.

SP Element has potential to occur in New Jersey, but no occurrences have been reported.

SR Elements reported from New Jersey, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. In some instances documentation may exist, but as of yet, its source or location has not been determined.

SRF Elements erroneously reported from New Jersey, but this error persists in the literature.

SU Elements believed to be in peril but the degree of rarity uncertain. Also included are rare taxa of uncertain taxonomical standing. More information is needed to resolve rank.

SX Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched and a reasonable search of potential habitat has been completed. Extirpated taxa are not a current conservation priority.

SXC Elements presumed extirpated from New Jersey, but native populations collected from the wild exist in cultivation.

SZ Not of practical conservation concern in New Jersey, because there are no definable occurrences, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped and

protected. In other words, the migrant regularly passes through the state, but enduring, mappable element occurrences cannot be defined.

Typically, the SZ rank applies to a non-breeding population (N) in the state - for example, birds on migration. An SZ rank may in a f instances also apply to a breeding population (B), for example certain lepidoptera which regularly die out every year with no signific return migration.

Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration dc not mean it receives an SZ rank. SZ will only apply when the migrants occur in an irregular, transitory and dispersed manner.

B Refers to the breeding population of the element in the state.

N Refers to the non-breeding population of the element in the state.

T Element ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species. For example *Stachys palustris* var. *homotricha* is ranked "G5T? SH" meaning the full species is globally secure but the global rarity of the var. *homotricha* has not been determined; in New Jersey the variety is ranked historic.

Q Elements containing a "Q" in the global portion of its rank indicates that the taxon is of questionable, or uncertain taxonomical stand e.g., some authors regard it as a full species, while others treat it at the subspecific level.

.1 Elements documented from a single location.

Note: To express uncertainty, the most likely rank is assigned and a question mark added (e.g., G2?). A range is indicated by combining two ranks (e.g., G1G2, S1S3).

IDENTIFICATION CODES

These codes refer to whether the identification of the species or community has been checked by a reliable individual and is indicative of significant habi

Y Identification has been verified and is indicative of significant habitat.

BLANK Identification has not been verified but there is no reason to believe it is not indicative of significant habitat.

? Either it has not been determined if the record is indicative of significant habitat or the identification of the species or community may be confusing or disputed.

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SUSSEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN

THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
*** Vertebrates						
ACCIPITER COOPERII	COOPER'S HAWK		T/T		G5	S3B,S4N
ACCIPITER GENTILIS	NORTHERN GOSHAWK		E/E		G5	S1B,S4N
ACRIS CREPITANS CREPITANS	NORTHERN CRICKET FROG		U		G5T5	S3
AMBYSTOMA JEFFERSONIANUM	JEFFERSON SALAMANDER		D		G5	S3
AMBYSTOMA LATERALE	BLUE-SPOTTED SALAMANDER		E		G5	S1
AMBYSTOMA MACULATUM	SPOTTED SALAMANDER		D		G5	S3
AMBYSTOMA OPACUM	MARBLED SALAMANDER		D		G5	S3
AMMODRAMUS HENSLOWII	HENSLOW'S SPARROW		E		G4	S1B
AMMODRAMUS SAVANNARUM	GRASSHOPPER SPARROW		T/S		G5	S2B
ARDEA HERODIAS	GREAT BLUE HERON		S/S		G5	S2B,S4N
ASIO OTUS	LONG-EARED OWL		T/T		G5	S2B,S2N
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER		E		G5	S1B
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN		E/S		G4	S2B
BUTEO LINEATUS	RED-SHOULDERED HAWK		E/T		G5	S1B,S2N
CISTOTHORUS PLATENSIS	SEDGE WREN		E		G5	S1B
CLEMMYS INSCULPTA	WOOD TURTLE		T		G4	S3
CLEMMYS MUHLENBERGII	BOG TURTLE	LT	E		G3	S2
CROTALUS HORRIDUS HORRIDUS	TIMBER RATTLESNAKE		E		G4T4	S2
DOLICHONYX ORYZIVORUS	BOBOLINK		T/T		G5	S2B
EMPIDONAX ALNORUM	ALDER FLYCATCHER		S/S		G5	S2B
EURYCEA LONGICAUDA LONGICAUDA	LONGTAIL SALAMANDER		T		G5T5	S2
HEMIDACTYLIUM SCUTATUM	FOUR-TOED SALAMANDER		D		G5	S3
LYNX RUFUS	BOBCAT		E		G5	S3
MELANERPES ERYTHROCEPHALUS	RED-HEADED WOODPECKER		T/T		G5	S2B,S2N
MYOTIS LEIBII	EASTERN SMALL-FOOTED MYOTIS		U		G3	S1
NEOTOMA MAGISTER	ALLEGHENY WOODRAT		E		G3G4	S1
PASSERCULUS SANDWICHENSIS	SAVANNAH SPARROW		T/T		G5	S2B,S4N
PETROCHELIDON PYRRHONOTA	CLIFF SWALLOW		S/S		G5	S2B
PODILYMBUS PODICEPS	PIED-BILLED GREBE		E/S		G5	S1B,S3N

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SUSSEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN

THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
POOECETES GRAMINEUS	VESPER SPARROW		E		G5	S1B,S2N
SOREX DISPAR	LONG-TAILED OR ROCK SHREW		U		G4	S1
STRIX VARIA	BARRED OWL		T/T		G5	S3B
VERMIVORA CHRYSOPTERA	GOLDEN-WINGED WARBLER		D/S		G4	S3B
VIREO SOLITARIUS	SOLITARY VIREO		S/S		G5	S3B
** Ecosystems						
BLACK SPRUCE SWAMP	BLACK SPRUCE SWAMP				G4	S1
BOLTONIA ASTEROIDES VAR. ASTEROIDES - MENTHA ARVENSIS - CYPERUS STRIGOSUS - ASTER RACEMOSUS SEASONALLY FLOODED HERBACEOUS VEGETATION	ASTER-LIKE BOLTONIA - FIELD-MINT - FALSE NUTSEDGE - SMALL-HEADED ASTER SINKHOLE POND HERBACEOUS VEGETATION				G2?	S2
CALCAREOUS FEN	LIMESTONE FEN				G3?	S1
CALCAREOUS RIVERSIDE OUTCROP COMMUNITY	CALCAREOUS RIVERSIDE OUTCROP COMMUNITY				G3?	S1S2
CALCAREOUS RIVERSIDE SEEP COMMUNITY	CALCAREOUS RIVERSIDE SEEP COMMUNITY				G3?	S1
CALCAREOUS SEEPAGE SWAMP	CALCAREOUS SEEPAGE SWAMP				G4?	S2S3
CAVE AQUATIC COMMUNITY	CAVE AQUATIC COMMUNITY				G4?	S2
CAVE TERRESTRIAL COMMUNITY	CAVE TERRESTRIAL COMMUNITY				G4?	S3
CHAMAEDAPHNE CALYCULATA-SPHAGNUM BOREAL DWARF-SHRUBLAND	LEATHERLEAF-SPHAGNUM BOREAL DWARF-SHRUBLAND				G4?	S1
DRY-MESIC CALCAREOUS FOREST	DRY-MESIC CALCAREOUS FOREST				G3G4?	S2?
GLACIAL BOG	GLACIAL BOG				G4?	S1
HARDWOOD-CONIFER SWAMP	HARDWOOD-CONIFER SWAMP				G4?	S2S3
INLAND ACIDIC SEEP COMMUNITY	INLAND ACIDIC SEEP COMMUNITY				G3?	S1
INLAND ATLANTIC WHITE CEDAR SWAMP	INLAND ATLANTIC WHITE CEDAR SWAMP				G3?	S1

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SUSSEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN

THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
LIMESTONE GLADE	LIMESTONE GLADE				G2Q	S1
POTENTILLA FRUTICOSA-MYRICA PENSYLVANICA/DESCHAMPSIA CAESPITOSA SPARSE SHRUBLAND	MARL FEN PLANT ASSOCIATION				G2	S1
TALUS SLOPE COMMUNITY	TALUS SLOPE COMMUNITY				G4?	S2S3
*** Invertebrates						
AESHNA TUBERCULIFERA	BLACK-TIPPED DARNER				G4	S1S2
ALASMIDONTA HETERODON	DWARF WEDGEMUSSEL	LE	E		G1G2	S1
ALASMIDONTA UNDULATA	TRIANGLE FLOATER				G4	S3
AMBLYSCIRTES HEGON	PEPPER AND SALT SKIPPER				G5	S1S2
BOLORIA SELENE MYRINA	A SILVER-BORDERED FRITILLARY				G5T5	S2
CALEPHELIS BOREALIS	NORTHERN METALMARK				G3G4	S2S3
CALLOPHRYS IRUS	FROSTED ELFIN				G3	S2S3
CALOPTERYX AMATA	SUPERB JEWELWING				G4	S1
CARTEROCEPHALUS PALAEMON	ARCTIC SKIPPER				G5	S1
CHLOSYNE HARRISII	HARRIS' CHECKERSPOT				G4	S2S3
CHLOSYNE NYCTEIS	SILVERY CHECKERSPOT				G5	SR
CICINDELA MARGINIPENNIS	COBBLESTONE TIGER BEETLE				G2G3	S1S2
CUCULLIA ALFARATA					G4	S2?
ENALLAGMA LATERALE	NEW ENGLAND BLUET				G3	S1S2
ENODIA ANTHEDON	NORTHERN PEARLY EYE				G5	S3S4
ERYNNIS LUCILIUS	COLUMBINE DUSKY WING				G4	SH
ERYNNIS MARTIALIS	MOTTLED DUSKY WING				G3G4	SH
EUPHYES BIMACULA	TWO-SPOTTED SKIPPER				G4	S3
GOMPHUS BOREALIS	BEAVERPOND CLUBTAIL				G4	S1
GOMPHUS ROGERSI	SABLE CLUBTAIL				G4	S1S2
HEMILEUCA SP 2	SCHWEITZER'S BUCKMOTH				G1Q	S1
LANTHUS VERNALIS	SOUTHERN PYGMY CLUBTAIL				G4	S2S3
LEUCORRHINIA HUDSONICA	HUDSONIAN WHITEFACE				G5	S1

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LIGUMIA NASUTA	EASTERN PONDMUSSEL				G4G5	S1
LYCAENA HYLLUS	BRONZE COPPER				G5	S2
MACROCHILO HYPOCRITALIS	A NOCTUID MOTH				G4	S3S4
NEONYMPHA MITCHELLII MITCHELLII	MITCHELL'S SATYR	LE	E		G1G2T1T2	SH
NICROPHORUS AMERICANUS	AMERICAN BURYING BEETLE	LE	E		G1	SH
OPHIOGOMPHUS ANOMALUS	EXTRA-STRIPED SNAKETAIL				G3	SH
OPHIOGOMPHUS ASPERSUS	BROOK SNAKETAIL				G3G4	S1S2
OPHIOGOMPHUS MAINENSIS	MAINE SNAKETAIL				G4	S2
PAPAIPEMA NECOPINA	SUNFLOWER BORER MOTH				G4?	SH
PAPILIO CRESPHONTES	GIANT SWALLOWTAIL				G5	S1
POLITES MYSTIC	LONG DASH				G5	S3?
POLYGONIA PROGNE	GRAY COMMA				G5	SH
PYRGUS WYANDOT	SOUTHERN GRIZZLED SKIPPER				G2	SH
SATYRIUM ACADICUM	ACADIAN HAIRSTREAK				G5	S2S3
SATYRIUM EDWARDSII	EDWARDS' HAIRSTREAK				G4	S3
SATYRODES EURYDICE	EYED BROWN				G5	S1
SPEYERIA APHRODITE	APHRODITE FRITILLARY				G5	S2S3
SPEYERIA IDALIA	REGAL FRITILLARY				G3	SX
** Nonvascular plants						
SPHAGNUM CAPILLIFOLIUM	SPHAGNUM				G5	S2
SPHAGNUM FUSCUM	SPHAGNUM				G5	S2
SPHAGNUM QUINQUEFARIUM	SPHAGNUM				G5	S1
SPHAGNUM SQUARROSUM	SPHAGNUM				G5	S2
SPHAGNUM SUBFULVUM	SPHAGNUM				G?	S1
SPHAGNUM TERES	SPHAGNUM				G5	S2
** Other types						
BAT HIBERNACULUM	BAT HIBERNACULUM				G?	S?

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*** Vascular plants						
ACER NIGRUM	BLACK MAPLE				G5Q	S2
ADLUMIA FUNGOSA	ALLEGHENY-VINE				G4	S2
AGASTACHE NEPETOIDES	YELLOW GIANT HYSSOP				G5	S2
AGASTACHE SCROPHULARIIFOLIA	PURPLE GIANT HYSSOP				G4	S2
ALISMA TRIVIALE	LARGE WATER-PLANTAIN		E		G5	S1
ALOPECURUS AEQUALIS	MARSH MEADOW FOXTAIL				G5	S2
AMELANCHIER SANGUINEA	ROUND-LEAVED SERVICEBERRY		E		G5	S1
ANDROMEDA GLAUCOPHYLLA	BOG ROSEMARY		E		G5	S1
ANEMONE CANADENSIS	CANADA ANEMONE				G5	SX
ANEMONE CYLINDRICA	LONG-HEADED ANEMONE		E		G5	S1
ANEMONE VIRGINIANA VAR RIPARIA	RIVER ANEMONE				G5T4T5	S2
ANTENNARIA NEGLECTA VAR CANADENSIS	CANADA PUSSYTOES		E		G4G5T?	S1.1
APLECTRUM HYEMALE	PUTTYROOT		E		G5	S1
ARABIS HIRSUTA	HAIRY ROCK CRESS				G5	S2
ARCEUTHOBIUM PUSILLUM	DWARF MISTLETOE		E		G5	S1
ARISTOLOCHIA SERPENTARIA	VIRGINIA SNAKEROOT				G5	S3
ARMORACIA LACUSTRIS	LAKE CRESS		E		G4?	SH
ASCLEPIAS VARIEGATA	WHITE MILKWEED				G5	S2
ASCLEPIAS VERTICILLATA	WHORLED MILKWEED				G5	S2
ASPLENIUM PINNATIFIDUM	LOBED SPLEENWORT		E		G4	S1
ASTER BOREALIS	RUSH ASTER		E		G5	S1
ASTER ERICOIDES VAR PROSTRATUS	PROSTRATE WHITE HEATH ASTER				G5T?	S3
ASTER FIRMUS	SHINING ASTER		E		G5Q	SH.1
ASTER INFIRMUS	CORNEL-LEAVED ASTER				G5	S2
ASTER PRENANTHOIDES	CROOKED-STEMMED ASTER				G4G5	S2
ASTER TRADESCANTII	TRADESCANT'S ASTER				G4Q	S2
ASTRAGALUS CANADENSIS	CAROLINA MILK-VETCH				G5	SX.1
ATHYRIUM PYCNOCARPON	GLADE FERN		E		G5	S1

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BETULA PAPYRIFERA	PAPER BIRCH				G5	S2
BETULA PUMILA	SWAMP BIRCH				G5	S2
BIDENS BECKII	WATER-MARIGOLD		E		G4G5T4	S1
BOLTONIA ASTEROIDES VAR ASTEROIDES	ASTER-LIKE BOLTONIA				G5T?	S2
BOTRYCHIUM MULTIFIDUM	LEATHERY GRAPE-FERN		E		G5	S1
BOTRYCHIUM ONEIDENSE	BLUNT-LOBED GRAPE-FERN				G4Q	S2
BOUTELOUA CURTIPENDULA	SIDE-OATS GRAMMA GRASS		E		G5	S1
BROMUS KALMII	KALM'S BROMEGRASS				G5	S2
CALLITRICHE VERNA	SPRING WATER STARWORT				G5	S2
CALYSTEGIA SPITHAMAEA	ERECT BINDWEED		E		G4G5	S1
CARDAMINE DIPHYLLA	TWO-LEAVED TOOTHWORT				G5	S3
CARDAMINE DOUGLASSII	PURPLE CRESS				G5	S2
CARDAMINE MAXIMA	LARGE-LEAVED TOOTHWORT		E		G5Q	S1.1
CARDAMINE PRATENSIS VAR PALUSTRIS	CUCKOO FLOWER				G5T5	S3
CAREX ALBURSINA	SEDGE		E		G5	S1
CAREX ALOPECOIDEA	FOXTAIL SEDGE		E		G5	S1
CAREX AQUATILIS	WATER SEDGE		E		G5	S1
CAREX ARCTATA	BLACK SEDGE		E		G5?	S1
CAREX BACKII	BACK'S SEDGE		E		G4	SH.1
CAREX BICKNELLII	BICKNELL'S SEDGE				G5	S2
CAREX BRUNNESCENS	BROWNISH SEDGE		E		G5	S1
CAREX BUSHII	BUSH'S SEDGE		E		G4	S1
CAREX BUXBAUMII	BROWN SEDGE				G5	S3
CAREX CONOIDEA	FIELD SEDGE				G5	S2
CAREX CRAWEI	CRAWE'S SEDGE		E		G5	S1
CAREX CRAWFORDII	CRAWFORD'S SEDGE				G5	S2
CAREX DEWEYANA	DEWEY'S SEDGE		E		G5	S1
CAREX DIANDRA	LESSER PANICLED SEDGE				G5	S2

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CAREX DISPERMA	SOFT-LEAVED SEDGE				G5	S2
CAREX EBURNEA	EBONY SEDGE				G5	S2
CAREX FORMOSA	HANDSOME SEDGE		E		G4	S1.1
CAREX HAYDENII	CLOUD SEDGE		E		G5	S1
CAREX HITCHCOCKIANA	HITCHCOCK'S SEDGE				G5	S2
CAREX LEPTONERVIA	FINELY-NERVED SEDGE		E		G4	S1
CAREX LIMOSA	MUD SEDGE		E		G5	S1
CAREX LUPULIFORMIS	HOP-LIKE SEDGE		E		G3G4	S1
CAREX OLIGOCARPA	FEW-FRUITED SEDGE		E		G4	S1
CAREX PALLESCENS	PALE SEDGE				G5	S2
CAREX PECKII	WHITE-TINGED SEDGE		E		G4G5	SH
CAREX PRAIREA	PRAIRIE SEDGE				G5?	S2
CAREX PSEUDOCYPERUS	CYPERUS-LIKE SEDGE		E		G5	S1
CAREX RETRORSA	RETRORSE SEDGE				G5	S2
CAREX ROSTRATA	BEAKED SEDGE				G5	S2
CAREX SICCATA	DRY-SPIKED SEDGE		E		G5	S1
CAREX STERILIS	ATLANTIC SEDGE				G4	S2
CAREX VIRIDULA	GREEN SEDGE				G5?	S2
CASTILLEJA COCCINEA	SCARLET INDIAN PAINTBRUSH				G5	S2
CELTIS TENUIFOLIA	GEORGIA HACKBERRY				G5	S2
CHAMAELIRIUM LUTEUM	DEVIL'S-BIT				G5	S3
CHEILANTHES LANOSA	HAIRY LIPFERN				G5	S2
CINNA LATIFOLIA	SLENDER WOOD REEDGRASS		E		G5	S1
CLAYTONIA VIRGINICA VAR HAMMONDIAE	HAMMOND'S YELLOW SPRING BEAUTY		E		G5T1	S1.1
CLEMATIS OCCIDENTALIS	PURPLE CLEMATIS				G5	S2
COELOGLOSSUM VIRIDE	LONG-BRACTED GREEN ORCHID				G5	S2
CONIOSELINUM CHINENSE	HEMLOCK-PARSLEY		E		G5	S1
CORALLORRHIZA TRIFIDA	EARLY CORAL-ROOT				G5	S2
CORNUS CANADENSIS	BUNCHBERRY				G5	S2

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CRATAEGUS CALPODENDRON	PEAR HAWTHORN		E		G5	S1
CRATAEGUS CHRYSOCARPA	FINEBERRY HAWTHORN				G5	S1
CRATAEGUS DODGEI	DODGE'S HAWTHORNE				G4	S2
CRATAEGUS PENNSYLVANICA	PENNSYLVANIA HAWTHORN				G3?Q	S1
CRATAEGUS PUNCTATA	DOTTED HAWTHORN				G5	S2
CUPHEA VISCOSISSIMA	BLUE WAXWEED				G5?	S3
CYNOGLOSSUM VIRGINIANUM VAR BOREALE	NORTHERN WILD COMFREY		E		G5T4	SH.1
CYNOGLOSSUM VIRGINIANUM VAR VIRGINIANUM	WILD COMFREY				G5T5	S2
CYPERUS LANCASTRIENSIS	LANCASTER FLATSEDGE				G5	S1
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER		E		G4	S1
CYSTOPTERIS PROTRUSA	LOWLAND BRITTLE FERN				G5	S2
DICENTRA CANADENSIS	SQUIRREL-CORN		E		G5	S1
DIRCA PALUSTRIS	LEATHERWOOD				G4	S2
ELATINE MINIMA	SMALL WATERWORT				G5	S2
ELEOCHARIS COMPRESSA	FLAT-STEMMED SPIKERUSH		E		G4	S1
ELEOCHARIS PAUCIFLORA	FEW-FLOWERED SPIKERUSH		E		G5	S1
ELYMUS TRACHYCAULUS	SLENDER WHEATGRASS		E		G5	S1
EPILOBIUM ANGUSTIFOLIUM	FIREWEED				G5	S1
EPILOBIUM LEPTOPHYLLUM	LINEAR-LEAVED WILLOW-HERB				G5	S3
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB				G5?	S2
EQUISETUM PRATENSE	MEADOW HORSETAIL		E		G5	S1
EQUISETUM VARIEGATUM	VARIEGATED HORSETAIL		E		G5	S1
ERAGROSTIS FRANKII	FRANK'S LOVEGRASS				G5	S2
ERIOPHORUM GRACILE	SLENDER COTTONGRASS		E		G5	SH
ERIOPHORUM VAGINATUM VAR SPISSUM	SHEATHED COTTONGRASS		E		G5T5	SH.1
GALIUM LABRADORICUM	LABRADOR MARSH BEDSTRAW		E		G5	S1
GALIUM PALUSTRE	MARSH BEDSTRAW				G5	S2

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GALIUM TRIFIDUM	SMALL BEDSTRAW		E		G5	S1
GAULTHERIA HISPIDULA	CREEPING SNOWBERRY		E		G5	S1
GENTIANELLA QUINQUEFOLIA	STIFF GENTIAN				G5	S2
GEUM VERNUM	SPRING AVENS				G5	S2
GLYCERIA BOREALIS	SMALL FLOATING MANNAGRASS		E		G5	SH.1
GLYCERIA GRANDIS	AMERICAN MANNAGRASS		E		G5	S1
GNAPHALIUM MACOUNII	CLAMMY EVERLASTING		E		G5	SH
GYMNOCARPIUM DRYOPTERIS	OAK FERN				G5	S2
HIERACIUM KALMII	CANADA HAWKWEED		E		G5	SH
HYPERICUM MAJUS	LARGER CANADIAN ST. JOHN'S-WORT		E		G5	S1
HYPERICUM PROLIFICUM	SHRUBBY ST. JOHN'S-WORT		E		G5	S1
HYPERICUM PYRAMIDATUM	GREAT ST. JOHN'S-WORT				G4	S2
ILEX MONTANA	MOUNTAIN HOLLY		E		G5	S1
ISOETES LACUSTRIS	LAKE QUILLWORT		E		G5	S1.1
ISOTRIA MEDEOLOIDES	SMALL WHORLED POGONIA	LT	E		G2G3	S1
JUNCUS BRACHYCEPHALUS	SMALL-HEADED RUSH				G5	S2
JUNCUS BREVICAUDATUS	NARROW-PANICLED RUSH				G5	S2
KALMIA POLIFOLIA	PALE LAUREL		E		G5	S1
KUHNIA EUPATORIOIDES	FALSE BONESET		E		G5	S1
LATHYRUS OCHROLEUCUS	PALE VETCHLING PEAVINE		E		G4G5	SH
LATHYRUS VENOSUS	SMOOTH VEINY PEAVINE		E		G5	SH
LECHEA INTERMEDIA	NARROW-LEAVED PINWEED				G5	S2
LEMNA TRISULCA	STAR DUCKWEED				G5	S2
LILIUM PHILADELPHICUM	WOOD LILY				G5	S3
LINUM SULCATUM	GROOVED YELLOW FLAX		E		G5	S1
LISTERA CORDATA	HEART-LEAVED TWAYBLADE		E		G5	S1
LISTERA SMALLII	KIDNEY-LEAVED TWAYBLADE		E		G4	S1.1
LITHOSPERMUM CANESCENS	HOARY PUCCOON				G5	SX
LOBELIA DORTMANNA	WATER LOBELIA		E		G4	SH

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LONICERA CANADENSIS	FLY HONEYSUCKLE		E		G5	S1
LYCOPODIUM ANNOTINUM	STIFF CLUBMOSS		E		G5	S1
LYCOPODIUM INUNDATUM	NORTHERN BOG CLUBMOSS				G5	S2
LYSIMACHIA HYBRIDA	LANCE-LEAVED LOOSESTRIFE				G5	S3
LYSIMACHIA THYRSIFLORA	TUFTED LOOSESTRIFE				G5	S3
MALAXIS MONOPHYLLOS	WHITE ADDER'S-MOUTH		E		G5	SH
MALAXIS UNIFOLIA	GREEN ADDER'S-MOUTH				G5	S2
MELANTHIUM VIRGINICUM	VIRGINIA BUNCHFLOWER		E		G5	S1
MENYANTHES TRIFOLIATA	BUCKBEAN				G5	S2
MILIUM EFFUSUM	TALL MILLET GRASS		E		G5	SH
MIMULUS MOSCHATUS	MUSK FLOWER				G4G5	S2
MITELLA PROSTRATA	CREEPING BISHOP'S-CAP				GUQ	SH.1
MONARDA DIDYMA	OSWEGO TEA				G5	S2
MUHLENBERGIA CAPILLARIS	LONG-AWNED SMOKE GRASS		E		G5	S1
MUHLENBERGIA GLOMERATA	EASTERN SMOKE GRASS				G5	S2
MYRIOPHYLLUM SIBIRICUM	COMMON WATER-MILFOIL				G5	S1
MYRIOPHYLLUM VERTICILLATUM	WHORLED WATER-MILFOIL		E		G5	SH
NELUMBO LUTEA	AMERICAN LOTUS		E		G4	S1
NYMPHOIDES CORDATA	FLOATING HEART			LP	G5	S3
ONOSMODIUM VIRGINIANUM	VIRGINIA FALSE-GROMWELL		E		G4	S1
OPHIOGLOSSUM VULGATUM VAR PSEUDOPODUM	ADDER'S-TONGUE FERN				G5T5	S3
ORYZOPSIS ASPERIFOLIA	WHITE-GRAINED MOUNTAIN RICEGRASS		E		G5	S1
ORYZOPSIS PUNGENS	SLENDER MOUNTAIN RICEGRASS		E		G5	SH.1
PANAX QUINQUEFOLIUS	AMERICAN GINSENG				G4	S2
PANICUM BOREALE	NORTHERN PANIC GRASS		E		G5	S1
PANICUM FLEXILE	WIRY PANIC GRASS		E		G5	S1
PANICUM XANTHOPHYSUM	SLENDER PANIC GRASS		E		G5	SH.1
PARIETARIA PENSYLVANICA	PELLITORY				G5	S3

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PEDICULARIS LANCEOLATA	SWAMP LOUSEWORT				G5	S3
PHASEOLUS POLYSTACHIOS	WILD KIDNEY BEAN				G4	S2
PICEA RUBENS	RED SPRUCE				G5	S1
PINUS RESINOSA	RED PINE		E		G5	S1.1
PLATANTHERA FLAVA VAR HERBIOLA	TUBERCLED REIN ORCHID				G4T4Q	S2
PLATANTHERA HOOKERI	HOOKER'S ORCHID		E		G5	S1
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID				G5	SX
PLATANTHERA ORBICULATA	LARGE ROUND-LEAVED ORCHID		E		G5?	S1
PLATANTHERA PSYCODES	PURPLE-FRINGED ORCHID				G5	S3
POA LANGUIDA	DROOPING BLUEGRASS				G3G4Q	S2
POA SALTUENSIS	BLUEGRASS		E		G5	SH.1
POLEMONIUM REPTANS	GREEK VALERIAN		E		G5	S1
POLYMNIA UVEDALIA	BEARSFOOT		E		G4G5	S1
PORTERANTHUS TRIFOLIATUS	INDIAN PHYSIC				G4G5	S2
POTAMOGETON CONFERVOIDES	ALGAE-LIKE PONDWEED		E		G3G4	S2
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED		E		G5	S1
POTAMOGETON PRAELONGUS	WHITE-STEMMED PONDWEED		E		G5	S1
POTAMOGETON ROBBINSII	ROBBIN'S PONDWEED		E		G5	S2
POTAMOGETON VAGINATUS	SHEATHED PONDWEED				G5	SH
POTAMOGETON ZOSTERIFORMIS	FLAT-STEMMED PONDWEED		E		G5	S1
POTENTILLA ARGUTA	TALL CINQUEFOIL				G5	S3
POTENTILLA PALUSTRIS	MARSH CINQUEFOIL		E		G5	S1
POTENTILLA TRIDENTATA	THREE-TOOTHED CINQUEFOIL		E		G5	S1.1
PRUNUS PUMILA VAR DEPRESSA	LOW SAND CHERRY				G5T5	S2
PUCCINELLIA FERNALDII	FERNALD'S MEADOW GRASS				G4Q	S1
PYCNANTHEMUM CLINOPODIOIDES	BASIL MOUNTAIN MINT		E		G2	S1
PYROLA CHLORANTHA	GREENISH-FLOWERED WINTERGREEN		E		G5	S1
QUERCUS MUEHLENBERGII	YELLOW OAK				G5	S3
RANUNCULUS ALLEGHENIENSIS	ALLEGHENY MOUNTAIN CROWFOOT		E		G4G5	S1.1
RANUNCULUS AMBIGENS	WATER-PLANTAIN SPEARWORT				G4	S2

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RANUNCULUS FASCICULARIS	EARLY BUTTERCUP		E		G5	S1
RANUNCULUS FLABELLARIS	YELLOW WATER CROWFOOT				G5	S3
RANUNCULUS LONGIROSTRIS	EASTERN WHITE WATER CROWFOOT				G5	S2
RANUNCULUS MICRANTHUS	ROCK CROWFOOT				G5	S2
RANUNCULUS TRICHOPHYLLUS	WHITE WATER BUTTERCUP				G5	S2
RHAMNUS ALNIFOLIA	ALDER-LEAVED BUCKTHORN				G5	S3
RHODODENDRON CANADENSE	RHODORA		E		G5	S1
RHYNCHOSPORA CAPILLACEA	CAPILLARY BEAKED RUSH		E		G5	S1
RHYNCHOSPORA SCIRPOIDES	LONGBEAKED BALDRUSH				G4	S2
RIBES GLANDULOSUM	SKUNK CURRANT		E		G5	S1.1
RUBUS CANADENSIS	SMOOTH BLACKBERRY		E		G5	S1
RUDBECKIA FULGIDA	ORANGE CONEFLOWER		E		G5	S1
SAGITTARIA CUNEATA	ARUM-LEAVED ARROW HEAD		E		G5	S1
SALIX CANDIDA	HOARY WILLOW				G5	S2
SALIX LUCIDA	SHINING WILLOW				G5	S2
SALIX PEDICELLARIS	BOG WILLOW		E		G5	S1
SALIX PETIOLARIS	MEADOW WILLOW				G5	S3
SALIX SERISSIMA	AUTUMN WILLOW				G4	S2
SANICULA TRIFOLIATA	LARGE-FRUITED SANICLE		E		G4	S1
SCHEUCHZERIA PALUSTRIS	ARROW-GRASS		E		G5	SH
SCHIZACHNE PURPURASCENS	SCHIZACHNE		E		G5	S1.1
SCHOENOPLECTUS ACUTUS	HARD-STEMMED BULRUSH				G5	S3
SCHOENOPLECTUS TORREYI	TORREY'S BULRUSH		E		G5?	S1
SCIRPUS MICROCARPUS	BARBER POLE BULRUSH		E		G5	S1
SCIRPUS PEDICELLATUS	STALKED BULRUSH		E		G4	SH.1
SCLERIA VERTICILLATA	WHORLED NUT RUSH		E		G5	S1
SCUTELLARIA LEONARDII	SMALL SKULLCAP		E		G4T4	S1
SELAGINELLA RUPESTRIS	LEDGE SPIKE-MOSS				G5	S2
SENECIO PAUPERCULUS	BALSAM RAGWORT				G5	S3
SILENE CAROLINIANA	WILD PINK				G5	S3

SUSSEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN

THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
SILENE NIVEA	SNOWY CAMPION		E		G4?	S1
SISYRINCHIUM MONTANUM	STRICT BLUE-EYED GRASS		E		G5	S2
SMILACINA TRIFOLIA	THREE-LEAVED SOLOMON'S-SEAL		E		G5	S1
SOLIDAGO RIGIDA	STIFF GOLDENROD		E		G5	S1
SPARGANIUM CHLOROCARPUM	GREEN-FRUITED BUR-REED				G5	S3
SPARGANIUM MINIMUM	SMALL BUR-REED		E		G5	S1
SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES				G5	S2
SPIRANTHES OCHROLEUCA	YELLOWISH LADIES'-TRESSES				G4	S3
SPOROBOLUS ASPER	TALL DROPSEED				G5	S2
SPOROBOLUS NEGLECTUS	PUFF-SHEATHED DROPSEED		E		G5	S1
STACHYS HISPIDA	HISPID HEDGE-NETTLE				G4Q	S3
STACHYS PALUSTRIS VAR HOMOTRICHA	MARSH HEDGE-NETTLE		E		G5?T?	SH
STELLARIA BOREALIS	NORTHERN STITCHWORT		E		G5	S1
STREPTOPUS AMPLEXIFOLIUS	WHITE TWISTED-STALK		E		G5	S1
STREPTOPUS ROSEUS	ROSY TWISTED-STALK		E		G5	S1
TAXUS CANADENSIS	AMERICAN YEW				G5	S2
THELYPTERIS PHEGOPTERIS	LONG BEECH FERN				G5	S2
THUJA OCCIDENTALIS	NORTHERN WHITE CEDAR		E		G5	S1
TIARELLA CORDIFOLIA	FOAMFLOWER		E		G5	S1
TRIADENUM FRASERI	FRASER'S ST. JOHN'S-WORT				G4G5	S3
TRIGLOCHIN MARITIMUM	SEA-SIDE ARROW-GRASS		E		G5	S1
TROLLIUS LAXUS SSP LAXUS	SPREADING GLOBE FLOWER		E		G4T3Q	S1
UTRICULARIA GIBBA	HUMPED BLADDERWORT			LP	G5	S3
UTRICULARIA INTERMEDIA	FLAT-LEAVED BLADDERWORT				G5	S3
UTRICULARIA MINOR	LESSER BLADDERWORT		E		G5	S1
VACCINIUM OXYCOCCOS	SMALL CRANBERRY				G5	S2
VERBENA SIMPLEX	NARROW-LEAVED VERVAIN		E		G5	S1
VIBURNUM ALNIFOLIUM	WITCH HOBBLE		E		G5	S1
VIBURNUM OPULUS VAR AMERICANUM	HIGHBUSH CRANBERRY				G5T5	S2

8 NOV 1999

SUSSEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN

THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
VICIA AMERICANA	AMERICAN PURPLE VETCH				G5	S2
VICIA CAROLINIANA	CAROLINA WOOD VETCH		E		G5	S1
VIOLA SEPTENTRIONALIS	NORTHERN BLUE VIOLET		E		G5	S1
VITIS NOVAE-ANGLIAE	NEW ENGLAND GRAPE		E		G4G5Q	S1
WALDSTEINIA FRAGARIOIDES	BARREN STRAWBERRY				G5	S2
XYRIS MONTANA	NORTHERN YELLOW-EYED GRASS		E		G4	S1

63 Records Processed

196 Baker Avenue, Concord, Massachusetts 01742

L:\WORK\39668\PROJ\Article X\T&E\Wawayanda NJ Fish, Game & Wildlife.doc

November 15, 2000

Endangered and Nongame Species Program
Division Fish, Game and Wildlife
CN 400
Trenton, New Jersey 08625

Subject: Rare or Endangered Species and Natural Communities Review for a Potential Natural Gas Pipeline Interconnect Route, Sussex County, NJ

Telephone
978.371.4000
Facsimile
978.371.2468

Dear Sir or Madam:

On behalf of Calpine Eastern, Earth Tech is in the process of collecting environmental resource data to be used in siting a natural gas interconnect route for the proposed Wawayanda Energy Facility, Wawayanda, Orange County, New York (see attached figures). The proposed gas interconnect route begins at an interconnection with El Paso Energy's existing pipeline in the Wantage Township, Sussex County New Jersey and extends approximately 20 miles northward to the proposed energy facility site. The pipeline would be aligned adjacent to or within existing utility rights-of-way or transportation corridors, wherever possible.

We are requesting information on the potential presence of rare or endangered species and natural communities within ½ mile of the proposed pipeline corridor in New Jersey. If you require any additional information, please contact me at (978) 371-4182. Thank you for your time and consideration in this matter.

Sincerely,

Earth Tech, Inc.

Darrell Oakley

Darrell Oakley
Environmental Scientist

Enclosures

cc: Don Neal, Calpine
Ann Hueston, TRC
Trish Gabriel, Earth Tech

196 Baker Avenue, Concord, Massachusetts 01742

L:\WORK\39668\PROJ\Article X\T&E\Walkill River National Wildlife Refuge.doc

November 15, 2000

Libby Herland
Manager
Wallkill River National Wildlife Refuge
1547 County Route 565
Sussex, NJ 07461

Subject: Potential Natural Gas Pipeline Interconnect Route, Sussex County, NJ

Telephone
978.371.4000
Facsimile
978.371.2468

Dear Ms Herland:

On behalf of Calpine Eastern, Earth Tech is in the process of collecting environmental resource data to be used in siting a natural gas interconnect route for the proposed Wawayanda Energy Facility, Wawayanda, Orange County, New York (see attached figures). The proposed gas interconnect route begins at an interconnection with El Paso Energy's existing pipeline in the Wantage Township, Sussex County New Jersey and extends approximately 20 miles northward to the proposed energy facility site. The pipeline would be aligned adjacent to or within existing utility rights-of-way or transportation corridors, wherever possible.

It has been determined that the proposed pipeline route is located within three miles of the property boundaries of the Walkill River National Wildlife Refuge. The purpose of this letter is to inform your office of the proposed project and offer to discuss any concerns or issues that your office may have. If you would like any additional information about the project, please do not hesitate to contact me at (978) 371-4182. Thank you for your time and consideration in this matter.

Sincerely,

Earth Tech, Inc.

Darrell Oakley

Darrell Oakley
Environmental Scientist

Enclosures

cc: Don Neal, Calpine
Ann Hueston, TRC
Trish Gabriel, Earth Tech

Waywayanda Pipeline (Calpine) Cultural [illegible]

TRC

Customer-Focused Solutions

December 13, 2000

Ms. Catherine Goulet
Public Information Officer
New Jersey Historic Trust
P.O. Box 457
Trenton, New Jersey 08625-0457

Re: Waywayanda Energy Center - Proposed Natural Gas Pipeline Alignment

Dear Ms. Goulet:

Calpine Construction Finance Company, L.P. (Calpine) is preparing to file an application for a Certificate under Article X of the Public Service Law for a 540 MW combined cycle power plant to be located in the Town of Waywayanda in Orange County, NY. The application will also include a map level cultural resources analysis relating to a natural gas pipeline to the Calpine Facility. The map level analysis will be followed by a thorough Phase I cultural resources analysis during the actual permitting of the pipeline, to be conducted by the pipeline company.

The proposed natural gas pipeline route starts at the interconnection with El Paso Energy's existing pipeline in the Wantage Township in Sussex County, New Jersey and will extend approximately 20 miles north to the proposed Waywayanda Energy Facility. Approximately 1/3 (7 miles) of the pipeline will be located in New Jersey. The pipeline will be constructed with industry standard specifications and will be subject Federal Energy Regulatory Commission (FERC) jurisdiction. In addition, the alignment will be constructed adjacent to or within existing right-of-way or transportation corridors wherever possible.

TRC is requesting your assistance in identifying any cultural resources within a 1/2-mile radius of the proposed pipeline alignment in the state of New Jersey. If you have any concerns please do not hesitate to contact me at (978) 656-3613.

Thank you in advance for your assistance.

Sincerely,

Patricia E Claussen

Patricia E. Claussen
Assistant Project Manager

Enclosures

Boott Mills South, Foot of John Street • Lowell, Massachusetts 01852
Telephone 978-970-5600 • Fax 978-453-1995

NATIONAL REGISTER OF HISTORIC PLACES

PROPERTY MAP FORM

(Type all entries - attach to or enclose with map)

COUNTY	
Sussex	
FOR NPS USE ONLY	
ENTRY NUMBER	DATE

SEE INSTRUCTIONS

1. NAME

COMMON: Elias Van Bunschooten House

AND/OR HISTORIC:

2. LOCATION

STREET AND NUMBER:

Route 23, four miles north of Sussex

CITY OR TOWN:

Wantage Township

STATE:	CODE	COUNTY:	CODE
New Jersey	34	Sussex	037

3. MAP REFERENCE

SOURCE:

U.S.G.S. Map : 7.5 Series : Port Jervis South Quadrangle

SCALE: 1: 24,000

DATE: 1943

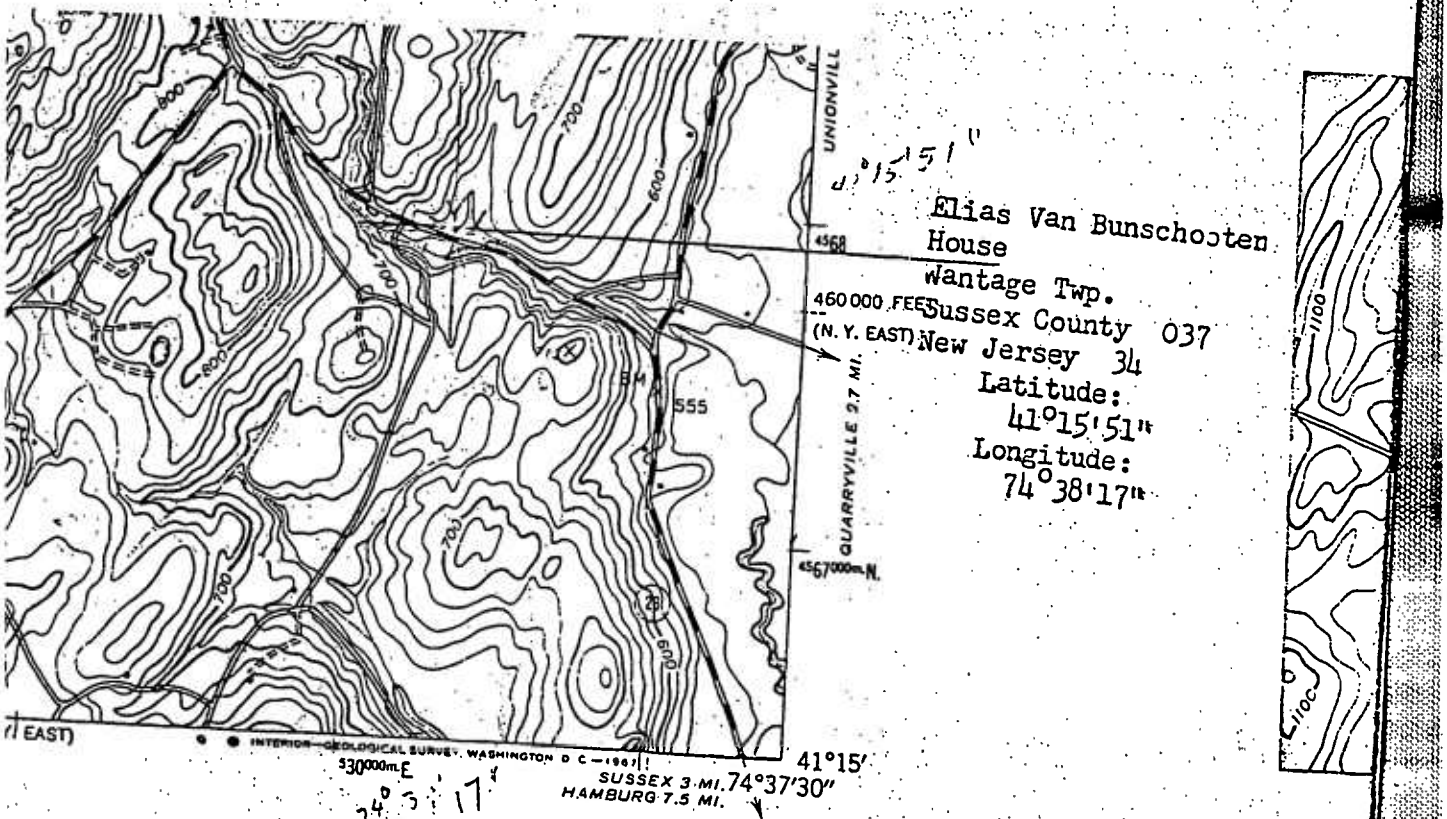
4. REQUIREMENTS

TO BE INCLUDED ON ALL MAPS

1. Property broundaries where required.
2. North arrow.
3. Latitude and longitude reference.

Longitude : 74°38'17"
Latitude : 41°15'51"

☆ U.S. GOVERNMENT PRINTING OFFICE : 1973-729-148/1441 3-1



Elias Van Bunschooten House
Wantage Twp.
Sussex County 037
New Jersey 34
Latitude:
41°15'51"
Longitude:
74°38'17"

PORT JERVIS SOUTH, N. J.-N. Y.-PA.

SW/4 PORT JERVIS 15' QUADRANGLE

N4115—W7437.5/7.5

COLUMBIA HERITAGE, LTD.
56 NORTH PLANK ROAD - SUITE 287
NEWBURGH, NEW YORK 12550
TEL: 888-294-4815 FAX: 845-565-9504

LETTER OF TRANSMITTAL

Date: 31 July 2001

To: Brian Thomas
TRC Garrow Associates,
Atlanta, Georgia

JOB NAME/NUMBER: CA383A/Wawayanda Energy Project - Gas Line

SERVICE: Phase IA Cultural Resources Survey - site file search

CONTENTS OF TRANSMITTAL:

- set of USGS quad portions showing project route and location of known archaeological sites and historical structures
- print out of sites corresponding to map locations

REMARKS:

Do not hesitate to call if you have any questions.

I was told by Pam Chan that someone from your office would be compiling the Sussex County, New Jersey site file information and I will cancel my appointment with the NJSHPO.

WAWAYANDA ENERGY PROJECT - GAS LINE

KNOWN CULTURAL RESOURCES: NY BORDER TO GENERATING FACILITY

STATE HISTORIC PRESERVATION OFFICE SITE FILES (OPRHP)

TOWN OF MINISINK

AO71-10-0007 (OR-WW04F) - Native American surface; no information
AO71-10-0008 (OR-WW05F) - "Archaic to Woodland"
AO71-10-0012 - structure
AO71-10-0015 (ORMI-12F) - Native American debitage from surface collection
AO71-10-0038 (Lower Road II Site) - Native American "surface evidence"
AO71-10-0040 (Laurel I Site) - Native American "surface evidence"
✓AO71-10-0042 - structure
✓AO71210-0043 - structure
AO71-10-0045 - structure

TOWN OF WALKILL

AO71-17-0147 (Brodi Site Loci 1&2) - "single component" Archaic Brewerton Phase Native American plowzone site

TOWN OF WAWAYANDA

AO71-19-0008 (OR-WW01F) - Native American surface; no information
AO71-19-0012 (OR-WW05F) - "Archaic to Transitional"
AO71-19-0013 (OR-WW06F) - Native American surface; no information
AO71-19-0016 (OR-WW09F) - same as above
AO71-19-0017 (OR-WW10F) - same as above
AO71-19-0019 (OR-WW12F) - same as above
✓AO71-19-0020 (OR-WW13F) - same as above
✓AO71-19-0021 (OR-WW14F) - same as above
AO71-19-0023 (OR-WW16F) - same as above
AO71-19-0027 (OR-WW20F) - "Archaic to Transitional"
AO71-19-0028 (OR-WW21F) - no information
AO71-19-0029 (OR-WW22F) - "Archaic to Woodland"
AO71-19-0032 (OR-WW25F) - "scrapers, debitage"; no further info.
AO71-19-0082 (Uhlig Road Site) - "Late Archaic"
✓AO71-19-0083 (Simon Site; NYSM 6170) - "Transitional Late Archaic Early Woodland"
AO71-19-0146 (Site 3A) - Native American surface; no information
AO71-19-0147 (Site 4A) - same as above
AO71-19-0148 (Site 5A) - same as above
AO71-19-0149 (Joe Gee Hill Site) - same as above
✓AO71-19-0150 (Site 2A) - same as above

NEW YORK STATE MUSEUM SITE FILES

774 (New Hampton School Site) - Native American, reported by Ritchie?
4401 (Parker Orange County Unnumbered Site) - "camp"
6149 - "Middle Woodland"
6150 - "Archaic"; no further information
6153 - same as above
✓6154 - same as above
6155 - "stray find" "axe"
✓6156 - "Archaic"; no further information
✓6157 - same as above
✓6166 - Native American; no information
6168 (Braeside Site) - Native American "camp"
✓6169 - Native American "cemetery"; no information
✓6170 (Bates Site) - Native American; no information (also AO71-19-0015)
✓6178 - same as above
6179 - same as above
6180 - same as above
6181 - same as above

Sites are taken from the Unionville, Otisville, Middletown and Pine Island USGS 7.5-minute series quadrangle sheets. Most sites for which no information is available belong to a group provided to the State without any details by the Incorporated Orange County Chapter of the New York State Archaeological Association (NYSAA)

Received 2-1-01

Pipeline Cultural

HPO-A2001-248
01-0729, page 1

State of New Jersey

Department of Environmental Protection
Division of Parks & Forestry
Historic Preservation Office
PO Box 404
Trenton, NJ 08625-0404
TEL: (609)292-2023
FAX: (609)984-0578

istine Todd Whitman
ernor

Robert C. Shinn, Jr.
Commissioner

January 25, 2001

Patricia E. Claussen
TRC
Boott Mills South, Foot of John Street
Lowell MA 01852

Dear Ms. Claussen:

In accordance with 36 CFR Part 800: Protection of Historic Properties, as published on December 12, 2000, in the *Federal Register* 65(239):77725-77739, I am providing **Consultation Comments** for the following proposed undertaking:

Sussex County, Wantage Township
Wallkill Transport Natural Gas Pipeline to Wawayanda Energy
Federal Energy Regulatory Commission Licensing

Summary: The Area of Potential Effects (APE) within New Jersey needs to be determined, and there needs to be an effort to identify districts, buildings, structures, and archaeological sites within the APE that are listed in, or eligible for listing in, the New Jersey Register of Historic Places and the National Register of Historic Places (NJRHP/NRHP)(aka historic properties).

The following comments are in reply to your December 19, 2000, letter to the New Jersey Historic Preservation Office (HPO) requesting initial Section 106 consultation comments regarding previously identified historic properties along the New Jersey portion of this proposed project based on the map and aerial photo locational information provided with your request.

800.4 Identification of Historic Properties

I realize your are requesting information regarding known historic properties for a half-mile wide "study area" at this time. There are two historic properties for the study area represented on HPO historic property maps. These are the Appalachian Trail (SHPO opinion of eligibility 6/14/1978, and Determination of Eligibility 10/2/1978), and the Elias Van Bunschooten house (listed in the NJRHP 7/1/1974 and in the NRHP 11/1/1974).

Your current study area includes a linear alignment for a prior gas pipeline that was surveyed for archaeological sites in 1993 and 1994 with negative results. Reports of that survey are in the HPO reference collection (accession numbers SUS R 64, 64a, and 64b). The archaeological survey was acceptable for the APE of that prior pipeline.

As your planning for the proposed project proceeds, the APE needs to be defined, that is, the depth and extent of the area within which project activities "may directly or indirectly cause changes in the character or use of historic properties" [36 CFR 800.16(d)]. The APE for the proposed project would include areas were there will be ground disturbing construction activities including pipe storage areas, construction staging areas, heavy equipment operating areas, access roads, and pipeline trench excavation.

Phase I archaeological survey is recommended for all previously unsurveyed portions of the APE where there are intact soils and subsoils. Survey efforts should follow the *New Jersey Historic Preservation Office Guidelines for Phase I Archaeological Investigations: Identification of Archaeological Resources.* Reports of archaeological survey results should conform to *Guidelines for the Preparation of Cultural Resources Management Archaeological Reports Submitted to the Historic Preservation Office.* Any archaeological deposits that may be discovered within the APE should be immediately registered with the New Jersey State Museum and, if they cannot be avoided by project construction activities, evaluated for their eligibility for listing in the NJRHP/NRHP in accord with the National Park Service's 2000 National Register Bulletin, *Guidelines for Evaluating and Registering Archaeological Properties.*

Eligibility evaluations should be performed by individuals who meet the *Secretary of the Interior's Historic Preservation Professional Qualification Standards* for archaeology. Plans for any archaeological site evaluative test excavation that may be necessary should be reviewed by the HPO for approval prior to their implementation.

800.5 Assessment of Adverse Effects

If the Appalachian Trail and or the Elias Van Bunschooten house are found to lie within the APE, then effects should be assessed, and the HPO consulted regarding the

finding. If these and/or other NJRHP/NRHP eligible districts, buildings, structures, or archaeological sites within the APE will be affected, then plans should be formulated, in consultation with HPO staff, to avoid, minimize, and/or mitigate adverse effects to them. Plans for any archaeological data recovery that may be necessary should be in accord with the *Secretary of the Interior's Standards and Guidelines for Archeological Documentation,* and should be reviewed by the HPO for approval prior to their implementation.

Additional Comments

Wantage Township does not have an Historic Preservation Commission to consult regarding historic properties in the New Jersey portion of the APE.

Thank you for providing the HPO an opportunity to comment on the potential for this proposed gas pipeline construction project to affect historic properties. We look forward to reviewing and commenting on plans for Phase I, II, and III cultural resources investigations that may be developed prior to their implementation. Please contact Mike Gregg of my staff at 609 633 2395 or mgregg@dep.state.nj.us with questions regarding archaeology, or Dan Saunders at 609 633 2397 or dsaunder@dep.state.nj.us regarding historic buildings, structures, trails, districts, and/or landscapes.

Sincerely,

Dorothy P. Guzzo,
Deputy State Historic
Preservation Officer

DPG:MLG
MLG:C\Letters\Ferc\Wallkill

c: Ruth Pierpont
Philip LaPorta

TRC

Customer-Focused Solutions

December 13, 2000

Ms. Ruth Pierpont
Director
New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau
Peebles Island
PO Box 189
Waterford, New York 12188-0189

Re: Waywayanda Energy Center - Proposed Natural Gas Pipeline Alignment
Project #00PR2461

Dear Ms. Pierpont:

Calpine Construction Finance Company, L.P. (Calpine) is preparing to file an application for a Certificate under Article X of the Public Service Law for a 540 MW combined cycle power plant to be located in the Town of Waywayanda in Orange County, NY. The application will also include a map level cultural resources analysis relating to a natural gas pipeline to the Calpine Facility. The map level analysis will be followed by a thorough Phase I cultural resources analysis during the actual permitting of the pipeline, to be conducted by the pipeline company.

The proposed natural gas pipeline route starts at the interconnection with El Paso Energy's existing pipeline in the Wantage Township in Sussex County, New Jersey and will extend approximately 20 miles north to the proposed Waywayanda Energy Facility. Approximately 2/3 (13 miles) of the pipeline will be located in New York. The pipeline will be constructed with industry standard specifications and will be subject Federal Energy Regulatory Commission (FERC) jurisdiction. In addition, the alignment will be constructed adjacent to or within existing right-of-way or transportation corridors wherever possible.

TRC is requesting your assistance in identifying any cultural resources within a 1/2-mile radius of the proposed pipeline alignment in the state of New York. If you have any concerns please do not hesitate to contact me at (978) 656-3613.

Thank you in advance for your assistance.

Sincerely,

Patricia E Claussen

Patricia E. Claussen
Assistant Project Manager

Enclosures

Boott Mills South, Foot of John Street • Lowell, Massachusetts 01852
Telephone 978-970-5600 • Fax 978-453-1995

ristine Todd Whitman
vernor

State of New Jersey
Department of Environmental Protection
Water Supply Administration, Bureau of Safe Drinking Water
P.O. Box # 426, Trenton, New Jersey 08625-0426
Tel# 609-292-5550, Fax# 609-292-1654

Robert C. Shinn, Jr.
Commissioner

February 1, 2001

Ms. Margaret A. Mills
Earth Tech
196 Baker Avenue
Concord, Massachusetts 01742

Re: Proposed Natural Gas Pipeline Route, Wawayanda Energy Facility

Dear Ms. Mills:

I have reviewed your letter to me of January 15, 2001 on the above referenced proposed natural gas pipeline route. This proposed interconnection route would start in Wantage Township, Sussex County, New Jersey on Hickory Road south of Snover Road, proceed north along Hickory Road and Ramsey Road to Route 23, proceed easterly to Route 651 (Unionville Road), and then proceed north again approximately along Route 651 to the New York state border.

As to its proximity to public water supplies, this route will cross the treated water transmission mains of the Sussex Borough Water Department, which runs along Route 23. Sussex Borough receives its drinking water from Lake Rutherford in High Point State Park. This water runs from Lake Rutherford in a small tributary of Clove Brook to a small reservoir in Colesville. From there it is piped to a treatment plant on Route 23/519 south of Colesville. After being treated for potable purposes it passes through a long transmission main approximately along Route 23 to Sussex Borough.

This crossing should be of some concern. First there is the task of exactly locating the Sussex Borough treated water transmission mains. Then construction specifications must be made to ensure these mains are not disturbed. While our New Jersey construction regulations for water mains do not specifically address crossings with gas pipelines, our

regulations (N.J.A.C. 7:10-11.10(e)5.) give distances that should be maintained from sanitary and industrial sewer lines. Crossings should have 18 inches vertical separation with the water main on top. The contacts for Sussex Borough are Denise L. Zuidema, Borough Manager, (973) 875-4831, David Kirkham of Earth Tech, Licensed Operator of the plant, (973) 875-6882, and Jeff Card, Director, Public Works (973) 875-4202

There are no known potable water intakes within three miles downstream of any of the proposed stream crossings. The potable water intake mentioned above is approximately one and one half miles upstream of the closest proposed stream crossing indicated.

As to the location of any public water wells located within 150 feet of the proposed pipeline route, this office has no direct knowledge of any so located. I gave you verbally the name of Steve Spayd of New Jersey Geological Survey, (609) 984-6587, who maybe able to help you. Furthermore, local knowledge of such wells, together with knowledge of any non-public potable water wells, i.e. private home wells, maybe obtained from the Sussex County Health Department, (973) 579-0370.

I hope this has been of assistance to you in obtaining environmental data for this proposed pipeline route. Should you have any further questions, feel free to call me at (609) 292-5550.

Sincerely,

A. William Dietze
Principal Environmental Specialist
Bureau of Safe Drinking Water

c: Denise L. Zuidema, Borough Manager, Sussex Borough
Marcia Cherico, Sussex County Health Department

ew York State Department of Environmental Conservation
vision of Environmental Permits, Room 538
Wolf Road, Albany, New York 12233-1750
one: (518) 457-7424 • FAX: (518) 457-7759
bsite: www.dec.state.ny.us

John P. Cahill
Commissioner

February 9, 2001

Margaret A. Miiis
Earth Tech
196 Baker Avenue
Concord, Massachusetts 01742

RE: Wawayanda Energy Facility, Proposed Natural Gas Pipeline Interconnect Route, Orange County

Dear Ms. Mills:

This is in response to your January 15, 2001 letter requesting information regarding the presence of municipal water supplies or watershed areas, potable water intakes and public groundwater supply wells within close proximity to the proposed natural gas pipeline for the above referenced project. Your request was accompanied with location maps showing the proposed interconnect route.

Staff consulted the Atlas of Community Water Supply Sources (1982) which was prepared by the New York State Health Department, based on local records. Staff did not find any potable water intake structures or surface water supplies (e.g., reservoirs) in close proximity to the interconnect route. The Atlas did identify several public groundwater supply wells located near the interconnect route. Due to the scale of the map, however, staff could determine if the wells were within 150 of the route, as specified in your letter. Below are the public wells identified in the atlas:

- Wawayanda Trailer Park
- Slate Hill (Hamlet)
- Hampton Realty Trailer Park
- Mt. Orange Trailer Park
- Village of Unionville

Staff recommends you contact the Orange County Health Department (845-291-2332) to determine the exact locations of these sources and the extent of the watershed for these supplies.

Should you have any questions regarding the information provided, please feel free to contact me.

Sincerely,

Christopher M. Hogan
Project Manager

cc: File

Joseph G. Rampe
County Executive

DEPARTMENT OF HEALTH

Maxcy J. Smith, M.D.
Commissioner of Health

124 Main Street
Goshen, New York 10924-2199

Environmental Health (845) 291-2331
Fax: (845) 291-4078

July 10, 2001

Darrell Oakley
Earth Tech
196 Baker Avenue
Concord, MA 01742

Re:
Wawayanda Energy Facility
Proposed Natural Gas Pipeline, Orange County, NY

Dear Mr. Oakley:

I am responding to your July 2, 2001 request for information regarding locations of Orange County public water supply wells within close proximity to the proposed natural gas pipeline.

Attached are figures showing the public water systems in the towns of Minisink and Wawayanda, Orange County in reference to the proposed pipeline. The pipeline (green line) was located as accurately as possible, from your figures, on the county parcel maps. Wells are indicated by the red dots labeled with the Federal ID and well number designation.

The specific requested well locations are not within 150 feet of the mapped pipeline, although are shown, by ID number, on the maps:

Slate Hill (Green)	3503569 (2 wells)
Hampton Realty Trailer Park	3513656
Mt. Orange Trailer Park	3501323
Village of Unionville	3503558 (2)
Wawayanda Trailer Park	No longer in existence

Two facilities within the 150 foot distance are: Westtown Sweet Treats (3530061), which has been inactive for about two years, and Janie's Sunoco (3517504). Both locations are non-community water systems.

Table 1, lists the public water systems within 1500 feet of the located pipeline. All of these are non-community water systems.

If you need additional information or have any questions, please contact me at (845) 291-2331.

Very truly yours,

David Kirkcaldy
Public Health Engineer

DK/aje

cc: File – Wawayanda Energy

Table 1

PWS within 1500 feet
of
Wawayanda Gas Interconnect

UNIQUE_ID_	FED_ID	SYS_NAME	NYLOC	S_NAME	TYPE
3509545.001	3509545	FOLDEROL II	T. MINISINK	DRILLED WELL	NCWS
3509565.001	3509565	FIRESIDE INN	T. WAWAYANDA	DRILLED WELL	NCWS
3509587.001	3509587	TOM'S DARK HORSE	T. WAWAYANDA	DRILLED WELL	NCWS
3517027.001	3517027	NYSDOT MIDDLETOWN RESIDENCY 8-5	T. WAWAYANDA	WELL #1	NCWS
3517027.002	3517027	NYSDOT MIDDLETOWN RESIDENCY 8-5	T. WAWAYANDA	WELL #2	NCWS
3517504.001	3517504	JANIE'S SUNOCO	T. WAWAYANDA	DRILLED WELL	NCWS
3519544.001	3519544	GREEN RIDGE GOLF CLUB	T. MINISINK	DRILLED WELL	NCWS
3520464.001	3520464	WAWAYANDA SENIOR CITIZEN CENTER	T. WAWAYANDA	WELL#1	NCWS
3521630.001	3521630	WESTTOWN PIZZA	T. MINISINK	DRILLED WELL	NCWS
3530018.001	3530018	ELEGANT PEASANT	T. WAWAYANDA	DRILLED WELL	NCWS
3530053.001	3530053	ALFREDO'S PIZZERIA	T. WAWAYANDA	WELL	NCWS
3530061.001	3530061	WESTTOWN SWEET TREATS	T. MINISINK	WELL	NCWS
3530064.001	3530064	GARDENS ON CATLIN CREEK (THE)	T. WAWAYANDA	WELL #1	NCWS
3530064.002	3530064	GARDENS ON CATLIN CREEK (THE)	T.WAWAYANDA	WELL #2	NCWS
3530089.001	3530089	D & D DELI	T. MINISINK	DRILLED WELL(NOT IN SERVICE)	NCWS
3530107.001	3530107	JIMMYS WESTTOWN MARKET	T. MINISINK	DRILLED WELL	NCWS
3530138.001	3530138	SUNRISE ENTERPRISES	T. WAWAYANDA	DRILLED WELL	NCWS
3530141.001	3530141	TORRISI PRODUCE WAREHOUSE OUTL	T. WAWAYANDA	DRILLED WELL	NCWS
3530151.001	3530151	84 QUICK STOP	T. WAWAYANDA	WELL #1	NCWS

STATE OF NEW YORK
DEPARTMENT OF AGRICULTURE AND MARKETS
1 WINNERS CIRCLE
ALBANY, NEW YORK 12235

Division of Agricultural Protection
and Development Services
518-457-7076
Fax: 518-457-2716

May 11, 1994

Hon. Lois Cashell
Office of the Secretary
Federal Energy Regulatory Commission
825 North Capitol St., N.E.
Washington, D.C. 20426

Re: OPR/DEER/ERC II
Docket No. CP93-548-000 Wallkill Transport Company, L.P.; Wallkill Pipeline Project Environmental Assessment -- Comments

Dear Secretary Cashell:

This agency has received the April 1994 WALLKILL PIPELINE PROJECT Environmental Assessment and is submitting these comments with attachments based on the document's review and our field assessment of May 6, 1994.

On page 9, the EA notes this agency's letter of March 21, 1994 in which we recommend full-width right-of-way topsoil stripping/segregation for tillable agricultural lands. The EA then notes that "small diameter pipelines can be installed with smaller equipment and narrower rights-of-way". It also notes that since Wallkill proposes to construct the pipeline during the summer and fall, construction should avoid the wettest part of the year..." The EA supports the narrow (30 feet wide) right-of-way and the use of the double ditching technique rather than full width topsoil stripping.

After reviewing the proposed project's aerial photos (of the Orange County New York section) with the cooperation of project representatives, and correlating respective agricultural lands on soil survey maps with the cooperation of the Orange County Soil & Water Conservation District, a site specific field assessment of agricultural lands was conducted for the primary purpose of comparing the Environmental Assessment's (EA's) project-specific method for agricultural topsoil protection with site-specific conditions of agricultural terrain and soils.

General Findings

Based on the field assessment of variety of agricultural lands, terrain, soils and drainage along the proposed right-of-way, as conducted May 6, 1994, both methods -- narrow right-of-way double ditching and full width topsoil stripping -- should be

employed on the Wallkill project, with the appropriate technique determined per site-specific condition(s) such as:

Example A. terrain requiring cross-slope construction using cut-and-fill grades for pipeline work; e.g. MP 10.6.

Example B. terrain not requiring cross-slope construction, using flat to gentle sloped lands along relatively dry, compacted "paths" of soil used as long-term farming access lanes; e.g. MP 8.7

Example C. terrain not requiring cross-slope construction, containing significant volumes of larger stones and rocks, naturally occurring in the topsoil horizon; e.g. MP 14.7

Example D. terrain not requiring cross-slope construction, comprising the lower topography on imperfectly drained soils, on the relatively poorer drained side of a field, with generally higher soil moisture even in summer; e.g. MP 12.5

Example E. terrain not requiring cross slope construction, containing highly specialized type of farm related use; e.g. MP 16.4

Example F. terrain not requiring cross-slope construction, used for permanent, unimproved pasture; e.g. MP 12.85

Comments/Recommendations

In example "A," where cross-slope alignment requires cutting-and-filling along the right-of-way, unless the topsoil is first stripped from the full-width, the "cutting" phase will simultaneously excavate and mix topsoil/subsoil/substratum materials, losing the fertile loam (topsoil) in the process; and, the "filling" phase will bury the remaining unstripped topsoil, occupying the low-side of right-of-way, under the mixed materials excavated from the high-side of right-of-way. The unstripped topsoil on the lower side will be damaged from the combination of: residual subsoils/substratum materials deposited on top of but not fully removed from the topsoil; and, gouging away of the topsoil materials during removal of the temporary fill materials. This extensive kind of soil disturbance resulting from cut-and-fill construction grading occurs regardless of 10 inch diameter size or larger, wherever cross-slope construction occurs.

On agricultural sites that are representative of "example A" cut-and-fill slopes, it is recommended that full-width topsoil stripping be applied, and the topsoil be stockpiled on the upslope side, separated from all trench spoil and fill materials, to prevent their burial and loss and to ease their replacement across the re-graded slope. A temporary construction right-of-way, wider than the present 30 feet will be necessary. See attachment: "TOPSOIL STOCKPILING ON SLOPES REQUIRING CUT AND FILL GRADE".

In agricultural sites that are representative of "example B", where the construction of a 10-inch diameter pipeline is aligned, on relatively flat, compacted soil used as a farm access lane, the EA plan for basic double-ditching is very well suited and is recommended.

In agricultural sites that are representative of "example D" where relatively higher soil moisture conditions are predominate we recommend that the right-of-way be stripped of topsoil for the full-width, so that all construction and related traffic activity will limit its rutting, compaction and soil material mixing to the exposed subsoil. This will avoid serious topsoil damage which would occur even in this situation of a 10 inch diameter line due to inherently higher moisture content of the affected soil. A temporary construction right-of-way, wider than the present 30 feet will be necessary to properly stockpile the segregated topsoil and also accommodate construction traffic, trenching and spoil segregation. Occasional "breaks" or brief openings through stockpile berms should be afforded to permit surface drainage and prevent "ponding" as applicable depending on the position of the berm relative to the immediate topography.

In agricultural sites that are representative of "example E" where there is the specialized farming use of the site for the ongoing distribution of liquid manure by spray (and a generally permanent livestock use of the site) with the right-of-way aligned along the far edge of field, adjacent to the highway right-of-way, the EA's plan for basic double-ditching is very well suited for the case of a 10 inch diameter line. The site should be graded to restore original surface free of any construction related ruts or similar depressions for the undesired pooling or "ponding" of spray liquid manure.

In agricultural sites that are representative of "example F" where the land is permanent, unimproved pasture not used for rotational haylands, the EA's plan for basic double ditching is very well suited and is recommended.

Included among the attachments are: a site-specific listing of the recommended technique per assessed agricultural site, and pictures of example sites.

Clarifications/Other Comments

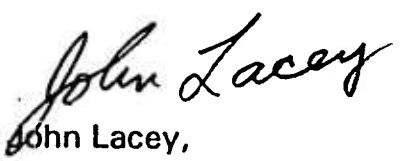
The EA notes this agency's letter of March 21, 1994 referring to NYSDAM's preference that the topsoil be restored evenly and to its original depth across the right-of-way, interpreting the letter to mean trench crowning should not be employed. This agency fully supports the use of trench crowning in ALL situations of restoration, regardless of technique: double ditching; full-width topsoil stripping or ditch and spoil side stripping. The intention of the earlier letter's statement was to help ensure that when a temporary trench crown is applied, it be done using the subsoil materials as

its base, followed by the replacement of the topsoil uniformly over the top of the mounded subsoil material, to match the original thickness of the topsoil across the right-of-way, such that when the trench settling is completed, the topsoil will be close to even throughout and across the right-of-way. Our concern stems from occasions where trench crowning is conducted improperly, using only topsoil material for the entire crown by removing topsoil materials from other portions of the right-of-way, depleting the original thickness in such areas. Again, we fully support trench crowning and hope that this clarification explains our concern.

Regarding all of the other specified standards for construction and restoration in agricultural lands, as explained in the April 1994 EA (e.g. burial depth of pipe, application of trench breakers, rock cleanup, subsoil decompaction, restoring vegetation, etc.), the Department supports their implementation. Additionally, during operations and maintenance phase, agricultural sites should be examined for residual effects (e.g. depressions and water ponding, trench zone saturation etc.) and implement corrective measures including but not limited to gravity-flow intercept tile drain lines.

Thank you for your consideration of our comments.

Yours truly,



John Lacey,
Agricultural Resource Specialist
NYS Dept. of Agriculture & Markets
149 Emerson Hall, Cornell University
Ithaca, NY 14853
Tel: (607) 255-1756
FAX: (607) 255-6143

JL\sm
Attachments
cc: Susan Cabrera, Orange County Soil & Water Conservation District
Don Cahill, U.S. Generating
Lyn Gressock, U.S. Generating
Gordon Hislop, c/o U.S. Generating
Lucy Joyce, Orange County Soil & Water Conservation District
Fred Sellers, HMM Associates
Dianne Smith, NYS Dept. of Agriculture & Mkts.
Bob Somers, NYS Dept. of Agriculture & Mkts.
Kevin Sumner, Orange County Soil & Water Conservation District
Laura Turner, Federal Energy Regulatory Commission

Attachment, Letter May 11, 1994
Hon. Lois D. Cashell
Docket No. CP 93-548-000

WALLKILL PIPELINE PROJECT, 10 INCH DIAMETER PIPELINE
SITE-SPECIFIC LISTINGS OF RECOMMEND TECHNIQUE
PER ASSESSED AGRICULTURAL SITE[1]

Approximate Location of Site	Condition of Right-of-Way (Examples A-F)[2]	Recommended Technique for Topsoil Protection
MP 6.6	(A) cut and fill	Full-width topsoil stripping
MP 7.2	(A) cut and fill	Full-width topsoil stripping
MP 8.6	(B) compacted lane	EA plan, double ditching
MP 8.7	(B) compacted lane	EA plan, double ditching
MP 10.5	(A) cut and fill	Full-width topsoil stripping
MP 10.6	(A) cut and fill	Full-width topsoil stripping
MP 11.4	(D) moist soil-terrain	Full-width topsoil stripping
MP 12.5	(D) moist soil-terrain	Full-width topsoil stripping
MP 12.85	(F) unimproved permanent pasture	EA Plan, double ditching
MP 14.7	(C) excess rock content	EA plan, double ditching
MP 16.4	(E) specialized use, liquid manure	EA Plan, double ditching

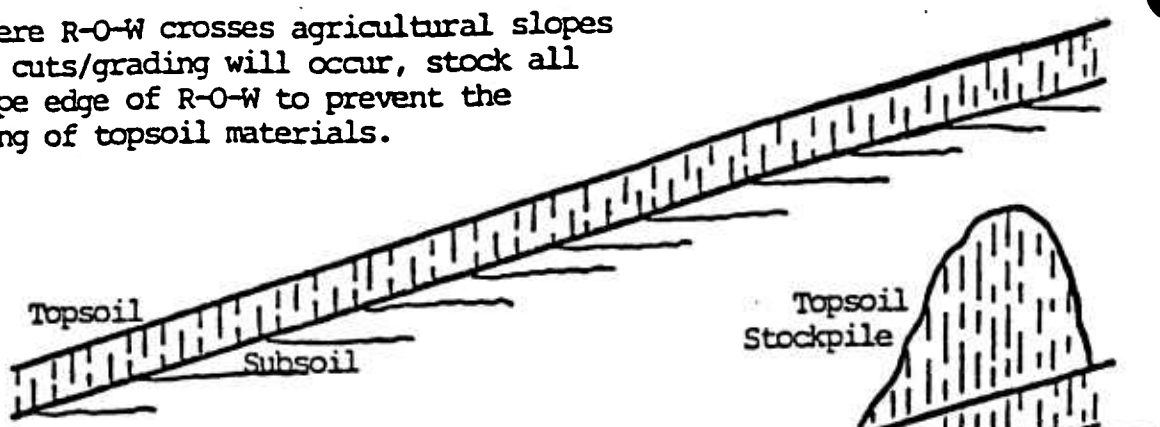
[1]This appended list is provided as a supplement to the "Comments/Recommendations" portion of the letter and for the Wallkill Pipeline Project's reference use in preparing final determinations of topsoil protection method(s) for the above noted locations and those with similar condition(s) which are not necessarily identified above.

[2]Refer to "General Findings/Recommendations" portion of letter for detailed description of each condition of right-of-way, examples "A-F"

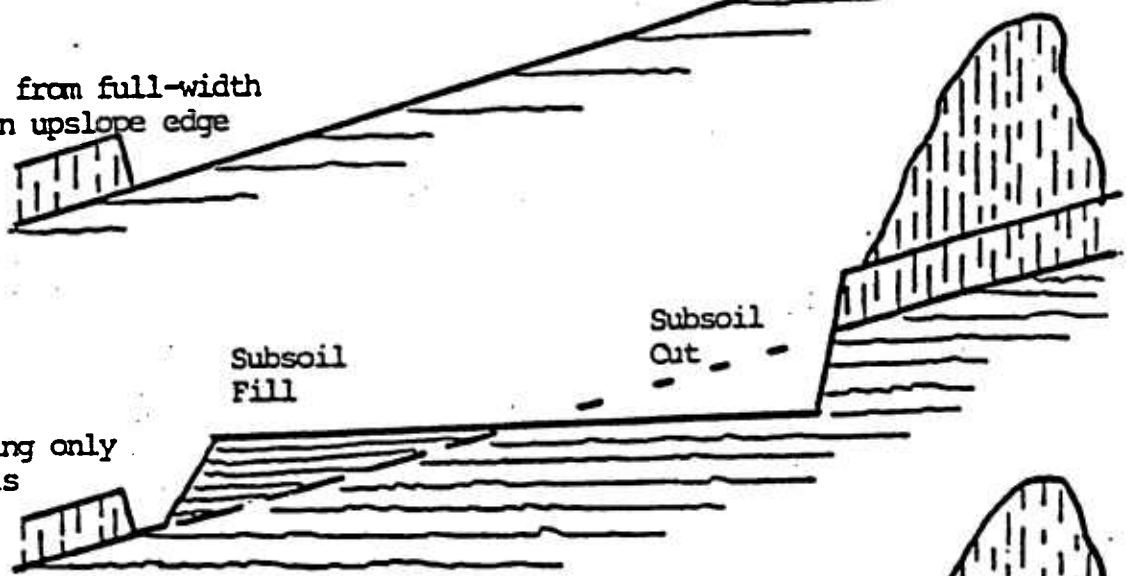
TOPSOIL STOCKPILING ON SLOPES

REQUIRING CUT AND FILL/GRADE

In situations where R-O-W crosses agricultural slopes and construction cuts/grading will occur, stock all topsoil on upslope edge of R-O-W to prevent the burying and mixing of topsoil materials.



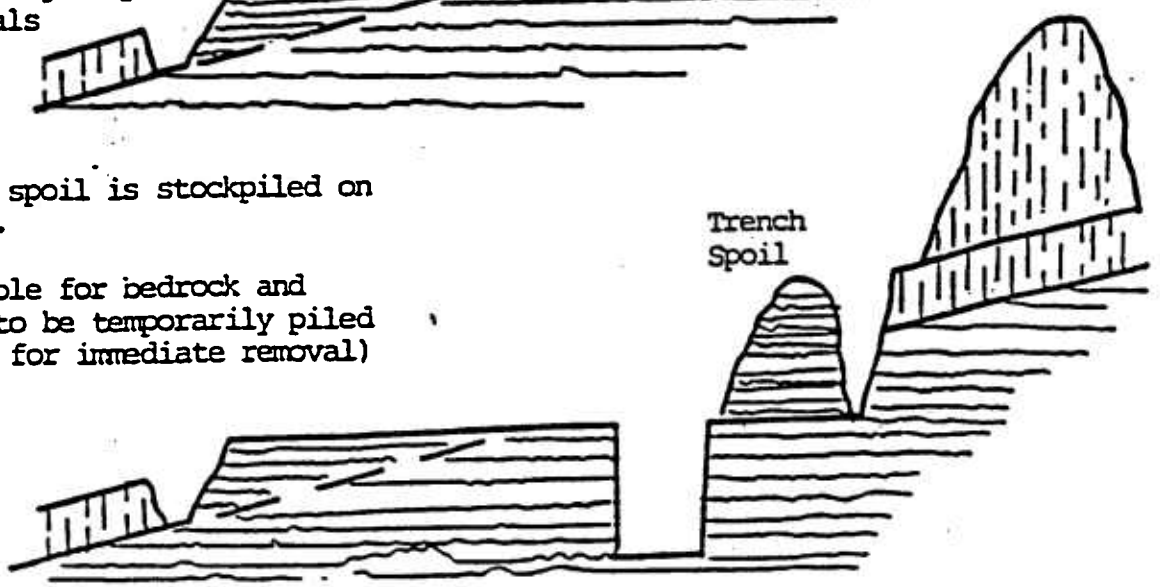
Topsoil stripped from full-width and stockpiled on upslope edge of R-O-W



Cut-and-fill using only subsoil materials over subsoil

Trench subsoil spoil is stockpiled on top of subsoil.

(Note: Preferable for bedrock and boulder spoil to be temporarily piled in access lane for immediate removal)



-- Subsoil is regraded to contour after pipe installation.

-- Topsoil is replaced over the R-O-W after the subsoil is decompacted and rocks/stones are removed.

APPENDIX H HISTORIC RESOURCES REPORT

Stip2Clause4submission

TRC

July 31, 2001

Ms. Ruth L. Pierpont, Director
Historic Preservation Field Services Bureau
New York State Office of Parks, Recreation, and Historic Preservation
Delaware Avenue
Cohoes, NY 12047

Subject: Wawayanda Energy Center
Siting Board case no. 00-F-1256, OPHRP no. 00-PR-2461

Dear Ms. Pierpont:

The attached report is submitted pursuant Stipulation 2, Clause 4 of the stipulations signed by Calpine, Department of Public Service, and other agencies with respect to cultural and visual resource assessments for the Wawayanda Energy Center. The clause reads as follows.

4. The analysis of potential impacts to Historic Resources shall include:

(a) Field inspections and consultation with local historic preservation groups to identify sites or structures listed or eligible for listing on the State or National Register of Historic Places within the Project Viewshed and within a 5-mile radius of the Project site. Photographs taken of standing structures within the viewshed, which appear to be at least 50 years old and potentially eligible for listing in the State or National Register of Historic Places, based on an assessment by an architectural historian;

(b) An OPRHP Building Structure Inventory Form will be completed for each potentially eligible (as described in paragraph 4(a)) or listed property and submitted to OPRHP and DPS Staff for review; Calpine will submit its documentation regarding listed and potentially eligible structures within the viewshed to OPRHP and DPS for review prior to completing the visual resources study; and

(c) Potential visual impacts to significant historic structures within the Project Viewshed that are listed, or, in the judgment of an architectural historian, are potentially eligible for listing on the State or National Register of Historic Places, will be characterized as part of the visual resources study, as described in Stipulation No. 11, entitled "Aesthetics and Visual Resources."

TRC Environmental Corporation
Boott Mills South, Foot of John Street • Lowell, Massachusetts 01852
Telephone 978-970-5600 • Fax 978-453-1995

Presently attached is a copy of the report, similar to a Phase I historical/architectural study, that includes Building/Structure Inventory forms, mapping, and photographs of all structures deemed to be potentially eligible for the State and National Registers of Historic Places. The report and documentation is being submitted for OPRHP and DPS review prior to completing the visual resources study for this project.

Thank you very much for your attention to this matter, and please do not hesitate to call me if you have any questions regarding this submission. I can be reached at 978 656 3663.

Sincerely yours,

Stephan Solzhenitsyn
Senior Project Manager

cc Ms. Christina Palmero, Department of Public Service (w/ enclosure)
Mr. Donald Neal, David Devine, Calpine (w/enclosure)
Mr. Craig Wolfgang, TRC (w/enclosure)
Mr. Michael Murphy, Beveridge & Diamond PC (w/o enclosures)

WAWAYANDA ENERGY CENTER

DPS No. 00-F-1256
OPRHP No. 00-PR-2461

Pre-Application Report to Office of Parks, Recreation, and Historic Preservation and Department of Public Service Staff

July 31, 2001

I. Introduction

The Wawayanda Energy Center, LLC (Calpine), a subsidiary of the Calpine Corporation, is proposing to build a 540-megawatt power generation facility (the Project) along the north side of Dolsontown Road in the Town of Wawayanda, Orange County, New York, just south of the Middletown city limits.

The site is situated on flat to moderately sloping land that was previously used for agriculture. The eastern portion of the parcel is nearly flat with wetlands, a pond, and a small stream running through it, and the western potion contains some steeper slopes. Monhagen Brook, a tributary to the Wallkill River, is located some 1000 feet (300 meters) to the south, across Dolsontown Road.

Elevations increase to the north in the City of Middletown and Town of Wallkill, and also rise in the southeast past the Wallkill River in the Town of Goshen. The abandoned Erie and Lackawanna Railroad grade forms the eastern margin of the property, and an Orange and Rockland electrical substation is located approximately 0.5 miles (0.8 km) to the northwest. The area around the project site generally consists of flat to rolling terrain and is occupied by farmland, scattered residential housing, and several commercial and industrial properties. Outside of the Wallkill valley, the land becomes hillier in all directions. Here, vistas are longer, but topographic features also more frequently interrupt them.

II. Methodology

In accordance with stipulations entered into by the Department of Public Service, Calpine, and other agencies, the purpose of this investigation was to identify all standing structures within a five mile radius of the Project site that meet the minimal National Register of Historic Places age eligibility criterion (50 years or older), have maintained their architectural integrity, and lie within the Project viewshed. As an initial step to the investigation, the standing structures on all roads within the five-mile radius were observed, and the buildings meeting the above criteria were identified. A preliminary viewshed analysis was used to identify which areas were more or less likely to be subject to visual impact. This viewshed reconnaissance included portions of the Town of Wawayanda west and south of the Project site, the Town of Wallkill northeast of the Project site, the Town of Goshen south-southeast of the Project site, as well as the City of Middletown north of the Project site.

After more precisely defining the extent of the project's potential visual impact through field surveys at all standing structures meeting the age eligibility criterion, the potentially eligible buildings that were still considered as having reasonable potential of a view of the proposed facility were photo-documented, reevaluated, and inventoried. Building-Structure Inventory Forms and a map indicating the locations of the subject structures are included in this report. Assessment of the viewshed was conservative in that if direct

views from a potentially eligible structure were not available, views in the vicinity of the potentially eligible structures have been sought out.

III. Historical Background

As with most of the Anglo American part of northeastern North America, the early historic era settlement pattern found in the towns of Wawayanda, Wallkill, and Goshen involved the dispersed placement of residential structures and associated farm outbuildings along roadways and the clustering of commercial, institutional, and residential buildings around crossroads, water-powered industries, and, later, railroad stations. Many of the older roads in the survey appear to have seen minimal alignment changes since the publication of detailed maps of Orange County in the mid-nineteenth century. Many new roads have been added during the second half of the twentieth century due to the proliferation of residential housing and the construction of associated schools, retail malls, and complexes of professional buildings. The City of Middletown developed into a major regional center as a result of its location at the intersection of several railroads. These were built during the Civil War era as part of the flourishing industry and commerce. The city's decline during the post-World War II decades also parallels that of the railroads. The settlement pattern in Middletown has been, from the outset, tightly nucleated with a mix of commercial, industrial, and residential buildings on small lots in close proximity to one another. Large, closely spaced properties surround the more elite housing in the elevated northern area of the city.

Some of the roads that served as major thoroughfares during the eighteenth and nineteenth centuries, along which rural structures were constructed, have been relegated to secondary status in the automobile age. New wider, straighter highways such as Interstate 84 and the southern portion of Dolson Avenue now carry the bulk of the commercial and long-distance traffic that previously wound its way past scattered farmsteads and crossroad communities like Denton and Pilgrim Corners.

IV. Currently Listed and Eligible Properties within a Five-Mile Radius

The following is a list and description of the properties in within a five-mile radius of the Project site that are listed on the National Register of Historic Places.

- The *Oliver Avenue Bridge* in Middletown was constructed in 1895 and was listed in the NRHP in July 1984. This bridge was part of the Goshen Trolley Line and was one of only two surviving bridges in New York built by the Havana Bridge Works. It was recently dismantled due to safety concerns.

- The *Hillside Cemetery* in Middletown was designed by Calvert Vaux, a co-designer of Central Park in New York City. The cemetery was constructed in 1861 and registered in September 1994.

- The *Webb Horton House* (also known as Morrison Hall) was the home of Webb Horton, a tanner from Pennsylvania, and his family. The 40-room mansion was built between 1902 and 1906. It is currently owned and occupied by the Orange County Community College.

- The *First Baptist (Primitive) Church of Bloomfield* was built in 1792 and was listed on the NRHP in November of 1976.

- The *District School No. 9, "Old Stone Schoolhouse"* was listed on the NRHP in 1988. It is located on Route 17A in Goshen.

- The *U.S. Post Office on Grand Street in Goshen* was listed on the NRHP in 1989 along with many other New York State Post Offices.

- The *1841 Goshen Courthouse* was listed on the NRHP in March 1975.

- The *Church Park Historic District* is partially located within 5 miles of the Project site.

- The *Duchess Quarry Cave Site* is a Paleoindian site. The location is restricted.

In addition to the sites listed above, several properties in this area have already been recognized as eligible for listing on the National Register of Historic Places. These sites include:

- The Middletown Psychiatric Historic District, Middletown
- The Mid-Hudson Psychiatric Center Historic District, New Hampton (Wawayanda)
- 94 Maples Road, Wallkill
- 105 Maples Road, Wallkill
- 220 Maples Road, Wallkill
- Holmes Bookstaver House, Crotty Road, Wallkill
- Frank Post House, Crotty Road, Wallkill
- Joseph Slaughter/Alanson Slaughter House, Goshen Turnpike, Wallkill
- 11 Webster Avenue, Village of Goshen
- Bennett House, 29 Cart Lane, Village of Goshen

- County Trust Bank, West Main Street, Village of Goshen
- Gavin Building, Greenwich Avenue, Village of Goshen
- Goshen Town Hall, 15 Webster Avenue, Village of Goshen
- Johnic Pharmacy, 62 West Main Street, Village of Goshen
- Norstar Bank, 54 West Main Street, Village of Goshen
- Horton House, NY 17A, Goshen
- John Wells Homestead, 6½ Station Road, Goshen

Several other sites whose location is restricted are also recognized as being eligible.

One of the currently listed or eligible National Register properties, the Web Horton House (Morrison Hall), is noted to lie within the Project viewshed based on computer modeling. This viewpoint will be represented in the Project visual impact assessment. The other listed and eligible structures noted above are screened from potential view of the Project, based on field visits to the structures and/or the nearest publicly accessible viewpoints in the vicinity of these structures.

V. Inventory Results

The goal of the method described above was to observe all standing pre-1950 structures within a five-mile radius, eliminate those unlikely to meet other Register eligibility criteria or which are screened from a view of the Project, and compile a list of the remaining buildings. The potentially eligible structures identified represent a range of vernacular constructions dating from the immediate post-Revolutionary War era through the early decades of the twentieth century.

The survey was carried out in March, April, and May 2001 by Stephen J. Oberon of Columbia Heritage, Ltd. Initial reconnaissance and observations were made during a period of minimal vegetation and little snow accumulation. Potentially eligible structures were identified by street number, the same system of identification that is used for the Building-Structure Inventory Form that was completed for each building. Structures were then keyed to the accompanying map. The photos were angled to document relevant features and to record more than one face of the structure if possible. Aspects of some structures, such as the primary (south) façade of the house at 1197 Dolsontown Road, were obscured by large coniferous shrubs and trees. Photo-documentation in such cases had to be restricted to available views.

The Historical Society of Middletown and the Wallkill Precinct indicated that they have not formally designated any local structures as having historical or architectural

significance. No historic designations are presently available from the Town of Wawayanda Historian. No formal local designations have been made by citizen-led groups in the Village or Town of Goshen or by the Orange County Historical Society.

One structure, a residence dating from the turn of the twentieth century located at 1128 Dolsontown Road, is subject to direct Project impact, as it is within the Project site and will be cleared to make way for Project facilities. The structure is a hipped-roof four-square farmhouse executed in vernacular Colonial Revival style, flanked by ornamental shrubs and trees. There is an oval driveway to the west of the house and a barn located on the south side of Dolsontown Road that appears to be contemporary with the residence. This is the only building of this type on Dolsontown Road, but the style is well represented in the Middletown area.

Twentieth century modifications of the structure, including the construction of a one-story addition to the northeast corner, the replacement of windows, the addition of aluminum siding throughout, and the construction of outbuildings to the north and west, have reduced the architectural integrity of the property. Based on these changes to the buildings, this structure is considered unlikely to meet State and National Register of Historic Places criteria for significance.

The following eight structures within the project viewshed are considered potentially eligible for listing on the State and National Register of Historic Places. Building/Structure Inventory Forms for each property are submitted as part of this report.

29 Gonzalez Drive

This farmstead complex contains a residence, barn, and assorted other outbuildings set well back from NYS Route 6 at the end of a private drive. The residence is oriented roughly cardinally with open fields to the south and west and mature trees to the north and east.

It is a modest two-story Queen Anne residence with free classic elements. It features a hipped roof with lower cross gables, a wrap-around, one-story porch with full-height classical columns and spindle balusters, and simple door and window surrounds with 1/1 single panes. The south entry has sidelights and pilasters around the door, which has a single large pane set into the upper portion. The southeast entry is plain with a narrow double door. The building has two twentieth century additions on the north and west aides and is surrounded by late nineteenth and early twentieth century farm outbuildings.

A viewpoint near this structure will be included in the visual impact assessment to be presented in the Article X application.

169 Greeves Road

This frame two-story/1½ story farmhouse is situated among a complex of farm-related structures. It is separated from the roadway by a lawn and several ornamental shrubs and trees. Most of the other buildings in the complex either date from the second half of the twentieth century or have been modified for residential use during the past fifty years. One formerly free-standing, one-story structure to the east of the house has been renovated and connected to the 1½ story portion of the principal structure. A building previously used as a barn has been modified and is now used as a dwelling. Scattered recently constructed houses populate this portion of Greeves Road, and farmland is visible in all directions.

The building is a frame vernacular Greek Revival side-gabled farmhouse with end chimneys, 6/6 sashes, and a full-width porch supported by unfluted Roman Tuscan columns with base. The main (south) entryway is characterized by full transom light, and the small frieze-band windows on the east side of the front façade are aligned symmetrically with the 3-ranked lower part of the 1½-story portion. The former outbuilding to the east, now connected to the main-structure through a twentieth century addition, is believed to date from the turn of the nineteenth century.

Field surveys showed that visibility in the direction of the Project site is screened by vegetation, both from this address and nearby houses. Because no nearby viewpoint with impact potential exists, no further analysis of this viewpoint is proposed.

134 South Street

This residence is situated in an urban residential setting populated by a variety of late nineteenth and early twentieth century structures. This house constitutes the only local example of the Craftsman style. It is surrounded by ornamental shrubs and trees that partially obscure views of the structure and a lawn that extends to the sidewalk to the southeast.

The structure is a 1½ story frame residence with a low-pitched side-gabled roof, an unenclosed eave overhang, and exposed second story roof rafters with decorative beams under the gables. There is a full-width porch on the front (south) façade supported by square, cobblestone faced columns that extend, uninterrupted, to the ground level. The chimney and step ornamentation in the main entry are both cobblestone faced as well. There is a small one-story wing on the western part of the property with a flat roof and exposed roof beams. The aluminum siding and storm windows threaten the exterior integrity of the property.

Field surveys showed that there is no visibility of the Project site from this address. However, nearby Webb Horton House (Morrison Hall, a listed NRHP property) will be represented in the visual impact assessment.

1081 Dolsontown Road

This farmhouse is surrounded by assorted farm-related outbuildings to the west and southwest, including a barn, a workshop, and sheds. Most of these outbuildings date from the twentieth century. The house is set back from the roadway at the end of a private drive. Around the house, there are grassy areas to the west and south and wooded land to the north and east. The residence is one of several late nineteenth century farmhouses along this portion of Dolsontown Road, which also contains several post-1950 residences.

The farmhouse is a vernacular, cross-gabled, two-story building with some Queen Anne style elements, such as asymmetry, a wrap-around porch with classical columns, simple door and window surrounds, and a relatively steep roof. Some of the elements, such as the 2/2 windows throughout, imply the house was initially constructed during the Civil War era. Several free classic touches, such as the classical porch columns and porch railings lacking turned, spindlework balusters, indicate the house was probably updated in the late nineteenth century. Two one-story mid-twentieth century additions extend from the northwest corner and a new roof has recently been installed. Most of the outbuildings date from the twentieth century.

Visibility from this structure will be limited, but there is a high degree of visibility from a nearby point along Dolsontown Road, and that viewpoint will be included in the visual impact assessment to be presented in the Article X application.

1197 Dolsontown Road

This house is situated within 75 feet (23 meters) of Dolsontown Road, and it is enclosed by tall evergreens on the south, west, and north sides. There is a lawn between the trees and the roadway. This is the only brick structure in this part of Dolsontown Road, and it is also the only residence that dates from the first part of the nineteenth century. The other buildings in the vicinity of the site date from the post Civil War era or the twentieth century.

The residence is a two-story, side-gabled, vernacular brick building with a moderately pitched roof, asymmetrical three-ranked front façade with an entry on the west end of the two-story portion. The doorway is surrounded on the sides by rectangular glass panes. The house has a one-story wing on the west side, a cut stone block foundation, and 6/6 window sashes. Several exterior improvements have compromised the architectural integrity of the property including the post-1950 replacement and enlargement of the east façade attic windows and the addition of concrete steps leading to the south entry way. The one-story porch probably dates from the latter part of the nineteenth century.

Visibility from this structure will be assessed via a surrogate viewpoint on Dolsontown Road, which has a high degree of visibility toward the Project site.

195 South Street

This building was constructed to be a residential structure, but it currently houses a medical practice. It is a large, two-story frame example of the Neoclassical style that appears to have maintained much of its architectural integrity. It is situated on spacious grounds with a circular driveway, mature trees, and ornamental shrubs; and is set well back from the road. It has a very limited view of the surrounding residential neighborhood at the edge of the more urban Middletown environment. Structures of this general style are scattered throughout the early twentieth century sections of the city.

The house itself is a side-gabled, two-story, symmetrical, five-ranked later Neoclassical style residence with a two-story full façade porch, 9/9 and 9/1 double hung sashes, and square vernacular Doric columns with capital and base. It has a simple, stylized recessed main entry with pilasters and some fan design elements on the gable ends. There is an exterior chimney on the west façade and the house has clapboard siding.

Field surveys showed that there is no visibility of the Project site from this address. A viewpoint from Heidt Avenue represents the nearest location with visual impact potential, and will be included in the visual impact assessment.

13 Adams Avenue

This early twentieth century residence is an eclectic, two-story, Italian Renaissance style house with symmetrical door placement. The lower facing of the house is stucco, and the upper facing is stone. The house has a hip roof covered by ceramic tiles and a projecting wing from the north side of the house. The windows are multiple pane over single pane, with casement windows on the west façade of the wing. The entrance to the house is accented by small, round Tuscan classical columns, which support the entry porch. This porch is also covered by ceramic tiles with cobblestone facing around the door, which is flanked by sidelights extending ¾ of the way to the base of the wall.

This is the only structure of this style in Middletown, and it is situated on a small lot surrounded by manicured evergreen shrubs and ornamental trees. The house has a small lawn and is accessed by concrete steps that appear to date from the construction of the building. The area around the house is an urban residential neighborhood populated by late nineteenth and early twentieth century single-family detached structures with some later twentieth century intrusions. The addition of aluminum storm windows, an aluminum door, and exterior air conditioners appear to be among the few compromises to this structure's integrity.

Field surveys showed that there is no visibility of the Project site from this address. The aforementioned viewpoint from Heidt Avenue represents the nearest location with visual impact potential, and will be included in the visual impact assessment.

32 Adams Avenue

This side-gabled Tudor style residence has a steeply pitched roof with decorative half-timbering and stucco infilling on the second story façade. The first story has brick wall cladding with decorative brickwork above the doorways and windows. The principal (east) façade is dominated by a cross-gabled entry. Sets of four- and five-pane vertical casement windows are placed in groupings of four on both the first and second stories or are singly adjacent to the doorway. A large exterior brick chimney with a simple shaft stands on the north façade of the structure.

This building is on a corner lot in an urban residential neighborhood that is characterized by small lots and a variety of late nineteenth and early twentieth century homes. This residence is the only Tudor style house in the area. The structure is placed on the center of its lot, and it is surrounded by fairly dense decorative shrubbery, flowerbeds, trees, and a lawn that extends to the edge of the sidewalk. A prominent aluminum door represents the only observed compromise to the architectural integrity of this building.

Field surveys showed that there is no visibility of the Project site from this address. The aforementioned viewpoint from Heidt Avenue represents the nearest location with visual impact potential, and will be included in the visual impact assessment.

VI. Conclusion

Per the requirements of stipulations entered into between Calpine, Department of Public Service, and other agencies, field inspections and consultation with local historic preservation groups have been conducted to identify sites or structures listed or eligible for listing on the State or National Register of Historic Places within the Project viewshed and within a 5-mile radius of the Project site. Photographs have been taken of standing structures within the viewshed that appear to be at least 50 years old and potentially eligible for listing in the State or National Register of Historic Places. An OPRHP Building Structure Inventory Form has been completed for each potentially eligible or listed property in the Project viewshed. These forms are presently being submitted to OPRHP and DPS Staff for review, prior to Calpine' s completion of its visual resources study for its Article X application.

VII. Acknowledgements

Stephen Oberon conducted field inspections and compiled this report. Judgments regarding potential eligibility of structures were made by Mr. Oberon in concert with Ruth Nichols, an architectural historian with TRC. Preliminary fieldwork was conducted by Mr. Oberon and Christopher Canniff of TRC. Visual impact analysis and viewpoint selection assistance has been provided by Craig Wolfgang and Ingrid Young of TRC. The authors express gratitude to county and municipal historic preservation organizations for their consultation.

BUILDING-STRUCTURE INVENTORY FORM
NYS OFFICE OF PARKS, RECREATION
& HISTORIC PRESERVATION
DIVISION FOR HISTORIC PRESERVATION

FOR OFFICIAL USE ONLY
UNIQUE SITE NO._____
QUAD_____
SERIES_____

YOUR NAME: S.J. Oberon DATE: 27 July 2001
YOUR ADDRESS: 56 North Plank Road, Newburgh, NY 12550
TELEPHONE: 888-294-4815
ORGANIZATION (if any): Columbia Heritage, Ltd.

* *

IDENTIFICATION

1. BUILDING NAME(S):
2. COUNTY: Orange CITY: Middletown VILLAGE:
3. STREET LOCATION: 134 South Street
4. OWNERSHIP: a. public _ b. private x
5. PRESENT OWNER:
6. USE: Original: residence Present: residence
7 ACCESSIBILITY TO PUBLIC: Exterior visible from public road: Yes x No _
Interior accessible: Explain:

DESCRIPTION

8. BUILDING MATERIAL a. clapboard b. stone c. brick x d. board&batten
e. cobblestone x f. shingles x g. stucco other:
9. STRUCTURAL SYSTEM (if known) a. wood frame with interlocking joints
b. wood frame with light members
c. masonry load bearing walls
d. metal (explain)
e. other
10. CONDITION: a. excellent x b. good c. fair d. deteriorated
11. INTEGRITY: a. original site x b. moved if so, when?
c. list major alterations and dates (if known):

12. PHOTO: 13. MAP:

14. THREATS TO BUILDING: a. none known x b. zoning c. roads
d. developers e. deterioration
f. other

15. RELATED OUTBUILDINGS AND PROPERTY:
a. barn b, carriage house c. garage x
d. privy e. shed f. greenhouse
g. shop h. gardens
l. landscape features: j. other

16. SURROUNDINGS OF THE BUILDING (check more than one if necessary):
a. open land b. woodland
c. scattered buildings
d. densely built up x e. commercial
f. industrial g. residential x
h. other

17. INTERRELATIONSHIP OF BUILDING AND SURROUNDINGS:
(Indicate if building/structure is in an historic district)

Situated in an urban residential setting populated by a variety of late 19th and early 20th century structures with occasional later constructions. This building constitutes the only local example of Craftsman style. Surrounded by ornamental shrubs and trees that partially obscure views; lawn extends southwest from house to sidewalk.

18. OTHER NOTABLE FEATURES OF BUILDING AND SITE (include interior features if known):

A Craftsman style 1½-story frame residence with low pitched side gabled roof, unenclosed eave overhang with brackets E side, decorative 2nd story roof beams and decorative beams under porch eaves. Full-width porch front (S) facade supported by square untapered columns extending without interruption to ground level. Cobblestone-faced porch columns, chimney and main (S) entry step ornamentation; brick foundation and front porch wall facade; small, 1-story enclosed porch with louvred windows at W with flat roof and exposed rafter tails. Storm windows are among the few compromises to exterior integrity.

SIGNIFICANCE

19. DATE OF INITIAL CONSTRUCTION: c.1910
ARCHITECT: unknown
BUILDER: unknown

20. HISTORICAL AND ARCHITECTURAL IMPORTANCE:

The only example of this style residence in this part of Middletown, the structure maintains architectural integrity.

21. SOURCES:

22. THEME:

UNITED STATES DEPARTMENT OF THE INTERIOR OMB NO. 1024-0018, NPS FORM
NATIONAL PARK SERVICE
NATIONAL REGISTER OF HISTORIC PLACES
REGISTRATION FORM

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in Guidelines for Completing National Register Forms (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets. Type all entries.

1. Name of Property

historic name WEBB HORTON HOUSE
other names/site number MORRISON HALL

2. Location

street & number 115 SOUTH STREET | | not for publication
city, town MIDDLETOWN | | vicinity
state NEW YORK code 036 county ORANGE code 071 zip code 10940

3. Classification

Ownership of property	Category	Number of resources within property: Contributing	Noncontributing	
[ ]private	[X]building(s)	5	0	buildings
[X]public-local	[ ]district	0	0	sites
[ ]public-State	[ ]site	0	0	structures
[ ]public-Federal	[ ]structure	0	0	objects
	[ ]object	5	0	Total

Name of related multiple property listings: NA

Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this [X] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, this property [X] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Signature of certifying official — Date 3/15/90
Deputy Commissioner for Historic Preservation
State or Federal agency and bureau

In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Signature of commenting or other official — Date

State or federal agency and bureau

5. National Park Service Certification

I hereby, certify that this property is:

[ ] entered in the National Register. [ ] See continuation sheet.
[ ] determined eligible for the National Register. [ ] see continuation sheet.
[ ] determined not eligible for the National Register.
[ ] removed from the National Register.
[ ] other, (explain:)

Signature of keeper — Date of Action

6. Function or Use

Historic Function (enter categories from intructions)	Current Functions (enter categories from instructions)
DOMESTIC/single dwelling	EDUCATION/college

7. Description

Architectural Classification (enter categories from instructions)

LATE 19TH AND 20TH CENTURY REVIVALS

Materials (enter categories from instructions)

foundation STONE
walls STONE
roof CERAMIC TILE
other

Describe present and historic physical appearance.

The Webb Horton House (Morrison Hall) is located in the southwest quadrant of the city of Middletown in Orange County, New York, near the edge of the historic section of the city (map 1). It sits on an elevated, five-acre plot facing South Street between East Conkling and Grand View Avenue (map 2). In size, scale, and architectural integrity, the mansion contrasts strongly with the surrounding neighborhood of modest, late nineteenth century and early twentieth century dwellings.

The residence was once part of an extensive estate that has become the campus for the Orange County Community College. Modern campus buildings have been built upon much of the area but elements of the estate remain intact in close proximity to the house including a garage/stable complex (one contributing building) and adjoining greenhouses and tool house (three contributing buildings). Although the estate setting has been largely compromised by the modern building program, the original curvilinear road system remains in place, recalling the landscape design of the grounds. The nominated boundaries have been drawn to include these vestiges of the Webb Horton estate, while excluding the modern intrusions on the property. The boundary begins on South Street, follows the curvilinear road system behind the house, includes the entire garage/stable complex, and returns to South Street between the mansion and Hudson Hall. The east boundary between the Webb Horton House and Hudson Hall is an arbitrary line drawn to exclude this massive modern building from the nomination.

The Webb Horton House (Morrison Hall) is situated to the front (southeast) of the nominated property, and is set back about 100 feet from South Street. The lot slopes down about five feet to South Street. Around the house the grade of the lot is relatively level. It slopes away gradually on the lawn behind the house and then steeply at the rear, to meet Wawayanda Brook. The grade level also slopes down from the vicinity of the house toward the north portion of the lot, where the garage and stable complex, tool house, and greenhouses are located.

The historic pattern of driveways on the grounds includes the main vehicular entrance on South Street which forks to the west and the north. The west section bends southward to connect to East Conkling Avenue; the north section leads to the porte cochere of the residence, extends west to connect with a drive flanked by a pair of cobblestone piers that leads to the garage and stable complex, and then sweeps south to connect with the first fork. The garage was originally bisected by an internal driveway, which connected with the driveway leading north to Grand View Avenue.

The dominant landscape feature is the spacious west lawn, which is circumscribed by the driveway and includes about 1.7 acres. The grounds are ornamented with many old trees, and college groups have added to the collection with commemorative non-historic plantings. A fence of masonry posts and ironwork with pickets and C scrolls, which

[X] See continuation sheet

measures approximately 6-1/2 feet high and sits on a stone curbing, borders the South Street, East Conkling Avenue, and Wawayanda Avenue property lines. The pedestrian gate on South Street holds a cartouche with a monogram of the initials WH; the vehicular gates have been removed and preserved. Stone retaining walls frame the garage complex and partially screen the service yard from view from the residence.

The Webb Horton House (Morrison Hall) was built in the early twentieth century as a residence for retired industrialist Webb Horton and his family; it was later named for the Morrison family who donated the property to Orange County Community College. The house is a vast marble pile, measuring approximately 118 feet long and 80 feet wide. The steel flooring system is tied into the load-bearing exterior walls. The walls rise two full stories above a high basement. Three-story towers on the front and rear facades, richly ornamented dormers faced with marble, tall, paneled chimneys, and steep, hipped roofs provide additional height and create a massive and picturesque profile.

The front (southeast) facade overlooks South Street. The walls of the basement and the two-story facade are constructed of blocks of rock-faced marble. The south end of the facade terminates in a two-story tower with three bays, or openings, which form a porch on the first story. Each opening has a broad, smooth-faced, stone lintel above a pair of stone, Corinthian columns and a stone balustrade. Above, each bay holds a pair of windows separated by a Corinthian pier. The bays are divided by rock-faced stonework. The windows here and throughout the house have single-light, double-hung sash. This tower is capped with a conical roof sheathed with green, interlocking ceramic tiles and pierced with three dormers, each holding one window. A pair of pilasters frame the dormer windows; the dormer roofs are also of tile. The gables of these dormers, like others of the house, are elaborately decorated with marble carved into a shell motif and terminated with a marble finial.

The remainder of the southeast facade can be divided into three sections. The section next to the tower described above has two broad bays. On the first story, both bays open onto the porch. The southernmost bay has the same architectural treatment as the tower porch, while the other bay serves as the entrance to the house. The lintel over the entrance is carved with a cartouche with a monogram of WH and with ribbons, fruit, and oak leaves. The wall of the house recessed behind the porch is constructed of rock-faced marble and pierced with two windows in the tower portion and a wide entrance doorway, which is flanked by marble panels carved with vases, foliage, and bellflowers. The windows have a Corinthian column at each side and egg-and-dart molding on the lintels. The floor of the porch is paved with pale gray mosaic with a darker gray border. The porch is lighted by electrical fixtures of bronze and opaque glass. The south bay of this section of the second story holds three windows separated by piers with Corinthian columns; the north bay has a shallow arched opening, which has been

filled with four-light windows; the lower portion is of elaborately carved marble. This section of the house is surmounted by a hipped roof with interlocking ceramic tile. The roof holds two dormers with ornament similar to the tower dormers but larger in size, each with a pair of windows. Below is a molded stone cornice and frieze which also extends around the tower, carved with foliage and flowers. Basement windows in this and other sections of the house are protected by grilles of cast and wrought iron.

The second section of the southeast facade is a broad, three-story bay, which is divided into three equally sized bays. The first and second stories have a single window in each bay; the lintels of those on the first floor are surmounted by cartouches and other carved ornamentation. Between the second and third stories is a wide frieze carved with torches, cornucopia, shells, flowers, and foliage. The three bays of the third story are open, forming a balcony; the architectural treatment of the openings follows that of the first story porch. Above is a frieze like that of the tower, a molded stone cornice, three dormers, and a hipped roof which terminates in a conical roof over the bay. At the intersection of the conical and hipped roofs there is a tall, paneled chimney.

The third section of the southeast facade is two bays wide. It echoes the architectural treatment of the entrance section of this facade. Each of the openings is filled with three windows, a change made circa 1956, to provide more space for the college. Originally, these bays opened onto porches at both levels. The two dormers are similar to those over the entrance and the roof is hipped. The original exterior walls behind the recessed porch have a bay window and doorway on the first story and two windows and a doorway on the second story.

The southeast facade terminates in a terrace with a stone balustrade like that of the porches. The terrace extends about halfway along the northeast facade and has a stairway leading down to the grounds. The exterior walls above the terrace are divided into three bays. The easternmost bay houses the former porch. It has the same architectural treatment as the porches on the southeast facade and has been similarly enclosed with glass. The other two bays have one window at each story similar to those on the curved bay on the southeast facade. Above, two dormers flank a chimney. The remainder of the northeast facade of the house projects out to the north edge of the terrace. It is two stories high and is divided into three bays with fenestration similar to that of the rest of the house. The east wall of this projection forms the west wall of the terrace. Above the wall is an intersecting, hipped roof with a single dormer facing north. The northeast facade terminates in a one-story stone porch, now enclosed, that originally opened into the service areas of the house. The porch has a balustrade around its flat roof. The openings of this small porch resemble those of the porches on the southeast facade.

The northwest (rear) facade of the house is dominated by a complex roofline made up of four towering chimneys and dormers in the hipped roofs on the main parts of the house and in the conical roof. Near the center of this facade is a curved bay similar to the one on the southeast facade. This bay rises four-and-one-half stories. It is three bays wide and has fenestration and a balcony similar to those of its counterpart on the southeast facade. The placement of windows in the section of the northwest facade north of this bay is less regular than on other facades. The square-headed entrance at the first story immediately north of the tower has transoms filled with iron grilles; marble steps lead through the lefthand doorway to a side hall, while the righthand entry provides access to the basement.

The south portion of the northwest facade is dominated by a porte cochere, rectangular in plan and constructed of marble. Its openings are treated similarly to those of the porches. At the top of the stairs there is an iron and glass vestibule that is curvilinear in plan and richly ornamented with cartouches, scrolls, foliage, and circles. On the second story above the entrance there is a large rectangular opening filled with a pictorial, stained-glass window traditionally attributed to the Tiffany studio. South of the entrance a terrace extends to the southwest corner of the building, where it meets the porch of the southwest facade. The remaining portion of the northwest facade is formed by a three-and-one-half story, curved bay with three bays. The carving of the stonework and the window treatments of this facade are as elaborate on the northwest facade as they are on the rest of the building.

A one-story porch extends along the full width of the southwest facade. It connects with the terrace of the northwest facade and the porch of the tower at the southeast corner of the building. The openings match those of the southeast facade. The porch is surmounted by a stone balustrade. Projecting from the hipped roof are two chimneys, each flanked by a pair of dormers. The five windows at the second story are spaced irregularly.

The dominating feature of the plan of each interior story of the Webb Horton House is the hall located in the center of the house (figure 1, 2). On the first story, the front entrance opens into the hall through a wood-paneled vestibule. At the southwest corner of the hall a short flight of stairs leads down to the porte-cochere and a broad stairway of mahogany leads up to the second floor. A stained glass window lights the landing and the hall. The major rooms of the house open off the hall on the first story. On the south are the music room and the reception room, or salon, which is circular in plan and connected to the music room by pocket doors. The library opens from the east side of the hall and extends into the curved bay. A large fireplace, ornamented with onyx and carved wood, forms a large portion of the north wall of the hall. A small anteroom to the right of the fireplace leads

from the northeast corner of the hall into the dining room, which fills the northeast corner of the building. The northwest corner of the first story housed a large kitchen, servant's dining room, and butler's pantry. This area of the house is connected to the back hall by a service hall, which contains a service stairway to all floors and a dumbwaiter. The back hall contains an elevator.

The floor levels of the rooms of the curved bay projecting from the west wall of the house are midway between those of the rest of the house. At each level there is one room in the bay with an adjacent bathroom or half bath.

The main stairway terminates with a curved baluster in the second story central hall. Another flight of stairs on the west wall provides access to the room in the west bay and to the hall on the third story. A large fireplace is located on the north wall of the hall, over the first floor fireplace.

The second floor contained bedrooms for the family and for guests. The room in the west bay was alternately referred to as the bedroom and den of Eugene Horton, son of Webb Horton. His sister, Carrie, occupied the bedroom in the opposite bay on the east side of the house. This bedroom had a private bath. The parents suite occupied the south end of the second story. At the west end were Webb Horton's bedroom and bathroom. At the east end were Elizabeth Horton's bathroom and bedroom, which was connected on its east side to what was probably a small sitting room. The adjoining circular tower room contained the solarium. The north end of the house contained the front and rear guest chambers and two adjoining bathrooms. Closets, the dumbwaiter, elevator, and a small room used for sewing open off the back hall.

The center hall is of similar size and proportions on the third story. According to family tradition, the center hall on the third story was used as a ballroom. The short run of steps on the west wall leads to a balcony, now enclosed but earlier used by musical groups. Opposite, on the east side of the hall, is a large room, which opens onto the balcony of the bay and which was a billiard room. Immediately south is a small room, probably used as a bedroom. Opening off the south side of the hall is a room used as a cedar closet and what was called on architectural drawings the family bath (although the family bedrooms had private baths). Among the fixtures in this bathroom are a tub, needle shower, and sitz bath, all shown on the architect's drawings of 1905. At the southeast corner of the third story is a small room believed to have been used as a sitting room. It leads into a small circular space, fitting under the conical roof, referred to as a trophy room. It is fitted with glass-fronted cases and lighted by very narrow dormer windows. The domed ceiling is ornamented with ribs and with Moorish-inspired designs in relief. At the southwest corner is a small study, once used by Carri

Horton. Opening off the service stair-hall are four bedrooms and a bathroom, probably used by servants, and storage areas.

To the right of the fireplace in the third-story hall are double doors which open onto the stairway to the fourth floor. At this level rooms are again organized around a center hall, smaller in size. There is a room lighted by dormer windows and fitted with closets in each of the west and east bays. These were probably servant's bedrooms. Rooms on the south side of this floor were probably used for storage. A narrow flight of stairs leads from the hall up to the roof.

The basement was used for service and storage functions. Basement rooms were designated as the front cellar, rear cellar, wine cellar, coal cellar, and laundry, when the house was originally built.

The interior finishes throughout the house were of high quality and have been very well preserved. Woods of various species were used throughout the house. The walls and staircase of the center hall on the first and second floor are paneled with Circassian walnut. The dining room has mahogany paneling with tooled leather above. The second floor sitting room as well as the adjoining bedroom have mahogany woodwork. Stained oak was used for the woodwork in the library and in Eugene Horton's den. In the service and servant's quarters the woodwork is of oak. Maple was used in the front guest room, and sycamore and poplar on the fourth floor. The dining room ceiling has wooden beams. Ceilings in the other major room are of plaster, typically with panels or cornices in high relief. Murals decorate the center of the ceilings of the music and reception rooms. The walls in the music room, reception room, and the second floor sitting room are notable for the high relief of the elaborate decorations, which incorporate many rococo motifs. Ceramic tile was used on the floors and walls of the service areas of the first story and basement. More ornamental ceramic tile was used in bathrooms. Floors in many public rooms are wood parquet. Floors of both the east and west vestibules are paved with colored mosaics. Throughout the house are numerous old lighting fixtures, many of which were fitted to provide illumination by both gas and electricity. Radiators were typically built in. A tunnel connects the basement of the residence with the garage.

The Webb Horton House (Morrison Hall) has been very little altered during the thirty-six years that it has served as the centerpiece of the Orange County Community College campus. The vestibule doors have been replaced but the originals may be preserved in the attic. Porches have been enclosed with windows matching others in the house in order to provide more office space, and the musicians' balcony enclosed to form an office. Partitions have been altered in the kitchen. A new furnace has been installed.

Northwest of the residence is a service complex enclosed by cobblestone walls. The largest building, which is L-shaped in plan, is

located at the north end of the complex. Originally, the first story of the main part of this building housed a carriage room, garage with turntable, auto wash bay, and office. The second story had a staff apartment with living room, dining room, pantry, kitchen, bathroom, and two bedrooms. The ell served as a stable with five stalls and a hay loft above. The layout of the second story has been retained. The first floor has been converted to offices and classrooms. Some portions have the original wall finishes of white porcelain and green enamel brick. On the north facade there is a one-story wing that does not appear on the original architectural drawings.

The exterior walls of the garage and stable building are constructed of very large pieces of irregularly cut masonry, which appears to be either a lava stone or an aggregate, artificial stone. Although the interior functions have been changed, the original doors and fenestration of this building have been preserved. Wooden, double doors near the center of the south side of the main facade originally provided a drive through the building to Grand View Avenue. Most windows have double-hung sash, with four to nine lights. Some larger, first-story windows have a single light in the lower sash. The hipped roof is covered with dark green, flat ceramic tiles. The second story of the building is lighted by picturesquely placed dormers of various sizes and with hipped roofs. Reflecting the dual functions of the building, a ventilator on the roof of the stable had a weathervane with a colt, while a slightly larger ventilator over the garage had a weathervane with a forty-inch long model of a Stutz-Bearcat. The weathervanes were removed in 1973 for safekeeping.

At the south end of the stable wing is an open space earlier used as a corral for the horses. Further south is a one-story building, rectangular in plan and similar in construction to the garage. It was used by the Morrisons as a tool house. At an earlier date it served as an ice house. It now houses electrical transformers.

South of the east end of the garage are two glass greenhouses with masonry foundations. The northernmost greenhouse has a small masonry structure at its west end. Between the greenhouses and southwest of them are the masonry foundations of cold frames. At the south end of the yard are stacked stones from the walls of the sunken garden, removed when the Learning Resource Center was built.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties: [ ] nationally [ ] statewide [X] locally

Applicable National Register Criteria [ ] A [ ] B [X] C [ ] D

Criteria Considerations [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F [ ] G

Areas of significance	Period of Significance	Significant Dates
ARCHITECTURE	1901-1908	1901

Cultural Affiliation: NA

Significant Person: NA

Architect/Builder: Frank Lindsey

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

The Webb Horton House (Morrison Hall) is architecturally significant as an exceptional turn-of-the-century mansion that combines an extravagant use of materials with outstanding craftsmanship. Located in Middletown, Orange County, and designed by local architect Frank Lindsey, the eclectic house is a vast stone pile, constructed of marble, that is imposing in size and scale. The heavy, roughly textured surfaces of the exterior masonry are indicative of the lasting popularity of the Richardsonian tradition, while the verandahs, balconies, and complex silhouette of the building recall the influence of the Queen Anne style. The exterior door and window openings are framed with piers and cartouches of Beaux-Arts derivation. The interior of the mansion is highlighted by a central large living hall with a large staircase and fireplace. The finely crafted finishes include polished wood paneling and elaborate plasterwork. Surrounding the hall are an impressive array of rooms for entertaining and family leisure. The layout recalls the popular late nineteenth century tradition of country seats that were erected for the growing class of wealthy industrialists, merchants and financiers who were building on the outskirts of America's principal cities. Built for Webb Horton, a retired industrialist, the mansion was once part of a large suburban estate. Although much of the original setting of the estate has been lost, an architecturally distinguished garage/stable complex remains to enhance the significance of the property as an artistic country seat. The Webb Horton House retains an extremely high degree of physical integrity, and is one of the most substantial residential buildings in the region. The mansion and estate grounds were donated for use as the campus of the Orange County Community College in 1950.

Webb Horton was seventy-six years old when the cornerstone of his new residence was laid in 1902. Horton was born in Delaware County and attended the district school. His father was a farmer, but his family had been successful tanners since the Eighteenth century. Horton's early years were spent teaching school, tending store, and working as a wood turner. In 1854 he established, with his brother, a tannery at Narrowsburg, New York. Ten years later he sold his interest in that business and established another tannery, this time in partnership with a nephew, in Warren County, Pennsylvania, a region rich with hemlock forests. A newly opened railroad provided the means to receive hides and then ship them to distant markets. After a difficult start this operation,

[X] See continuation sheet

known initially as the Sheffield tannery, became what has been called "perhaps, the largest and most remunerative business of its kind in the world."[1] In 1893 Horton and his partners sold their interests in the company to the United States Leather Company, and Horton retired.[2] Horton's son, Eugene, worked at the New York Office of the United States Leather Company until his death in 1918.

In 1855, Horton married Elizabeth Radeker, who had been born in Montgomery, Orange County, in 1833. Their early married life was spent in the sparsely settled areas of northern Pennsylvania where the tanneries were located. In 1868, the Hortons moved to Middletown so that their three children could be educated. The population of Middletown was expanding greatly during the second half of the nineteenth century. In 1857, when Webb Horton was starting out in the tanning business in Pennsylvania, it stood at 2,190. By 1888, the population was 11,977. In 1907, as the Horton house was completed, there were 16,000 residents.[3]

When the Hortons first moved to Middletown they resided at 141 South Street in a house on a parcel of land that eventually was incorporated into their new estate. In 1883, Webb Horton began acquiring other nearby lots. During that year, he purchased 8.27 acres of land to the west along what was then the Middletown and Unionville Plank Road (later called Canal Street and now Wawayanda Avenue). In 1893, the year when he retired, Horton acquired another lot at the corner of Conkling Avenue and Canal Street. In 1901, the heirs of his neighbor to the south sold to Horton a lot along South Street. In 1901 and 1902, Horton's son began acquiring other nearby lots.[4]

Construction of the Horton house began in 1901.[5] The cornerstone, which is located at the northeast corner of the building, is dated 1902. The plumbing plans for the house, prepared by architect Frank Lindsey and dated August 16, 1905, suggest that construction work was proceeding slowly. Horton resided in the completed house for only a short time before his death in September, 1908. A few months earlier, one writer remarked that he "is now living retired in the enjoyment of a peaceful old age in one of the finest residences in the state, overlooking Middletown, which he recently built."[6]

Meanwhile, in 1907 and 1908, Eugene Horton had been acquiring more lots at the north end of the estate to serve as the site of a new service complex. In June, 1908, David Hastings Canfield, a young architect who had recently established a practice in Middletown, prepared plans for a stable and garage complex and for a machine shop. This complex was erected largely as designed. Also on the grounds at this time were a conservatory, a hot house, and a frame house facing East Conkling Avenue.[7] In 1911, Elizabeth and Eugene Horton acquired the lot at the northwest corner of East Conkling Avenue and South Street, on which had been the residence of Israel Cole.[8] By 1921, that house had been torn down and a sunken garden constructed on the lot.[9]

After Webb Horton's death, his family continued to live in the house, although Eugene Horton spent much time at his office in New York. His sister, Carrie, died two years later, and his mother died in 1917. In the decade after his father's death, Eugene Horton arranged for the construction of two important Middletown institutions: the Webb Horton Memorial Presbyterian Church and the Horton Hospital, a memorial to his mother. Eugene Horton, who like his sister never married, succumbed to pneumonia in 1918. He was an early victim of an epidemic of Spanish influenza that swept the country.

According to local accounts, Webb Horton had commissioned Franklin (Frank) J. Lindsey, the Middletown architect, to design the family's new residence. Lindsey was born in 1854 in Liberty, New York. [10] Like many architects of the late nineteenth century, Lindsey "had had no formal instruction in architecture." He learned from his father, who was described as "a fine master carpenter," and "from the sound training he received when he was associated with Giles and Giles," well-respected Middletown contractors. [11]

By 1886, Lindsey had joined with his brother, Arthur R. Lindsey, in a company called Lindsey Brothers. They advertised as "Manufacturers, Contractors, Builders, And Artistic Wood Workers." The firm did "Scroll Sawing and Turning in All Their Branches" and listed their specialties as "Fine Residence, Interior Finish, Store Fronts, Stair Cases, Fancy Gable Finish, Piazzas, Etc., Etc." In addition, the brothers furnished "Plans and Specifications" and provided estimates. [12] The mortgage on the Lindsey Brothers' property was foreclosed in 1893, and Frank Lindsey carried on as Lindsey and Company, contractors and builders. This firm was dissolved in 1899. A fire insurance map of 1897 shows Lindsey and Co. located at 22 Union Street in Middletown. Their two-story plant housed woodworking machinery and space for lumber storage. By 1904 the plant had expanded and was being operated by the Crane-Giles Company. In 1910 it was in the hands of "Giles-Giles & Co., Carpenters, Builders, & General Wood Workers." [13] The Giles firm was the contractor for the Horton house. Christine Morrison, who later donated the house to Orange County Community College, worked for the firm as a bookkeeper before her marriage.

Even before the dissolution of Lindsey and Company, Frank Lindsey had been listing himself as an architect. In 1897, for example, he took out a full-page advertisement in the Middletown city directory, describing himself as an architect with an office at 16 Union Street and illustrating his design for a "Proposed New Hotel to be erected on the site of the Russell House." During the years when he was at work on the Horton house, Lindsey continued to list himself as an architect, sometimes citing "Artistic Cottages a Speciality." By 1905, his son, Harry, had joined the firm. They advertised as architects, supplying "Plans, Specifications, and Personal Superintending."[14]

Lindsey was the architect of the Middletown armory and of many residences in the city. He is remembered now mostly for his work on grand houses on Highland Avenue that were built for the city's most affluent families. He was considered "highly dedicated" and "totally absorbed in each project." One admirer wrote that "while he was working on the Horton Mansion [the present Morrison Hall] he was meticulous about the quality of the materials. He had contracted for green tiling for the roof but rejected carload after carload, because it did not exactly match the shade he had selected." [15] Lindsey was last listed in the city directories in 1918. He lived in California intermittently during the 1910s and 1920s, but returned to Middletown in 1929. He died in Middletown at the home of his daughter during the following year. [16]

The Horton house is an important regional example in the architectural history of country seats erected in the late nineteenth century for the growing class of industrialists, merchants, and financiers who were building in the outskirts and suburbs of eastern and midwestern American cities and towns. Frank Lindsey's eclectic plan and interior finishes incorporate many features associated with the Queen Anne style in America, particularly a large living hall with a large staircase and fireplace, around which other spacious rooms were placed asymetrically. The wall and ceiling finishes include richly polished wood paneling and elaborate plasterwork. Like the more metropolitan houses featured in Artistic Country-Seats, an influential book attributed to George William Sheldon and published in 1886-1887, the Horton house featured an impressive array of rooms for entertaining and family leisure -- reception room, music room, library, dining room, and billiard room, as well as spacious grounds ornamented with gardens and greenhouses. [17] On the exterior, heavy, roughly textured masonry reflects the sustained popularity of the Richardsonian Romanesque tradition, while the elaborate silhouette of the tile roof, the verandahs, and balconies, recall the Queen Anne style. The exterior window and door openings are framed with Beaux-Arts inspired piers and cartouches. Other Middletown houses of this period were generously proportioned, but the Horton house was exceptional for its size and solid construction. It was, and is, one of the best built residences in the region.

Eugene Horton bequeathed the family estate on South Street to his cousin, John H. Morrison. Morrison, his wife, Christine, and their four children moved into the house in 1918. [18] The Morrisons made few changes to the property. When approached by the organizers of the new community college, Mrs. Morrison was the only member of the family still living in the house. She remained in the house through the end of 1950 and then moved into the modest frame house which she and her family had occupied before 1918 and which was moved from 32 Mills Avenue to a lot at the corner of Mills and Bennett streets, just east of the stone house. She lived there quietly until 1977, when she died at the age of 97. Mrs. Morrison continued the tradition of the Horton family's philanthropy in Middletown. She was a generous benefactor to the college and to many

churches and social service agencies in Middletown. Christine Morrison's death prompted a renewed call for a United Fund or Community Chest in order to generate broader-based charitable giving in Middletown. [19]

The creation of Orange County Community College was a community-based effort. A survey made in the late 1940s revealed that Orange County had fewer students enrolled in college than any other New York county. The secretary of the Chamber of Commerce, Fred Germain, organized a Committee on Higher Education and held meetings throughout the county. The Committee convinced Mrs. Morrison to donate her property, although her contribution required additional community cooperation. Under the terms of her husband's will she was granted life tenancy and upon her death the property was to pass to the Horton Memorial Hospital. So that the college could acquire the property, a committee raised $480,000 to eliminate the hospital's debt, and the hospital then relinquished its interest in the mansion. In June, 1950, the County Board of Supervisors, after some initial hesitation, agreed to sponsor the college and became the first county to sponsor a community college in the State University of New York system. The first classes were held in the garage and stable complex in September, 1950. The founding of the college was part of the mushrooming growth of two-year colleges after World War II. In the 1950s, two popular national magazines, Reader's Digest and Life, publicized the founding of Orange County Community College as a model. [20] Since the establishment of the college, more than 100,000 people have studied on the campus.

Today, the architectural integrity of Morrison Hall is particularly notable. The Morrison family made few changes to the property during their residence. Even more remarkable are the very few alterations made by the college. Morrison Hall has served the college for more than 35 years, but it has been spared the fate of institutional-style remodeling.

FOOTNOTES:

1. Orange County Times Press, September 18, 1908.

2. Walter C. Casler, Tionesta Valley (N.P.: N. Pub., 1973), pp. 804-807. Identified as No. 8 in the series entitled Logging Railroad Era of Lumbering In Pennsylvania. Orange County Times Press, March 27, 1917.

3. Russel Headley, ed. The History of Orange County, New York (Middletown; Van Deusen and Elms, 1908), p. 416.

4. Orange County Clerk's Office (Goshen), Deeds, Liber 323, p. 363; Liber 404, p. 353; Liber 450, p. 391, Liber 452, p. 500; Liber 456, p. 127; Liber 457, p. 227.

5. Orange County Press, Oct. 15, 1901. Architectural drawings for the estate are housed in the office of the physical plant manager at the college.

6. Headley, p. 863.

7. J. M. Lathrop, Atlas of Orange Co., N. Y. (Philadelphia: A. H. Mueller & Co., 1903), plates 29 and 30.

8. Orange County Clerk's Office, Deeds, Liber 523, p. 75.

9. Maps of Middletown, N. Y. (New York: Sanborn Map Co, 1921).

10. Middletown Times Herald, Nov. 3, 1930.

11. Quoted in Times Herald Record, July 30, 1981. This biography of Lindsey, written by Beatrice G. Rosenblum, contains much valuable information on Lindsey's career. Peter Laskaris of Middletown kindly shared other biographical sources on Lindsey.

12. Middleton City Directory, 1886-87.

13. Insurance Maps of Middletown, Orange Co., N. Y. (New York: Sanborn Perris Map Co., 1897). Insurance Maps of Middletown, Orange Co., N. Y. (New York: Sanborn Map Co., 1904 and 1910).

14. Middletown City Directories, 1897, 1901, 1905.

15. Quoted in Times Herald Record, July 30, 1981.

16. Middletown Times Herald, Nov. 5, 1930.

17. Arnold Lewis, American Country Houses of the Gilded Age (Sheldon's Artistic Country-Seats) (New York: Dover Publications, 1982). See also, John Zukowsky and Robbe Pierce Stimson, Hudson River Villas (New York: Rizzoli International Publications, 1985).

18. Letter from Ray Morrison to Clifford [_____], March 21, 1968. Collection of Middletown Historical Society.

19. Middletown Times Herald, July 18 and 24, 1977. Sunday Record, July 24, 1977.

20. "A County Opens a College," Life (octo. 16, 1950), pp. 75-79. Reprint of "With a Barnful of Students and a Countyful of Faith," Reader's Digest (Feb., 1959).

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Headley, Russel. The History of Orange County, New York. Middletown: Van Deusen and Elms, 1908.

Lathrop, J. M. Atlas of Orange County, New York. Philadelphia: A. H. Mueller & Co., 1903.

[X] See continuation sheet

Previous documentation on file (NPS):
- [ ] preliminary determination of individual listing (36 CFR 67) has been requested
- [ ] previously listed in the National Register
- [ ] previously determined eligible by the National Register
- [ ] designated a National Historic Landmark
- [ ] recorded by Historic American Buildings Survey #_____
- [ ] recorded by Historic American Engineering Record #_____

Primary location of additional data:
- [X] State historic preservation office
- [ ] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [ ] Other

Specify repository: _____

10. Geographical Data

Acreage of property 5 acres

UTM References

	Zone	Easting	Northing
A	18	587490	4587030
B			
C			
D			

[ ] See continuation sheet

Verbal Boundary Description

The Webb Horton House is located on an elevated, five-acre plot facing South Street between East Conkling and Grand View Avenue. The nominated boundary begins on South Street, follows the curvilinear road system behind the house, includes the garage/stable complex, and returns to South Street between the mansion and Hudson Hall. See map 2.

[ ] See continuation sheet

Boundary Justification

The nominated boundaries have been drawn to include all of the remaining vestiges of the Webb Horton estate, while excluding the modern intrusions on the property.

[ ] See continuation sheet

11. Form Prepared By

name/title Robert D. Kuhn, Historic Preservation Program Assistant
organization Office of Parks, Rec., & Historic Preservation date March 13, 1990
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MAJOR BIBLIOGRAPHIC REFERENCES (cont'd):

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Maps of Middletown, New York. New York: Sanborn Map Co., 1921.

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Middletown Times Herald. 3 November 1930.

Middletown Times Herald. 5 November 1930.

Middletown Times Herald. 18 July 1977.

Middletown Times Herald. 24 July 1977.

Orange County Times Press. 18 September 1908.

Orange County Times Press. 27 March 1917.

Sunday Record. 24 July 1977.

Times Herald Record. 30 July 1981.

Zukowsky, John, and R. P. Stimson. Hudson River Villas. New York: Rizzoli International Publications, 1985.

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APPENDIX I ARCHAEOLOGICAL RESOURCES

Phaselltr.doc

TRC

Customer-Focused Solutions

July 10, 2001

Ms. Cynthia Blakemore, Archaeologist
New York State Office of Parks, Recreation, and Historic Preservation
Peebles Island, PO Box 189
Waterford, NY 12188-0189

Subject: Wawayanda Energy Project, Project Review no. 00PR2461

Dear Ms. Blakemore:

Enclosed please find a copy of the report "Phase I Archaeological Survey of the Proposed Wawayanda Energy Center Project, Town of Wawayanda, Orange County, New York".

This report presents the results of the Phase IA & B archaeological survey effort for the referenced project site. As documented in the report, TRC found no cultural material suggesting that the project area contains archaeological sites eligible for inclusion in the National or State Registers of Historic Places. Accordingly, no further archaeological research is recommended. Architectural and historical surveys are ongoing, and when complete, the results of those efforts will be provided to the OPRHP as well.

At this time we request that you review the report and its conclusions and provide written confirmation that no further archaeological investigations are required.

Thank you very much for your attention to this matter, and please do not hesitate to call me if you have any questions. I can be reached at (978) 656 3663, or you may contact Richard Holmes of TRC at (505) 761-0099.

Sincerely yours,

Stephan Solzhenitsyn
Senior Project Manager

cc Ms. Ruth Pierpont, Director, OPRHP Field Services Bureau (without enclosure)
Mr. Robert Kuhn, Assistant Director, OPRHP Field Services Bureau (without enclosure)
Mr. Donald Neal, Calpine (without enclosure)
Mr. Richard Holmes, TRC (without enclosure)

Boott Mills South, Foot of John Street • Lowell, Massachusetts 01852
Telephone 978-970-5600 • Fax 978-453-1995

Phase I Archaeological Survey of the Proposed Wawayanda Energy Center, Town of Wawayanda, Orange County, New York

Siting Board Case 00-F-1256

OPRHP Review no. 00PR2461

Phase I Archaeological Survey of the Proposed Wawayanda Energy Center Project, Town of Wawayanda, Orange County, New York

Prepared by

Richard D. Holmes
Timothy Marshall
Nathan Morphew
Toni R. Goar
Gwyneth Duncan
Deann Muller

Presented by

TRC
Boot Mills South
Foot of John Street
Lowell, Massachusetts 01852

Presented to

Wawayanda Energy Center, LLC (a subsidiary of Calpine Corporation)

Principal Investigators

Richard D. Holmes, Ph.D., R.P.A.
Nathan Morphew, M.A.

OPRHP Project Review Number 00PR2461

TRC Project Number 29156-0040

June 2001

Abstract

TRC conducted a Phase I archaeological survey for the proposed Wawayanda Energy Center project in Wawayanda, Orange County, New York. TRC of Lowell, Massachusetts conducted this survey for the Wawayanda Energy Center, LLC, a subsidiary of Calpine Corporation. The project area consists of a Northern Portion, a Southern Portion, and a Water Line Route; these portions were subdivided into survey units.

The first session of fieldwork was conducted from October 16–20, 2000, on a parcel of approximately 25 acres in the Northern Portion of the project area. During the first session, 467 shovel test pits were excavated at 15 m (50 foot) intervals, except for delineated wetlands, areas covered by water during fieldwork, on steep slopes, or in areas of evident ground disturbance (e.g., deep tractor scars, animal burrows, or push piles).

Subsequent to the first session of fieldwork, additional land was added to the Northern Portion, the Southern Portion was included in the project, and a Water Line Route was defined. Fieldwork in these additional areas was conducted from June 11–17, 2001. An additional 96 shovel test pits were excavated in the Northern Portion, 135 shovel test pits in the Southern Portion, and 25 shovel test pits along the Water Line Route. Part of the Southern Portion could not be subjected to subsurface investigation since it was planted with corn; this area will not be disturbed, according to project plans, and will have electric transmission wires span the area between transmission towers. An area that is densely wooded was examined with four shovel test probes.

The intervals between shovel test pits were somewhat closer than 15 m (50 feet) in areas with the highest archaeological potential (i.e., on a ridge top with an eastern exposure). Soils uniformly exhibited a plow zone (typically 10YR 4/1 dark gray) that was generally silty soil with a high organic content over a B horizon (typically 10YR 6/2 light brownish-gray silt loam or a 10YR 5/8 yellowish brown silt loam). In flat areas, on the bottom of slopes, and near wetlands, soils exhibited illuviation and mottling.

One chert flake was found in a shovel test pit behind the house in the Northern Portion; four other units were excavated at a 1 m interval around it, but these pits contained no artifacts or features. No subsurface features were found in any shovel test pit. A single piece of ironstone ceramic had been found on the surface during the pedestrian inspection, and several historic ceramics from the nineteenth and twentieth centuries were recovered from shovel test pits.

An earthen ramp with unmortared boulders on the sides leads from the project area to the old railroad grade, providing access to the tracks or to the land beyond; the railroad grade has been impacted by construction of an outfall pipe. Stone fences line parts of the property boundary. An 1875 map indicates that this was open land, and was apparently a pasture or a meadow. No archaeological or historical data suggest that the property is eligible for the National or State Registers of Historic Places. No additional archaeological research is recommended. The standing farmhouse and barns should be evaluated for architectural significance.

Management Summary

This report documents a Phase I archaeological survey conducted by TRC for Wawayanda Energy Center, LLC, a subsidiary of Calpine Corporation. The New York State Office of Parks, Recreation and Historic Preservation assigned Project Review Number 00PR2461 to this project.

The Public Service Law of New York requires the Siting Board to issue a Certificate for a proposed project only if it finds that the project "minimizes adverse environmental impacts, considering...the interest of the state with respect to...preservation of historic sites" [PSL § 1678.2(c)(i)]. Furthermore, the Siting Board regulations explicitly require applicants to list local cultural resources, specifically the "identified historic, community, and archaeological resources listed, or eligible to be listed, in the National or State Registers of Historic Places" [16 NYCRR 1001.3(b)1(iv)].

Consultation was undertaken with the New York State Office of Parks, Recreation and Historic Preservation, whose commissioner acts as the State Historic Preservation Officer under the National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.). In a letter dated July 7, 2000, the New York State Office of Parks, Recreation and Historic Preservation requested a complete Phase I archaeological survey.

TRC requested Kim Croshier of Hartgen Archaeological Associates, Inc., to conduct a site files search in the records of the New York State Office of Parks, Recreation and Historic Preservation's Field Services Bureau at Peebles Island State Park. This information is incorporated into the present report. Nathan Morphew, staff archaeologist of TRC, performed a pedestrian inspection on July 26, 2000. The results of the pedestrian inspection are as follows:

> *There are no recorded archaeological sites within the proposed project area. Several archaeological sites, however, are nearby. Most of the recorded sites were discovered as the result of surface collections made after fields had been plowed. The majority of sites are surface scatters of artifacts.*
>
> *Four properties within 5 miles of the project area are listed on the National Register of Historic Places. These are the Hillside Cemetery (ca. 1861), the Oliver Avenue Bridge (1895), the Webb Horton House (ca. 1902), and the First (or Primitive) Baptist Church of Bloomfield (1792). At the 5-mile boundary is the Dutchess Quarry Cave site. Other properties have been listed on the State Register of Historic Places or determined eligible for the National Register of Historic Places; these are discussed in the present report.*
>
> *TRC conducted a pedestrian inspection over all of the project area, except for delineated wetlands. The project area had been planted recently, and surface visibility was about 80 percent. A systematic walkover was performed. One artifact, an ironstone plate fragment was found. No features were observed.*

In a letter dated September 21, 2000, TRC informed the New York State Office of Parks, Recreation and Historic Preservation that it had undertaken a comprehensive site file search on this project and that it would conduct subsurface investigations.

Fieldwork for the survey was performed during the week of October 16–20, 2000. Before subsurface investigations began, the field crew performed a walkover. The surface was covered with vegetation. Currently, the land is a meadow with delineated wetlands, a pond, places that were wet during fieldwork, some steep and moderately steep slopes, and areas of disturbance (e.g., animal burrows, and two-track roads). Areas with the greatest archaeological potential on the basis of topographic features included the

northeastern end of a ridge on the western side of the property, the relatively level southeastern-facing top of the ridge, and a knoll at the northern end of the property. Flat areas, places near the bottom of a slope, and land adjacent to delineated wetlands had accumulated water from rain during and prior to fieldwork.

Shovel test pits (STP) were excavated at 15 m (approximately 50 foot) intervals along transects 15 m (approximately 50 feet) apart across all of the project area, except for delineated wetlands, areas that were covered with water at the time of fieldwork, on steep slopes, or in areas of evident ground disturbance. The STPs were 0.3–0.5 m in diameter and hand excavated in 0.1 m levels. All soil was screened through ¼-inch mesh. Stratigraphic information was recorded, and a typical soil profile was described with a Munsell Color Chart. A typical soil profile revealed a plow zone (typically 10YR 4/1 dark gray) of generally silty soils with high organic content for approximately 0.20+ m over a B horizon (typically 10YR 6/2 light brownish gray) silt loams. Soils were hard packed or stony below 0.35–0.40+ m.

During the first field session, 467 shovel test pits were excavated in the Northern Portion. An additional 96 shovel test pits were excavated in the Northern Portion, 135 shovel test pits in the Southern Portion, and 25 shovel test pits along the Water Line Route during the second field session (June 11-17, 2001). A single chert flake was the only prehistoric artifact found. Historic artifacts (excluding recent trash) included nineteenth and twentieth century ceramics. No subsurface features were found.

An earthen ramp with sides held by unmortared boulders and cobbles is at the northern edge of the property and leads to the old railroad grade. This ramp was used for access to the railroad and the land beyond it. The railroad grade has been impacted by construction of an outfall pipe. No artifacts or features were found on or near the ramp. Stone fences are along portions of the northern and western boundaries of the property.

Richard D. Holmes investigated the historic maps and other materials in the history room of the Thrall Public Library in Middletown, New York. The project area was used as farmland from the late nineteenth century to the present. A map from 1875 indicates that this was a rural area at that time, although the railroad grade already existed adjacent to the project area. Land in the project area was cultivated as recently as this year.

TRC found no cultural material suggesting that the project area contains archaeological sites eligible for inclusion in the National or State Registers of Historic Places. No further archaeological research is recommended. The standing farmhouse and barns should be evaluated for architectural and historical significance.

Table of Contents

List of Figures

1.0 Introduction

This report documents the Phase I archaeological survey of the proposed Wawayanda Energy Center Project in the Town of Wawayanda, Orange County, New York. TRC of Lowell, Massachusetts conducted this survey for Wawayanda Energy Center, LLC, a subsidiary of Calpine Corporation (Calpine). Site file data were acquired by a comprehensive site files search performed by Kim Croshier of Hartgen Archaeological Associates, Inc. The New York State Office of Parks, Recreation and Historic Preservation (OPRHP) assigned Project Review Number 00PR2461 to this project.

1.1 Project Location and Description

The project area is in the Town of Wawayanda, Orange County, New York (Figure 1.1). It is approximately 96 km (60 miles) north-northwest of New York City. Middletown, the nearest city, and Wallkill are to the north. Goshen is to the east, Warwick is to the south, and Greenville and Minisink are to the west.

The project area is depicted on the 1969/1976 Middletown, New York, United States Geological Survey (USGS) 7.5' quadrangle (Figure 1.2). Dolsontown Road bisects the project area; across this road are farms and a few residence. To the west are other residences and an electrical substation. The unused railroad grade of the Erie and Lackawanna Railroad, which has been subsequently used for a right-of-way for the Middletown wastewater treatment plant discharge line, forms the eastern boundary. Subsequent to the first session of fieldwork, additional land was added.

For this report, the project area is divided into a Northern Portion, a Southern Portion, and a Water Line Route (Figure 1.3). These sub-areas are further divided into survey units based on topography. Subdivisions, called survey units, are discussed further below. Elevations range from approximately 400–500 feet above mean sea level.

Historically and currently the land is agricultural. This year, the ground had been plowed and cultivated as a meadow. It appears that this area was primarily used for dairy purposes for many years. Deciduous forest with a dense understory lines the boundary on the west, north, and parts of the east.

1.1.1 The Northern Portion

The Northern Portion consists of a ridge with an eastern and northeastern aspect (designated the Ridge Unit), a slope, relatively flat areas that include delineated wetlands (designated the South Field, North Field, and Flat Units), and a small knoll (the Knoll Unit). Additions to the Northern Portion included the East of House Unit, Backyard Unit, and West Wedge Unit. TRC excavated an additional transect of shovel test pits (STPs) in the Flat Unit, which had been very wet during the first fieldwork session.[1] Figures 1.4 through 1.9 illustrate the Northern Portion. Figure 1.9 illustrates the farmhouse added to this project area.

Wetlands occupy much of the level ground in the eastern half of the property; they include a small stream and a tributary drainage, a pond, and areas with typical wetland vegetation. During the first fieldwork session, much of the soil near the wetlands was saturated and temporarily covered with water. Some of the slope to the east of the Ridge Unit is steep. There is some evidence of ground disturbance by farm equipment, including tractor scars and a two-track road at the northern boundary nearest the electrical substation; a portion of the Ridge Unit was disturbed by the presence of a utility pole carrying a transmission line from the electrical substation. Animal burrows were found in several parts of the Northern Portion. Beyond the trees bordering the Northern Portion's northern boundary is an old railroad bed (Figure 1.10); an earthen ramp leads from the Northern Portion to the railroad bed (Figure 1.11).

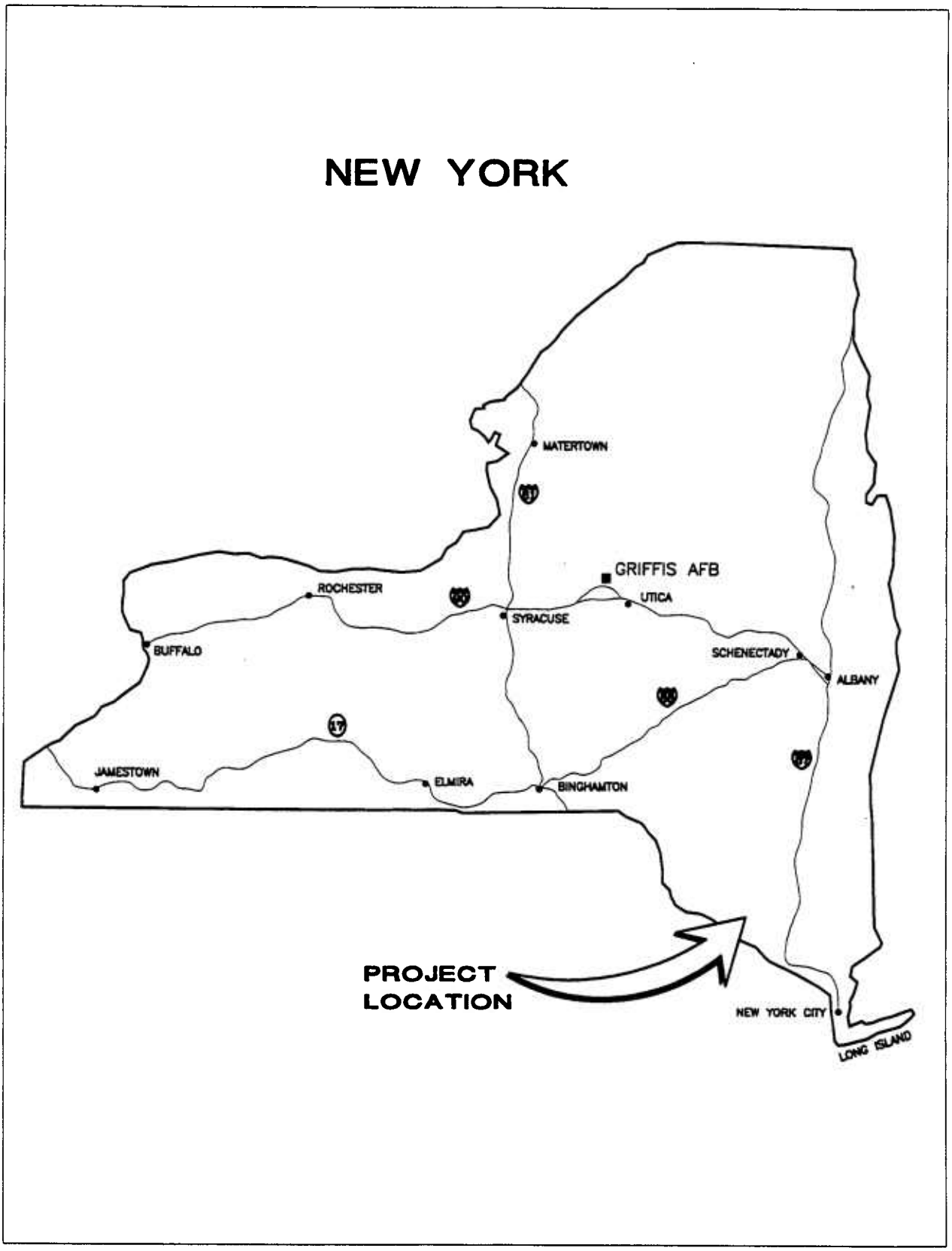

Figure 1.1 Location of Project.

Specific goals of this project were to (1) locate and identify cultural resources within the project area and (2) make recommendations on (a) their potential eligibility for the National and State Registers of Historic Places and (b) the need for further research.

1.4 Legal Authorities

This project has been conducted to provide the Siting Board with information needed to determine that the proposed construction project "minimizes adverse environmental impacts, considering...the interest of the state with respect to...preservation of historic sites" [PSL §168.2(c)(i)]. Furthermore, the Siting Board regulations require applicants for a Certificate to list local cultural resources, specifically the "identified historic, community and archaeological resources listed, or eligible to be listed, in the National or State Registers of Historic Places" [16 NYCRR 1001.3(b)1(iv)]. The OPRHP is or will be reviewing this project pursuant to Section 106 of the National Historic Preservation Act of 1966 and/or Section 14.09 of the New York State Parks, Recreation and Historic Preservation Law.

1.5 Personnel

Richard D. Holmes, Ph.D., R.P.A., and Nathan Morphew, M.A., were co-Principal Investigators (co-PIs) for this project. Both of these TRC employees are qualified as archaeologists under the Secretary of the Interior's Professional Qualifications Standards, as amended and annotated (36 CFR 61). For the first fieldwork session, Toni R. Goar, who has archaeological field experience in the Northeast, directed fieldwork and assisted in report preparation. Gwyneth Duncan also assisted in reporting. Field crew members were Juan Arias, Bruce Boeke, and Michael Okies. For the second fieldwork session, Timothy Marshall, M.A., was the Crew Chief. Field crew members were Juan Arias, Lance Lundquist, Deann Muller, and Michael Okies. Richard D. Holmes was present at both sessions. Jewell Paschke produced graphics. Technical editing was completed by Jodi Chapman and Constance Upton. Jodi Chapman, Karen Laney, and Tracy Suzuki formatted the report. Pamela Chan and Stephan Solzhenitsyn of TRC's Lowell office managed the project.

1.6 Structure of the Report

This report presents information on the environmental background, a brief culture history of the region, a summary of previous research and recorded sites, methods employed, research results, recommendations and conclusions, and references cited. Appendix A presents field data by excavation unit.

2.0 Environmental Background

The project area is located in a rural region experiencing construction and growth. Farms and rural residences are in the immediate vicinity, as are some businesses. Areas of wetlands and deciduous forest remain between open fields and meadows. An electrical substation is to the west and high-voltage power lines are north, east and south of the site. Further west, Dolsontown Road meets State Highway 17M; the area at this intersection is a local commercial center.

2.1 Physiography and Hydrology

There are three physiographic provinces in Orange County: the Hudson Lowland Section, the New England (Upland) Province, and in the western part of the county is a small portion of the Glaciated Allegheny Plateau. The relative proximity of the project area to all three physiographic provinces probably made this area attractive for prehistoric use and settlement.

The Town of Wawayanda is in the western portion of Orange County. The region is characterized by rolling terrain. To the southeast, there is a range of hills nearly parallel to the Wallkill River, as well as highlands in the northwest. Wawayanda is drained by the Wallkill River to the east and southeast and by Rutger's Creek to the south and southwest. Delineated wetlands, including a small pond at the eastern end, are located on the project area. Monhagen Brook, which flows into the Wallkill River, is to the south of the project area.

2.2 Geology and Soils

Bedrock is more than 30 m (approximately 100 feet) below ground surface (bgs). Soils in the project area were derived from glacial till, glacial outwash deposits, and alluvial deposits. The eastern portion of the project area consists of soils deposited in periglacial lakes. Beneath the soil are laminated lacustrine silts and clays with a thickness of 91 m (approximately 300 feet). Soils have been surveyed by the Soil Conservation Service (SCS, now the Natural Resource Conservation Service) (SCS 1981).

One soil type in the project area is Mardin soil. This is a gravelly silt loam that is deep and has a dense fragipan. Permeability is moderate at the surface and in the upper part of the soil, but it is slow in the fragipan and substratum. The water table in this soil is perched above the fragipan in the early spring and during wet periods. Seasonal wetness and slow permeability in the fragipan limit the uses of Mardin soil.

Also present in the project area are Wayland and Erie silt loams and Hoosic gravelly sandy loam. Most of the eastern portion consists of the Wayland silt loam, which is a deep, poorly drained soil. Wayland soil is commonly subject to flooding in the spring and the water table is at or near the surface for prolonged periods, unless the soil is drained. A drainage ditch in the eastern portion of the project area is a tributary of Monhagen Brook. Delineated wetlands in the project area are Wayland soils. Hoosic soil is a deep, well-drained soil with a high content of sand and gravel.

The Town of Middletown sewer plant and the adjacent land is mostly fill material. This fill contains recent trash and debris.

Most of the project area has been plowed for agricultural purposes. A plow zone was anticipated in almost all of the project area, except for delineated wetlands. Slopes on the ridge at the western end of the project area and at the base of the slope contain colluvial deposits. Evidence of ground disturbance includes tractor scars, animal burrows, and some push piles. The area at the base of the ridge slope and the ground near the delineated wetlands were very wet during fieldwork, with some areas under a shallow layer of water.

2.3 Flora and Fauna

Grasses cover the surface of the project area, except for the delineated wetlands, which contain typical wetland vegetation. The margins of the property contain either brushy vegetation or are at the edge of a deciduous forest. Canada geese and whitetail deer were observed in the project area during fieldwork. Animal burrows are in several areas.

3.0 Cultural History

3.1 Prehistoric Background

3.1.1 Paleoindian Period (10,500–8000 BC)

Current archaeological consensus suggests that southern New York was first occupied during the Early Paleoindian period (10,500–9000 BC) (Funk 1978; Ritchie 1980). To date, the earliest accepted items of material culture in the region represent Clovis-like lithic assemblages found in open-air sites located on hills and rises (Funk 1978). Early occupations occurred in a tundra or park-tundra like environment created by the retreating Wisconsin glacial ice sheet. Site distribution data are limited but suggest the presence of larger multi-seasonal, multi-purpose habitation sites (Funk 1978; Ritchie 1980). Data from early Paleoindian sites in the region suggest that Clovis peoples were primarily big game hunters who exploited caribou (genius *Rangifer*), mastodon, moose-elk, and other large Pleistocene fauna when available, and small game and edible plants at other times (Ritchie 1956). Late Paleoindian period (9000–8000 BC) occupations, defined by Plano-like projectile points, are rare in eastern New York. This may reflect changing climatic conditions, as the tundra environments of the earlier period were replaced by coniferous forests with low carrying capacities for game species (Ritchie 1980).

3.1.2 Archaic Period (8000–1000 BC)

Archaic-period occupation in the northeastern United States can be divided into the Early (8000–6000 BC), Middle (6000–4000 BC) and Late (4000–1400 BC) periods. Early and Middle Archaic-period occupations are rare in the eastern New York study area and occupation of this region by Archaic peoples may have coincided with the northward advancement of deciduous forests during the Hypsithermal climatic interval of 8000–5000 BC (Ritchie 1980).

Late Archaic sites are much more common in the eastern New York region. Deciduous forests would have been present in this region for over a thousand years and Late Archaic occupations appear well adapted to this environment. At the Late Archaic River and Bent sites, approximately 40 percent of the total artifact assemblages were composed of lithic projectile points and atlatl weights, indicating the continued emphasis of hunting; however, the presence of burned-rock roasting pits containing carbonized acorn cotyledons and notched pebble net sinkers also attests to the significance of wild plant and riverine resources (Ritchie 1980).

Late Archaic period occupations continue to be discovered near large river drainages and lakes. Sites during this period appear as either large multipurpose settlements containing abundant sheet midden or small, specialized camps that lack such debris. Structural, floral, faunal, and artifactual data from such sites attest to a seasonally contingent resource extraction strategy whereby large riverine central-base settlements were occupied by macro-bands throughout the spring and summer, and small camps were either winter-fall micro-band camps or specialized resource extractive locations.

Ritchie (1980) defined a so-called Transitional stage up to the use of ceramics for the Middle Atlantic region. In New York, this pre-adaptation, known as the Susquehanna tradition, appears to be confined to river drainages in the central part of the state. This transition is defined by the appearance of soapstone bowls and crude ceramics with steatite temper on several archaic period sites. The Transitional stage appears to reflect a change in technology and cooking practices rather than any dietary or economic shift.

3.1.3 Woodland Period (1000 BC–AD 1600)

The Early Woodland period (1000 BC–300 BC) is defined by the introduction of ceramics on a scale larger than the tentative applications found at the end of the Transitional stage. Early Woodland

occupations, such as those of the Meadowood phase, continued to be located on rivers and lakes near propitious fishing grounds. Thick and coarse tempered gray to black or bluff colored wares, such as Vinette 1, were employed instead of steatite and/or wooden vessels for cooking. The presence of copper beads and implements and marine shell beads suggests ties to the Great Lakes and Atlantic coast regions, while numerous stone gorgets and tubular ceramic pipes indicate a heightened emphasis on status and ritual. Mortuary ceremonialism becomes much more formalized during this period and burials are often cremated, placed in pits with a variety of grave offerings, and covered with red ochre.

The Middle Woodland period (300 BC–AD 1000) is characterized by a continued riverine focus and an increase in trade contacts and ceremonialism as documented by the Adena related materials associated with the Middlesex phase in eastern New York (Ritchie 1980).

During the Late Woodland period (AD 1000–1600) the region was occupied by the Delawares. These Algonkian speakers were not related to the Owasco people of upper New York State, who may be ancestral to the Iroquois. Linguistic differences distinguished the aboriginal inhabitants of the region from New England and Long Island. Subsistence was based on hunting, fishing, and cultivation of maize, beans, and squash.

3.2 Historic Background

Sustained European-Native American contact in southern New York State dates to 1609, when Henry Hudson sailed up the Hudson River. The Dutch West India Company directed the first permanent and lasting European settlement of what became New York State. Orange County, which included Rockland County until 1798, was established in 1683. Most of the early settlement by Dutch, English, and French Huguenot people was in the southeastern part of the county, now within Rockland County.

Settlement in the vicinity of Wawayanda possibly occurred prior to 1700. In 1738, the population for Minisink was listed as 339, estimated to have been about 60 families. A blockhouse was built as protection against the Indians in 1756, and general settlement of Wawayanda is dated sometime during the revolution or at its close. In 1779, a clash with Indians at Minisink left many houses burned and some of the settlers killed (Ruttenber and Clark 1980).

The area was primarily agricultural. Some regional centers for commerce were established, but no large cities developed. Transportation corridors used roads, canals, and then railroads.

The town of Wawayanda was formed from part of the Town of Minisink on November 15, 1849. By 1880, principal villages in Wawayanda were: New Hampton, Denton, Ridgebury, Slate Hill, Centerville, Millsburg, and Gardnerville. In the eighteenth and nineteenth centuries, farming was the primary means of business. Various villages within the town of Wawayanda contained grist, cider, and feed mills, a woolen factory, blacksmith shops, a wagon shop, general merchandise stores, a shoe shop, a saloon, and a distillery. In 1880, the village of Wawayanda was listed as a milk station on the New Jersey Midland Railroad (Ruttenber and Clark 1980).

The project area has been used for agricultural purposes for many years. An Orange County Atlas from 1875 includes a map of Wawayanda that shows the land as open and probably used as a pasture or a meadow (Figure 3.1). Nearby structures are rural residences and some recent commercial buildings.

4.0 Previous Research

4.1 Archaeological Surveys or Excavations

A Phase IB survey was conducted along the route of a sewer outfall pipe along the railroad right-of-way, bordering the present project area on the north (Landscape Studies, Inc. 1983). No cultural material was found in the railroad corridor, which was subsequently disturbed by construction. An earthen ramp—a feature discussed in the present report—provides access to this railroad grade.

A cultural resources survey report was prepared for the New York State Department of Transportation for a proposed reconstruction of a bridge on Dolsontown Road where it crosses Conrail railroad tracks (Stevens 1982). This project was to the east of the present project area. No cultural materials were found, although the report noted historic map information suggesting nineteenth century houses and farms nearby.

Hartgen Archaeological Associates, Inc. (1989) conducted a survey for the Marcy-South 345 kV Transmission Line. This survey recorded site A07119.00083, the Simon site (23-131-13), discussed below. The site contained lithics, including a transitional Late Archaic/Early Woodland projectile point and projectile point base.

A survey was conducted for the proposed Orange County Recycling and Ethanol Production Facility, immediately to the northwest of the project area (BTK Associates, Inc. 1998). No historic resources were identified by map research; no cultural resources were reported.

A survey was conducted for the Sunrise Office Building (Gimigliano 1987). No further research was recommended.

A Phase IB survey and supplementary survey were conducted for the Wallkill Pipeline Project (Oberon and Emery 1994a and 1994b; reports filed together as Report #150). Isolated occurrences of prehistoric material were within 1.6 km (1 mile) of the present project area.

Roberta Wingerson and Stuart Fiedel of Cultural Resource Surveys, Inc. conducted surface inspections and subsurface investigations for Cloverleaf Park. A form filed with the OPRHP indicates that no cultural material was found.

Hartgen Archaeological Associates, Inc. (1989) conducted a survey for Hampton Village. No sites were reported.

A survey was conducted at the Kosuga-Uhlig Property (Lenik et al. 1990; Report #111). Historic features from the late nineteenth and early twentieth centuries were found, as were three prehistoric sites. Two prehistoric sites had been recorded previously (A07119.0082 and A07119.0008 [discussed below]). Generally, no further research was recommended.

4.2 Recorded Archaeological Sites

No archaeological sites have been recorded in the project area. Within 1.6 km (1 mile) of the project area are several sites recorded in the OPRHP site files, including: A07119.0008, A07119.0015, A07119.0016, A07119.0017, A07119.0018, A07119.0021, and A07119.0083. Most of these sites were recorded by the Orange County Chapter of the New York State Archaeological Association, but there is minimal information on the nature of the finds and the cultural affiliation. Site A07119.0008 was revisited by a later survey (Lenik et al. 1990); a chert flake and a chert core were recovered from a STP.

Hartgen Archaeological Associates, Inc., recorded A07119.00083. It is also known as the Simon site (23-131-13). This site contained a transitional Late Archaic/Early Woodland projectile point and projectile point base, a bifacially worked chert blade, a roughly flaked bifacial tool, chert cores, chert flakes, and a water-worn block flake scraper. This site was found during a survey of the Marcy-South 345 kV Transmission Line near Dolsontown Road (Hartgen Archaeological Associates, Inc. 1985). Although this site is relatively close to the project area, it is in an environmental setting very different from the present project area.

There are several archaeological sites within 8 km (5 miles) of the project area. Those on the National or State Registers are discussed in general below.

Two New York State Museum (NYSM) site numbers are listed within 1.6 km (1 mile) of the project area. They are NYSM 6169, a cemetery, and NYSM 6170, a site whose location is the only information on file.

4.3 National and State Register Properties

Properties currently listed on the National Register of Historic Places (NRHP) within 8 km (5 miles) of the project area include:

The Oliver Avenue Bridge, Middletown. The bridge, constructed in 1895, served the Middletown to Goshen Trolley Line. It was an excellent example of a high Pratt truss bridge and one of only two surviving bridges in New York built by the Havana Bridge Works. The bridge was listed on the NRHP in July 1984. The bridge was unsafe and recently dismantled.

Hillside Cemetery, Middletown. This is located at the end of Mulberry Street and was listed on the NRHP in September 1994. Calvert Vaux, co-designer of Central Park in New York, designed the cemetery, which was constructed in 1861.

The Webb Horton House, Middletown. It was built between 1902 and 1906. The forty-room mansion was the home of Webb Horton, a tanner from Warren, Pennsylvania, and his family. Family members owned the house until Christine Morrison donated it for use by Orange County Community College (OCCC). The mansion currently houses OCCC's administrative offices and is named Morrison Hall. The house was listed in April 1990.

The First Baptist Church of Bloomfield, also called the Primitive Church of Bloomfield was listed on the NRHP in November 1976. The church was built in 1792. It is located on the north side of US 6 near the intersection of NY 284 in Wawayanda (Slate Hill).

District School No. 9, "Old Stone Schoolhouse," on NY 17A in Goshen. It was listed in September 1988.

U.S. Post Office, Goshen. This is on Grand Street and was listed in May 1989 as part of the nomination for U.S. Post Offices in New York State.

1841 Goshen Courthouse, Goshen. This building is at 101 Main Street, and it was listed in March 1975.

Church Park Historic District, Goshen. Part of this district is within an 8 km (5 mile) radius of the project area.

Dutchess Quarry Cave Site, location restricted. This is a Paleoindian site.

Several properties within 8 km (5 miles) of the project area have been evaluated and deemed eligible for the NRHP but are not listed in the NRHP. They include:

- The Middletown Psychiatric Historic District, Middletown
- The Mid-Hudson Psychiatric Center Historic District, Wawayanda (New Hampton)
- 94 Maples Road, Wallkill
- 105 Maples Road, Wallkill
- 220 Maples Road, Wallkill
- Holmes Bookstaver House, Crotty Road, Wallkill
- Frank Post House, Crotty Road, Wallkill
- Joseph Slaughter/Alanson Slaughter House, Goshen Turnpike, Wallkill
- 11 Webster Avenue, Village of Goshen
- Bennett House, 29 Cart Lane, Village of Goshen
- County Trust Bank, West Main Street, Village of Goshen
- Gavin Building, Greenwich Avenue, Village of Goshen
- Goshen Town Hall, 15 Webster Avenue, Village of Goshen
- Johnic Pharmacy, 62 West Main Street, Village of Goshen
- Norstar Bank, 54 West Main Street, Village of Goshen
- Houston House, NY 17A, Goshen
- Sanford House, 4 West Street, Village of Goshen
- Saver House, 9 New Street, Goshen
- John Wells Homestead, 6 ½ Station Road, Goshen
- Site 23-15-16-4, location restricted
- Site ORGO-08F, location restricted
- Gilman Site, location restricted

A review of the State Register of Historic Places (SRHP) indicates that there are properties listed in the SRHP as well as those evaluated as eligible for the NRHP but not listed on the NRHP: Middletown Psychiatric Historic District, on the western edge of Middletown, and Mid-Hudson Psychiatric Center Historic District, on US 6 and NY 17M in Wawayanda (New Hampton).

4.4 Potentially Relevant Historic Contexts and Anticipated Resources

Historic contexts that may be relevant to the project area include prehistoric land use of the Wallkill drainage, historic occupation and agriculture in Wawayanda, and construction and use of railroads in Orange County. Resources that may be present include prehistoric remains, farm machinery and equipment, and material related to the adjacent railroad grade. There are no surface indications or map evidence that structures were located here; it is not likely that many architectural fragments will be present.

5.0 Research Methods

5.1 Background Research

Background research consisted of a site files and literature search at the Field Services Bureau of the OPRHP at Peebles Island State Park. Kim Croshier of Hartgen Archaeological Associates, Inc. performed this search. Information reviewed by the co-PIs included site forms and portions of previous research reports.

Additional information was acquired at the Thrall Public Library in Middletown and from previous research conducted for the Preliminary Scoping Statement submitted as part of the permitting process under Article X of the New York State Public Service Law.

5.2 Fieldwork

Fieldwork consisted of a 100 percent pedestrian survey over the project area, except for delineated wetlands. A systematic walkover was performed at 15 m (approximately 50 foot) intervals.

The field crew also examined the ground surface prior to excavation of STPs—each 0.3–0.5 m in diameter—were excavated along transects that were 15 m (50 feet) apart, at intervals of 15 m (50 feet). Soil was manually excavated in 0.1 m levels and screened through ¼-inch mesh; a trowel had to be used to work the soil through the screen, which was mostly heavy and wet. All of the project area was subjected to subsurface investigation, except for delineated wetlands, slopes, and areas of either obvious surface disturbance or which were covered with water during fieldwork. Soil stratigraphy was recorded.

6.0 Research Results

6.1 Pedestrian Inspection

TRC conducted a pedestrian inspection over all of the project area, except for delineated wetlands. Surface visibility was about 80 percent during the first session, but less than 50 percent during the second. A systematic walkover was performed. One artifact, an ironstone plate fragment was found. No features were observed, except for an earthen ramp that leads up to the railroad from the Northern Portion (Figure 1.11). Stone fences are present along portions of the project area boundary.

6.2 Northern Portion

Parts of the Northern Portion were very wet during the first fieldwork session. Many areas that had been very wet were dry during the June 2001 session; only the last day was rainy. A total of 563 STPs was excavated in the Northern Portion. STP locations are indicated in Figure 6.1, and STPs are listed in Appendix A.

Soils uniformly exhibited a plow zone (typically 10YR 4/1 dark gray) from 0 to about 0.2 m bgs; the plow zone soil was silty with generally high organic content. The plow zone lies over a B horizon (typically 10YR 6/2 light brownish gray silt loam) from 0.2 m or more bgs to depths of 0.35–0.4 m bgs. Soil became hard packed or stony at about this level. Soils in flat areas, on the bottom of slopes, and near wetlands exhibited illuviation and mottling in the B horizon.

In the South Field Unit, bordering Dolsontown Road, 122 STPs were excavated. None of these STPs contained artifacts or subsurface features. Soils all had a plow zone. The northern edge of the unit was wet and borders a delineated wetland; land to the east, which is adjacent to private houses, contained areas of brushy vegetation and some wet areas.

Along the Ridge Unit, 232 STPs were excavated. Along transect K, STPs were excavated at a closer interval than elsewhere in the project area, approximately 10 m (33 feet); this was done to investigate the ridge top that, in the opinion of the co-PIs, had the greatest potential for subsurface remains. Elsewhere in this unit, several STPs were not excavated at the appropriate interval along transects because of a steep slope. No artifacts or features were found in any STP.

In the Knoll Unit, 24 STPs were excavated. Soils were similar to other portions of the project area. Being on higher ground than the surrounding land, this unit appeared to the co-PIs to have a greater potential for containing prehistoric remains than lower and wetter units, such as the North Field and Flat Units. No artifacts or features, however, were found here.

The North Field Unit is bordered by two delineated wetlands, the bottom of a slope, and a low-lying flat area. Soil here was darker than the typical soil profile in the project area. The typical soil profile in this unit had a plow zone of 10YR 3/1 very dark gray silty soil over a B horizon of 10YR 6/2 light brownish gray silt loam. A total of 48 STPs was excavated. No artifacts or features were found.

In the Flat Unit, 68 STPs were excavated. Transect B, along the base of the slope, contained rocky and mottled soil. The rockiness may be the result of materials being transported down the slope, or this may be the remnants of an old farm road that was stabilized by rocks and fill material. Near the edge of the no-build area (i.e., the building setback along the abutter's property line), soils in transects E, F, and G were notably mottled, suggesting occasional flooding. Several tractor scars were also observed in the vicinity. No artifacts or features were found.

In the Backyard Unit, 16 STPS were excavated. Soils were similar to other portions of the project area. Some of the STPs contained historic artifacts, fragments of ceramics, glass, coal clinkers, etc. A possible prehistoric artifact necessitated digging four STPs 1 m away from the positive STP. Only historic artifacts contemporary to the house were encountered.

In the East of House Unit, 30 STPS were excavated. Soils were similar to other portions of the project area. In the initial STPs of transect B a dark compact, organic soil was found (5Y 3/1-5Y 2.5/1, very dark gray to black). This may be the remains of a buried wetland. Historic artifacts such as coal slag, brick, and corroded iron were found within the first 20 cm of the plow zone during shovel testing.

In the West Wedge Unit, 23 STPs were excavated. Soils were similar to other portions of the project area. STPs along the end of the C transect encountered a tan clay soil (10YR 5/8 yellow-brown clay) rather than the normal gray soil. The final STP in transect F contained many heavy cobbles. Historic artifacts were encountered in greater numbers than in any other area. These included many sherds of different types of ceramics, some small pieces of brick, shell, glass, and coal slag. All historic artifacts were found within the plow zone, typically within the first 20 cm (0.20 m) and decreasing in frequency toward the lower levels. The low-density distribution of historic artifacts recovered is consistent with household and farming debris typical of plowed fields near farmsteads.

An earthen ramp was observed at the northeastern edge of the project area (Figure 1.11). This ramp has sides held up by boulders that are unmortared. Access to and across the railroad grade is provided by the ramp. Stone fences are standing at the eastern end of the property. No evidence of structures was found in the project area other than the house and barn in the parcel added to this project.

6.3 Southern Portion

In the Southern Portion, the ground slopes towards the south. The southern half and central part of the portion contains extensive wetlands. The mid-west portion of the parcel has been plowed and was recently planted with corn. A barn complex occupies the northeastern portion of the parcel.

Soils uniformly exhibited a plow zone (typically 10YR 4/1 dark gray) from 0 to about 0.2 m bgs; the plow zone soil is silty with generally high organic content. The plow zone lies over a B horizon (typically 10YR 5/8 gray silt loam) from 0.2 m or more bgs to depths of 0.35–0.4 m bgs. Soil became hard packed or stony at about this level. Soils in relatively level areas, on the bottom of slopes, and near wetlands exhibited illuviation and mottling in the B horizon.

A total of 135 STPs were excavated in the Southern Portion. STP locations are indicated in Figure 6.2, and STPs are listed in Appendix A. They were distributed among the survey units as follows:

The Crest Unit is at the highest point in the Southern Portion of the project area. A total of 40 STPs were dug. Soils were similar to other portions of the project area. Only modern trash was encountered during the excavation.

The Gap Unit is at a slight leveling of the terrain before it dips to the south band of wetlands. Ten STPs were excavated. Soils were similar to that found in STPs elsewhere in the project area. One nail was encountered in the units.

The area south of the barn complex (Behind Barn Unit) slopes gently towards the wetland area. A total of 51 STPs were excavated. Soils were similar to other portions of the project area. Historic artifacts were encountered in this unit. One piece of clear glass and one piece of coal clink were found in the first 0.10 m of the plow zone.

The Below the Knoll Unit sloped gently down from the highway towards the wetland and the barn complex. In this survey unit, 34 STPs were excavated. Soils were similar to other portions of the project area. Two STPs (Q4 and S2) were terminated due to cobbles or wet soil. One STP (Q3) contained an unusual B horizon, which was dry, containing loose sand, and the usual mix of gravels and cobbles. One sherd of historic earthenware ceramic was found in the upper 0.20 m of the plow zone.

7.0 Conclusions and Recommendations

No previously recorded sites are in the project area. One fragment of ironstone ceramic was found during the pedestrian inspection. A single chert flake was found in the backyard of the house in the Northern Portion; no prehistoric materials were found in the four additional STPs excavated within 1 m of this positive STP. The nature and low-density distribution of historic materials such as ceramics, brick, coal slag, glass, and iron nails is consistent with use of the land for farming and pasture and does not suggest any research potential for the project area. No subsurface features were found in any of the STPs excavated. An earthen ramp is located near the former railroad grade, and stone fences are present on the parts of the project area boundaries.

The project area was used for agricultural purposes throughout its history, and no structures are known to have been located there. Soils are heavy and wet, and a plow zone is present throughout the project area. Wetlands and poorly drained areas, slopes, areas of either animal or mechanical disturbances are present. No archaeological sites were found, and no further archaeological research is recommended for this project area.

The standing farmhouse and barns have separately been evaluated by an architectural historian for NRHP eligibility, and not deemed to be eligible for listing on the NRHP. Information regarding historic structures has been submitted to OPRHP for review.

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Appendix A
Excavation Units and Soil Data

Completed between October 16th and 20th, 2000:

Project: Wawayanda
Transect: A
Survey Unit: South Field
Date: 10/17/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	PZ, 10YR 4/1, dark brown	
	20-35	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-20	B horizon, 10YR 6/2, light brownish gray silt loam	
	20-35	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-22	B horizon, 10YR 6/2, light brownish gray silt loam	
	22-40	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-25	PZ, 10YR 4/1, dark brown	
	25-35	Burrow	
5	0-25	PZ, 10YR 4/1, dark brown/stony	
6	0-30	PZ, 10YR 4/1, dark brown/very stony	
7	0-25	PZ, 10YR 4/1, dark brown/very stony	
8	0-8	PZ, 10YR 4/1, dark brown	Brick flecks/fragments and coal clinker
	8-19	PZ, 10YR4/1, dark brown	
	19-32	Hard packed	
9		PZ, 10YR 4/1, dark brown and B horizon, 10YR 6/2, light brownish gray silt loam/mottled	In 2-track road
10	0-35	PZ, 10YR 4/1, dark brown and B horizon, 10YR 6/2, dark brownish gray silt loam/mottled	
	35-40	light gray silty sand	Next to wetland

Project: Wawayanda
Transect: B
Survey Unit: South Field
Date: 10/17/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-15	PZ, 10YR 4/1, dark brown	
	15-42	B horizon, 10YR 6/2, light brownish gray silt loam/gravels	
2	0-20	PZ, 10YR 4/1, dark brown	
	20-35	B horizon, 10YR 6/2, light brownish gray silt loam/gravels	
3	0-23	PZ, 10YR 4/1, dark brown	
	23-27	B horizon, 10YR 6/2, light brownish gray silt loam/gravels	
4	0-23	PZ, 10YR 4/1, dark brown	
	23-43	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-13	PZ, 10YR 4/1, dark brown	
	13-28	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-25	PZ, 10YR 4/1, dark brown	
	25-48	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-13	PZ, 10YR 4/1, dark brown	
	13-28	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-15	PZ, 10YR 4/1, dark brown	Brick at 13 cm
	15-38	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-23	PZ, 10YR 4/1, dark brown	1 brick 0-23
	23-43	B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-15	PZ, 10YR 4/1, dark brown	
	15-30	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-15	PZ, 10YR 4/1, dark brown	
	15-30	B horizon, 10YR 6/2, light brownish gray silt loam	
12	0-15	PZ, 10YR 4/1, dark brown	
	15-35	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: C
Survey Unit: South Field
Date: 10/17/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-10	PZ, 10YR 4/1, dark brown	
	10-40	B horizon, 10YR 4/1, light brownish gray silt loam	
2	0-16	PZ, 10YR 4/1, dark brown	
	16-35	B horizon, 10YR 4/1, light brownish gray silt loam	
3	0-28	PZ, 10YR 4/1, dark brown	
	28-40	B horizon, 10YR 4/1, light brownish gray silt loam	
4	0-19	PZ, 10YR 4/1, dark brown	
	19-22	20 tan rocks	
5	0-20	PZ, 10YR 4/1, dark brown	
	20-40	Large gravels	
6	0-30	PZ, 10YR 4/1, dark brown	
	18-30	Gravels	
7	0-12	PZ, 10YR 4/1, dark brown	
	12-30	B horizon, 10YR 4/1, light brownish gray silt loam	
8	0-12	PZ, 10YR 4/1, dark brown	
	12-40	B horizon, 10YR 4/1, light brownish gray silt loam	
9	0-17	PZ, 10YR 4/1, dark brown	
	17-30	B horizon, 10YR 4/1, light brownish gray silt loam	
10	0-21	PZ, 10YR 4/1, dark brown	
	21-35	B horizon, 10YR 4/1, light brownish gray silt loam	
11	0-13	PZ, 10YR 4/1, dark brown	
	13-30	B horizon, 10YR 4/1, light brownish gray silt loam	
12	0-16	PZ, 10YR 4/1, dark brown	
	16-35	B horizon, 10YR 4/1, light brownish gray silt loam	

Project: Wawayanda
Transect: D
Survey Unit: South Field
Date: 10/17/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-16	PZ, 10YR 4/1, dark gray/clay	
	16-30	Clay	
2	1-18	PZ, 10YR 4/1, dark gray/clay	
	18-30	Clay	
3	0-20	PZ, 10YR 4/1, dark gray /clay	
	20-30	Clay	
4	0-20	PZ, 10YR 4/1, dark gray	
	20-32	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-18	PZ, 10YR 4/1, dark gray	
	18-35	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-23	PZ, 10YR 4/1, dark gray	
	23-35	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-18	PZ, 10YR 4/1, dark gray	
	18-32	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-50	Large gravels throughout, PZ undistinguishable, 10+ cm rock	
9	0-20	PZ, 10YR 4/1, dark gray/stopped due to large rocks	
10	0-17	PZ, 10YR 4/1, dark gray	
	17-35	Gravels throughout	
11	0-25	PZ, 10YR 4/1, dark gray	
	25-35	Gravels throughout	
12	0-15	PZ, 10YR 4/1, dark gray	
	15-30	Gravels	

Project: Wawayanda
Transect: E
Survey Unit: South Field
Date: 10/17/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	Wet PZ, 10YR 4/1 dark gray	Ruts
2	0-27	PZ, 10YR 4/1 dark gray	
	27-35	B horizon, 10YR 6/2 light brownish gray silt loam	Iron mottling
3	0-20	PZ, 10YR 4/1 dark gray	
	20-35	B horizon, 10YR 6/2 light brownish gray silt loam	
4	0-35	PZ, 10YR 4/1 dark gray/mottled with B horizon, 10YR 6/2 light brownish gray silt loam	
	35-40	B horizon, 10YR 6/2 light brownish gray silt loam	
5	0-35	PZ, 10YR 4/1 dark gray/mottled soil	
	35-40	PZ, 10YR 4/1 dark gray/mottled with B horizon, 10YR 6/2 light brownish gray silt loam	
6	0-27	PZ, 10YR 4/1 dark gray	
	27-40	B horizon, 10YR 6/2 light brownish gray silt loam	Drier than PZ, 10YR 4/1 dark gray
7	0-18	PZ, 10YR 4/1 dark gray	
	18-31		Strat 2/hard packed like at rd top
8	0-19	PZ, 10YR 4/1 dark gray	At bottom of steeper slope near D8
	19-32	B horizon, 10YR 6/2 light brownish gray silt loam/hard packed	
9		Not completed, rocky	Slope
	0-20	PZ, 10YR 4/1 dark gray	
	20-30	B horizon, 10YR 6/2 light brownish gray silt loam	
	30-45	Silty mixed sod, burrow	
11	0-19	PZ, 10YR 4/1 dark gray	
	19-33	Mottled, mini hill near road	
	33-50	Strat 4, next to road	
12	0-20	PZ, 10YR 4/1 dark gray	
	20-50	B horizon, 10YR 6/2 light brownish gray silt loam	

Project: Wawayanda
Transect: F
Survey Unit: South Field
Date: 10/17/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-17	PZ, 10YR 4/1, dark gray	Brick fragments in soil
2	0-21	PZ, 10YR 4/1, dark gray	
	21-52	Disturbed mottled, burrow	
3	0-16	PZ, 10YR 4/1, dark gray	
	16-27	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-12	PZ, 10YR 4/1, dark gray	
	12-28	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-16	PZ, 10YR 4/1, dark gray	
	16-28	Mottled soil	
	28-45	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-12	PZ, 10YR 4/1, dark gray	
	12-32	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-16	PZ, 10YR 4/1, dark gray	
	16-32	B horizon, 10YR 6/2, light brownish gray silt loam	
8		Not done	Slope
9	0-12	PZ, 10YR 4/1, dark gray/gravels	
	12-30	Gravels and B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-10	PZ, 10YR 4/1, dark gray	
	10-25	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-17	PZ, 10YR 4/1, dark gray	
	17-42	Gravels and B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: G
Survey Unit: South Field
Date: 10/17/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-16	PZ, 10YR 4/1, dark brown	
	16-35	Burrow	
2	0-17	PZ, 10YR 4/1, dark brown	
	17-40	Gravels	
3	0-14	PZ, 10YR 4/1, dark brown	
	14-30	Gravels	
4	0-40	Undistinguishable gravels	
5	0-17	PZ, 10YR 4/1, dark brown	
	17-30	B horizon, 10YR 6.2, light brownish gray silt loam	
6	0-17	PZ, 10YR 4/1, dark brown	
	17-35	Clay	
7	0-19	PZ, 10YR 4/1, dark brown	
	19-30	Clay	
8	0-32	PZ, 10YR 4/1, dark brown	
	32-40	Clay	
9	0-20	PZ, 10YR 4/1, dark brown	
	20-42	Darker soil in B horizon, organic material	
10	0-10	PZ, 10YR 4/1, dark brown	
	10-30	Clay	

Project: Wawayanda
Transect: H
Survey Unit: South Field
Date: 10/17/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-50	PZ, 10YR 4/1,next to road, bottom of hill	
2	0-20	Hard packed rocky soil	
3	0-30	Hard packed rocky soil	
4	0-35	Hard packed rocky soil	
5	0-20	PZ, 10YR 4/1, dark brown, bottom of hill	
	20-35	Mottled soil with inclusions and iron striations	
6	0-18	PZ, 10YR 4/1, dark brown	
	18-40	Mottled soil with inclusions and iron striations	
7	0-30	PZ, 10YR 4/1, dark brown	
	30-45	Mottled soil with inclusions and iron striations	
8	0-20	PZ, 10YR 4/1, dark brown	
	20-30	Mottled soil with inclusions and iron striations	
9	0-20	PZ, 10YR 4/1, dark brown	
	20-35	Mottled soil with inclusions and iron striations	
10	0-15	PZ, 10YR 4/1, dark brown, very rocky, on hill	

Project: Wawayanda
Transect: I
Survey Unit: South Field
Date: 10/17/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-15	PZ, 10YR 4/1, dark brown/gravels	
	15-30	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-23	PZ, 10YR 4/1, dark brown/gravels, big root	
3	0-12	PZ, 10YR 4/1, dark brown/glacial till	
	12-30	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-22	PZ, 10YR 4/1, dark brown	
	22-40	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-11	PZ, 10YR 4/1, dark brown	
	11-25	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-11	PZ, 10YR 4/1, dark brown	
	11-40	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-15	PZ, 10YR 4/1, dark brown	
	15-52	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-13	PZ, 10YR 4/1, dark brown	
	13-30	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-8	PZ, 10YR 4/1, dark brown	
	8-28	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: J
Survey Unit: South Field
Date: 10/17/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-8	PZ, 10YR 4/1, dark brown	
	8-22	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-8	PZ, 10YR 4/1, dark brown	
	8-25	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-14	PZ, 10YR 4/1, dark brown	
	14-33	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-9	PZ, 10YR 4/1, dark brown	
	9-26	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-7	PZ, 10YR 4/1, dark brown	
	7-22	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-11	PZ, 10YR 4/1, dark brown/gravels	
	11-25	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-12	PZ, 10YR 4/1, dark brown	Soil sample
	12-35	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-22	PZ, 10YR 4/1, dark brown	
	22-35	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: K
Survey Unit: South Field
Date: 10/17/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	No PZ	
	very wet	Mottled soil with inclusions	
2	0-20	PZ, 10YR 4/1, dark brown/mottled soil with inclusions	Very hard packed
3	0-20	PZ, 10YR 4/1,dark brown/mottled soil with inclusions	
	20-30	Mottled soil with inclusions	
4	0-30	PZ, 10YR 4/1, dark brown/mottled soil with inclusions	
	30-40	Mottled soil with inclusions	
5	0-15	PZ, 10YR 4/1, dark brown	
	15-18	Very rocky	
6	0-18	PZ, 10YR 4/1, dark brown	
	18-30	B horizon, 10YR 6/2, light brownish gray silt loam	Last in transect, too close to road for next

Project: Wawayanda
Transect: L
Survey Unit: South Field
Date: 10/17/00
Recorder: JA/MO

Shovel Test #	Depth	Soil Type(s) and Munsell Colors	Notes
1	0-30	Clay and mottled soil	
2	0-12	PZ, 10YR 4/1, dark brown	
	12-25	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-25	Mottled gravels, undistinguishable	
4	0-25	PZ, 10YR 4/1, dark brown/mottled soil	
	25-30	Clay	
5	0-23	PZ, 10YR 4/1, dark brown/charcoal pieces	
	23-30	Clay	
6	0-16	PZ, 10YR 4/1, dark brown	
	16-27	Large rocks and gravels	

Project: Wawayanda
Transect: M
Survey Unit: South Field
Date: 10/17/00
Recorder: JA/MO/BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-40	Mottled soil	Next to road and bridge by wetland flat area
2	0-11	PZ, 10YR 4/1, dark brown	
	11-27	Clay/wetland strat	
3	0-16	PZ, 10YR 4/1, dark brown	
	16-30	Silt loam	
4	0-25	Mottled, undistinguishable	

Project: Wawayanda
Transect: A
Survey Unit: Ridge
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	not dry	Disturbed by mechanical tracks	
2	0-18	PZ, 10YR 4/1, dark gray	
	18-35	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-29	PZ, 10YR 4/1, dark gray/mixed	In 2-track road

Project: Wawayanda
Transect: B
Survey Unit: Ridge
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-28	Disturbed, large rocks near surface	
2	0-18	PZ, 10YR 4/1, dark gray	
	18-30	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-19	PZ, 10YR 4/1, dark gray	
	19-30	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-16	PZ, 10YR 4/1, dark gray	
	16-30	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-19	PZ, 10YR 4/1, dark gray	
	19-31	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-20	PZ, 10YR 4/1, dark gray	
	20-32	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-19	PZ, 10YR 4/1, dark gray	
	19-35	B horizon, 10YR 6/2, light brownish gray silt loam, cobbles	
8	0-21	PZ, 10YR 4/1, dark gray	
	21-38	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-19	PZ, 10YR 4/1, dark gray	
	19-32	B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-21	PZ, 10YR 4/1, dark gray	
	21-32	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-18	PZ, 10YR 4/1, dark gray	
	18-34	B horizon, 10YR 6/2, light brownish gray silt loam	
12	0-18	PZ, 10YR 4/1, dark gray	
	18-35	B horizon, 10YR 6/2, light brownish gray silt loam	
13	0-23	PZ, 10YR 4/1, dark gray	
	23-35	B horizon, 10YR 6/2, light brownish gray silt loam, high gravel content	
14	0-17	PZ, 10YR 4/1, dark gray	
	17-30	B horizon, 10YR 6/2, light brownish gray silt loam, high gravel content	
15	0-14	PZ, 10YR 4/1, dark gray	
	14-25	B horizon, 10YR 6/2, light brownish gray silt loam, cobbles	
16	0-13	PZ, 10YR 4/1, dark gray	
	13-26	B horizon, 10YR 6/2, light brownish gray silt loam	
17	0-22	Mottled, high gravel content	

Transect B, Ridge Unit (Continued)

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
18	0-20	PZ, 10YR 4/1, dark gray	
	20-35	B horizon, 10YR 6/2, light brownish gray silt loam	
19	0-18	PZ, 10YR 4/1, dark gray	
	18-35	B horizon, 10YR 6/2, light brownish gray silt loam	
20	0-22	PZ, 10YR 4/1, dark gray	
	22-40	B horizon, 10YR 6/2, light brownish gray silt loam	
21	0-17	PZ, 10YR 4/1, dark gray	
	17-35	B horizon, 10YR 6/2, light brownish gray silt loam	
22	0-23	PZ, 10YR 4/1, dark gray	
	23-30	B horizon, 10YR 6/2, light brownish gray silt loam	
23	0-17	PZ, 10YR 4/1, dark gray	
	17-30	B horizon, 10YR 6/2, light brownish gray silt loam	
24	0-26	Mottled soil	
	26-35	B horizon, 10YR 6/2, light brownish gray silt loam	
25		Not done	Power lines
26		Not done	Power lines
27	0-20	PZ, 10YR 4/1, dark gray	
	20-30	B horizon, 10YR 6/2, light brownish gray silt loam	
28	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam, high gravel content	
29	0-16	PZ, 10YR 4/1, dark gray	
	16-23	B horizon, 10YR 6/2, light brownish gray silt loam	
30	0-24	PZ, 10YR 4/1, dark gray	
	24-35	B horizon, 10YR 6/2, light brownish gray silt loam, high gravel content	
31	0-25	PZ, 10YR 4/1, dark gray	
	25-40	B horizon, 10YR 6/2, light brownish gray silt loam	
32	0-25	PZ, 10YR 4/1, dark gray	
	25-38	B horizon, 10YR 6/2, light brownish gray silt loam	
33	0-20	PZ, 10YR 4/1, dark gray	
	20-35	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: C
Survey Unit: Ridge
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	PZ, 10YR 4/1, dark gray	
	20-32	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-23	PZ, 10YR 4/1, dark gray	
	23-32	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-27	PZ, 10YR 4/1, dark gray	
	27-30	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-22	PZ, 10YR 4/1, dark gray	
	22-33	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-22	PZ, 10YR 4/1, dark gray	
	22-34	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-20	PZ, 10YR 4/1, dark gray	
	20-30	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-24	PZ, 10YR 4/1, dark gray	
	24-35	B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-27	PZ, 10YR 4/1, dark gray	
	27-35	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-24	PZ, 10YR 4/1, dark gray	
	24-35	B horizon, 10YR 6/2, light brownish gray silt loam	
12	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
13	0-22	PZ, 10YR 4/1, dark gray	
	22-32	B horizon, 10YR 6/2, light brownish gray silt loam	
14	0-25	PZ, 10YR 4/1, dark gray	
	25-35	B horizon, 10YR 6/2, light brownish gray silt loam	
15	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
16	0-22	PZ, 10YR 4/1, dark gray	
	22-32	B horizon, 10YR 6/2, light brownish gray silt loam	
17	0-21	PZ, 10YR 4/1, dark gray	
	21-31	B horizon, 10YR 6/2, light brownish gray silt loam	
18	0-20	PZ, 10YR 4/1, dark gray	
	20-27	B horizon, 10YR 6/2, light brownish gray silt loam	
19	0-23	PZ, 10YR 4/1, dark gray	
	23-33	B horizon, 10YR 6/2, light brownish gray silt loam	
20	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
21	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
22	0-25	PZ, 10YR 4/1, dark gray	
	25-33	B horizon, 10YR 6/2, light brownish gray silt loam	
23	0-20	PZ, 10YR 4/1, dark gray	
	20-27	B horizon, 10YR 6/2, light brownish gray silt loam	
24	0-20	PZ, 10YR 4/1, dark gray	
	20-30	B horizon, 10YR 6/2, light brownish gray silt loam	
25	0-22	PZ, 10YR 4/1, dark gray	
	22-28	B horizon, 10YR 6/2, light brownish gray silt loam	

C, Ridge Unit (Continued)

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
26	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
27	0-20	PZ, 10YR 4/1, dark gray	
	20-27	B horizon, 10YR 6/2, light brownish gray silt loam	
28		Disturbed soil, not completed	Power lines
29		Disturbed soil, not completed	Power lines
30	0-23	PZ, 10YR 4/1, dark gray	
	23-34	B horizon, 10YR 6/2, light brownish gray silt loam	
31	0-19	PZ, 10YR 4/1, dark gray	
	19-32	B horizon, 10YR 6/2, light brownish gray silt loam	
32	0-20	PZ, 10YR 4/1, dark gray	
	20-24	B horizon, 10YR 6/2, light brownish gray silt loam	
33	0-25	PZ, 10YR 4/1, dark gray	
	25-35	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: D
Survey Unit: Ridge
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-18	PZ, 10YR 4/1, dark gray	
	18-31	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-18	PZ, 10YR 4/1, dark gray	
	18-35	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-24	PZ, 10YR 4/1, dark gray	
	24-33	B horizon, 10YR 6/2, light brownish gray silt loam	Rocks at bottom, on slope
4	0-20	PZ, 10YR 4/1, dark gray	Rock on bottom
5	0-40	PZ, 10YR 4/1, dark gray	
	40+ rock	B horizon, 10YR 6/2, light brownish gray silt loam	Rock on bottom
6	0-27	PZ, 10YR 4/1, dark gray/mixed, no strat change, stony	
7	0-35	PZ, 10YR 4/1, dark gray/no strat change, stony	
8	0-42	PZ, 10YR 4/1, dark gray, no strat change, stony, slope	
9	0-35	PZ, 10YR 4/1, dark gray, no strat change, stony, slope	
10	0-25	PZ, 10YR 4/1, dark gray, no strat change, very stony	
11	0-25	PZ, 10YR 4/1, dark gray, no strat change, stony	
12	0-35	PZ, 10YR 4/1, dark gray, no strat change, stony	
13	0-25	PZ, 10YR 4/1, dark gray, no strat change, stony	
14	0-25	PZ, 10YR 4/1, dark gray	
	25-40	B horizon, 10YR 6/2, light brownish gray silt loam	
15	0-33	PZ, 10YR 4/1, dark gray	
	33-37	B horizon, 10YR 6/2, light brownish gray silt loam	
16	0-30	Mixed PZ, 10YR 4/1, dark gray/B horizon, 10YR 6/2, light brownish gray silt loam	
	30-40	Mottled soil, stony at bottom	
17	0-28	PZ, 10YR 4/1, dark gray	
	28-32	B horizon, 10YR 6/2, light brownish gray silt loam/very stony	

D, Ridge Unit (Continued).

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
18	0-42	PZ, 10YR 4/1, dark gray	
	42-45	B horizon, 10YR 6/2, light brownish gray silt loam	
19	0-32	PZ, 10YR 4/1, dark gray/very stony, no change	
20	0-30	PZ, 10YR 4/1, dark gray/very stony, no change	
21	0-20	PZ, 10YR 4/1, dark gray	
	20-27	B horizon, 10YR 6/2, light brownish gray silt loam, very stony	
22	0-10	PZ, 10YR 4/1, dark gray/broken cobbles, very rocky	
23	0-35	PZ, 10YR 4/1, dark gray/mottled at bottom	
24	0-37	PZ, 10YR 4/1, dark gray/mottled at bottom	
25	0-35	PZ, 10YR 4/1, dark gray /mottled, stony	
26	0-25	PZ, 10YR 4/1, dark gray /mottled, stony	
27	0-30	PZ, 10YR 4/1, dark gray/B horizon, 10YR 6/2, light brownish gray silt loam, 2 mixed, more clay	
28	0-30	PZ, 10YR 4/1, dark gray/B horizon, 10YR 6/2, light brownish gray silt loam, mixed, more clay	
29	0-30	PZ, 10YR 4/1, dark gray/B horizon, 10YR 6/2, light brownish gray silt loam, mixed, more clay	

Project: Wawayanda
Transect: E
Survey Unit: Ridge
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-19	PZ, 10YR 4/1, dark gray	
	19-32	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-26	PZ, 10YR 4/1, dark gray/large rocks encountered	
4	0-17	PZ, 10YR 4/1, dark gray	
	17-30	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-24	PZ, 10YR 4/1, dark gray	
	24-37	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-23	PZ, 10YR 4/1, dark gray	
	23-30	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-20	PZ, 10YR 4/1, dark gray	
	20-33	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-30	Mottled soil throughout STP	
9	0-25	PZ, 10YR 4/1, dark gray	
	25-35	B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-15	PZ, 10YR 4/1, dark gray	
	15-30	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
12	0-17	PZ, 10YR 4/1, dark gray	
	17-30	B horizon, 10YR 6/2, light brownish gray silt loam	
13	0-25	PZ, 10YR 4/1, dark gray	
	25-32	B horizon, 10YR 6/2, light brownish gray silt loam	
14	0-25	PZ, 10YR 4/1, dark gray	
	25-35	B horizon, 10YR 6/2, light brownish gray silt loam	
15	0-23	PZ, 10YR 4/1, dark gray	
	23-30	B horizon, 10YR 6/2, light brownish gray silt loam	
16	0-18	PZ, 10YR 4/1, dark gray	
	18-30	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: F
Survey Unit: Ridge
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-22	PZ, 10YR 4/1, dark gray	
	22-28	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-22	PZ, 10YR 4/1, dark gray	
	22-32	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-25	PZ, 10YR 4/1, dark gray	
	25-33	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-23	PZ, 10YR 4/1, dark gray	
	23-30	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-23	PZ, 10YR 4/1, dark gray	
	23-33	B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
12	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
13	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
14	0-20	PZ, 10YR 4/1, dark gray	
	20-27	B horizon, 10YR 6/2, light brownish gray silt loam	
15	0-13	PZ, 10YR 4/1, dark gray	
	13-22	B horizon, 10YR 6/2, light brownish gray silt loam	
16	0-22	PZ, 10YR 4/1, dark gray	
	22-27	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: G
Survey Unit: Ridge
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	PZ, 10YR 4/1, dark gray, rocky	
2	0-27	PZ, 10YR 4/1, dark gray, mottled with B horizon, 10YR 6/2, light brownish gray silt loam, rocky	
3	0-10	PZ, 10YR 4/1, dark gray, very rocky in area	
4	0-27	PZ, 10YR 4/1, dark gray/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
5	0-30	PZ, 10YR 4/1, dark gray/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
6	0-25	PZ, 10YR 4/1, dark gray/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
7	0-32	PZ, 10YR 4/1, dark gray, mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
8	0-30	PZ, 10YR 4/1, dark gray, mottled with B horizon, 10YR 6/2, light brownish gray silt loam, rocky	
9	0-27	PZ, 10YR 4/1/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
10	0-31	PZ, 10YR 4/1, dark gray, mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
11	0-28	PZ, 10YR 4/1, dark gray/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
12	0-25	PZ, 10YR 4/1, dark gray/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
13	0-25	PZ, 10YR 4/1, dark gray/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	
14	0-15	PZ, 10YR 4/1, dark gray/mottled with B horizon, 10YR 6/2, light brownish gray silt loam, very rocky	

Project: Wawayanda
Transect: H
Survey Unit: Ridge
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	PZ, 10YR 4/1, dark gray	
	20-30	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-20	PZ, 10YR 4/1, dark gray	
	20-32	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-12	PZ, 10YR 4/1, dark gray	
	12-22	B horizon, 10YR 6/2, light brownish gray silt loam, very compact	
4	0-17	PZ, 10YR 4/1, dark gray	
	17-32	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-21	PZ, 10YR 4/1, dark gray	
	21-30	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-24	PZ, 10YR 4/1, dark gray	
	24-30	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-23	PZ, 10YR 4/1, dark gray	
	23-34	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-20	PZ, 10YR 4/1, dark gray	
	20-31	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: I
Survey Unit: Ridge
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-27	PZ, 10YR 4/1, dark gray	
	27-35	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-22	PZ, 10YR 4/1, dark gray	
	22-30	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: J
Survey Unit: Ridge
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-35	PZ, 10YR 4/1, dark gray and B horizon, 10YR 6/2, light brownish gray silt loam, mottled	
2	0-24	PZ, 10YR 4/1, dark gray and B horizon, 10YR 6/2, light brownish gray silt loam, mottled, very rocky	
3	0-15	PZ, 10YR 4/1, dark gray and B horizon, 10YR 6/2, light brownish gray silt loam, mottled, very rocky	PZ and strat 2 mottled, very rocky, in 2-track

Project: Wawayanda
Transect: K
Survey Unit: Ridge
Date: 10/19/00
Recorder: RGH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	PZ, 10YR 4/1, dark gray, very rocky	
2	0-33	PZ, 10YR 4/1, dark gray, very rocky	
3	0-30	PZ, 10YR 4/1, dark gray, very rocky	
4	0-36	PZ, 10YR 4/1, dark gray, very rocky	
5	0-30	PZ, 10YR 4/1, dark gray, very rocky, especially at bottom	
6	0-28	PZ, 10YR 4/1, dark gray, very rocky	
7	0-30	PZ, 10YR 4/1, dark gray, very rocky	
8	0-28	PZ, 10YR 4/1, dark gray, very rocky	
9	0-30	PZ, 10YR 4/1, dark gray, very rocky	
10	0-30	PZ, 10YR 4/1, dark gray, mottled soil	
11	0-29	PZ, 10YR 4/1, dark gray, mottled soil	
12	0-27	PZ, 10YR 4/1, dark gray, mottled soil	
13	0-30	PZ, 10YR 4/1, dark gray, mottled soil	
14	0-20	PZ, 10YR 4/1, dark gray, mottled soil	
15	0-25	PZ, 10YR 4/1, dark gray, mottled soil	
16	0-26	PZ, 10YR 4/1, dark gray, mottled soil	
17	0-35	PZ, 10YR 4/1, dark gray, mottled soil	
18	0-30	PZ, 10YR 4/1, dark gray, mottled soil	
19	0-37	PZ, 10YR 4/1, dark gray, mottled soil	
20	0-32	PZ, 10YR 4/1, dark gray, mottled soil	
21	0-28	PZ, 10YR 4/1, dark gray, mottled soil	
22	0-30	PZ, 10YR 4/1, dark gray, mottled soil	
23	0-30	PZ, 10YR 4/1, dark gray, mottled soil	
24		Not done	Slope
25		Not done	Slope
26	0-32	PZ, 10YR 4/1, dark gray, mottled soil	
27	0-31	PZ, 10YR 4/1, dark gray, mottled soil	
28	0-33	PZ, 10YR 4/1, dark gray, mottled soil	

Project: Wawayanda
Transect: L
Survey Unit: Ridge
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-15	PZ, 10YR 4/1, dark gray	
	15-20	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-25	PZ, 10YR 4/1, dark gray	
	25-33	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-25	PZ, 10YR 4/1, dark gray	
	25-33	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-23	PZ, 10YR 4/1, dark gray	
	23-30	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-24	PZ, 10YR 4/1, dark gray	
	24-30	B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-30	PZ, 10YR 4/1, dark gray	
	30-36	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-30	PZ, 10YR 4/1, dark gray	
	30-60	B horizon, 10YR 6/2, light brownish gray silt loam	
12	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
13	0-25	PZ, 10YR 4/1, dark gray	
	25-32	B horizon, 10YR 6/2, light brownish gray silt loam	
14		Not done	Slope
15		Not done	Slope
16		Not done	Slope
17		Not done	Slope
18		Not done	Slope
19		Not done	Slope
20		Not done	Slope
21		Not done	Slope
22		Not done	Slope
23		Not done	Slope
24		Not done	Slope
25		Not done	Slope
26	0-35	PZ, 10YR 4/1, dark gray	
	35-40	B horizon, 10YR 6/2, light brownish gray silt loam	
27	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
28	0-22	PZ, 10YR 4/1, dark gray	
	22-28	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: M
Survey Unit: Ridge
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-15	PZ, 10YR 4/1, dark gray	
	15-25	B horizon, 10YR 6/2, light brownish gray silt loam, cobbles	
2	0-23	PZ, 10YR 4/1, dark gray	
	23-35	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-40	Mottled soil throughout STP	
4	0-35	PZ, 10YR 4/1, dark gray	
	35-40	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-30	PZ, 10YR 4/1, dark gray/cobbles	
6	0-40	PZ, 10YR 4/1, dark gray/cobbles	
7	0-20	PZ, 10YR 4/1, dark gray/cobbles	
8	0-30	PZ, 10YR 4/1, dark gray/cobbles	
9	6-16	PZ, 10YR 4/1, dark gray	
	16-31	B horizon, 10YR 6/2, light brownish gray silt loam, cobbles	
10	0-25	PZ, 10YR 4/1, dark gray/large cobbles	
11	0-35	PZ, 10YR 4/1, dark gray (burrow 2 m north)	
	35-40	B horizon, 10YR 6/2, light brownish gray silt loam, cobbles	
12	0-25	PZ, 10YR 4/1, dark gray/large cobbles	
13	0-36	Mottled soil	
14	0-23	PZ, 10YR 4/1, dark gray	
	23-36	B horizon, 10YR 6/2, light brownish gray silt loam, cobbles	
15	0-23	PZ, 10YR 4/1, dark gray	
	23-37	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: A
Survey Unit: Knoll
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-23	PZ, 10YR 4/1, dark gray	
	23-37	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-24	PZ, 10YR 4/1, dark gray	
	24-32	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-18	PZ, 10YR 4/1, dark gray	
	18-30	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-30	PZ, 10YR 4/1, dark gray	
	30-34	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-28	PZ, 10YR 4/1, dark gray	
	28-32	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-40	PZ, 10YR 4/1, dark gray, gravels	

Project: Wawayanda
Transect: B
Survey Unit: Knoll
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	PZ, 10YR 4/1, dark gray	
	20-28	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-30	PZ, 10YR 4/1, dark gray	
	30-40	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-22	PZ, 10YR 4/1, dark gray	
	22-27	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-24	PZ, 10YR 4/1, dark gray	
	24-30	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-24	PZ, 10YR 4/1, dark gray	
	24-30	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: C
Survey Unit: Knoll
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1		Not completed	Slope
2	0-15	PZ, 10YR 4/1, dark gray	
	15-30	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-28	PZ, 10YR 4/1, dark gray	
	28-39	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-35	Mottled soil throughout STP	
5	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: D
Survey Unit: Knoll
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-25	PZ, 10YR 4/1, dark gray/mottled	
	25-35	B horizon, 10YR 6/2, light brownish gray silt loam, rocky	
2	0-25	PZ, 10YR 4/1, dark gray/mottled	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam, rocky	
3	0-30	PZ, 10YR 4/1, dark gray/mottled	
	30-39	B horizon, 10YR 6/2, light brownish gray silt loam, rocky	
4	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, dark brownish gray silt loam	
6	0-30	PZ, 10YR 4/1, dark gray/mottled	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam, rocky	

Project: Wawayanda
Transect: A
Survey Unit: North Field
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-40	PZ, 10YR 3/1, very dark gray	
	40+	B horizon, 10YR 6/2, light brownish gray silt loam	Rock below B horizon
2	0-10	PZ, 10YR 3/1, very dark gray	
	10-1`22	B horizon, 10YR 6/2, light brownish gray silt loam Silt loam	
3	0-22	PZ, 10YR 3/1, very dark gray	
	22-28	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-35	PZ, 10YR 3/1, very dark gray	
	35-40	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-20	PZ, 10YR 3/1, very dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-30	PZ, 10YR 3/1, very dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-20	PZ, 10YR 3/1, very dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-25	PZ, 10YR 3/1, very dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
9		Soil saturated, not completed	
10	0-35	PZ, 10YR 3/1, very dark gray	
	35-40	B horizon, 10YR 6/2, light brownish gray silt loam	
11	0-25	PZ, 10YR 3/1, very dark gray	
	25-32	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: B
Survey Unit: North Field
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-19	PZ, 10YR 3/1, very dark gray	
	19-45	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-22	PZ, 10YR 3/1, very dark gray	
	22-33	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-25	PZ, 10YR 3/1, very dark gray	
	25-35	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-20	PZ, 10YR 3/1, very dark gray	
	20-30	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-25	PZ, 10YR 3/1, very dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-25	PZ, 10YR 3/1, very dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-40	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-23	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-13	PZ, 10YR 3/1, very dark gray	
	13-30	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: C
Survey Unit: North Field
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-35	PZ, 10YR 3/1, very dark gray, very organic, rocks at bottom	
2	0-35	PZ, 10YR 3/1, very dark gray, with mottled soil inclusions	
3	0-30	PZ, 10YR 3/1, very dark gray	
	30-35	Mottled soil throughout STP	
4	0-30	Mottled soil throughout STP	
5	0-32	Mottled soil throughout STP	
6	0-30	Mottled soil throughout STP	
7		Not done	Standing water
8	0-30	Mottled soil throughout STP	
9		Not done	Standing water
10	0-30	Mottled soil throughout STP	

Project: Wawayanda
Transect: D
Survey Unit: North Field
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	Soil saturated	
2	0-35	PZ, 10YR 3/1, very dark gray	
	35-40	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-40	Disturbed soil	Animal burrow
4	0-22	PZ, 10YR 3/1, very dark gray	
	22-28	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-20	PZ, 10YR 3/1, very dark gray	
	20-25	B horizon, 10YR 6/2, light brownish gray silt loam	
6	0-25	PZ, 10YR 3/1, very dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-25	PZ, 10YR 3/1, very dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-25	PZ, 10YR 3/1, very dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
9	0-10	PZ, 10YR 3/1, very dark gray	
	10-15	B horizon, 10YR 6/2, light brownish gray silt loam	
10	0-22	PZ, 10YR 3/1, very dark gray	
	22-28	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: E
Survey Unit: North Field
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-27	PZ, 10YR 4/1, dark brown	
	27-35	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-30	PZ, 10YR 4/1, dark brown	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-12	PZ, 10YR 4/1, dark brown	
	12-30	B horizon, 10YR 6/2, light brownish gray silt loam	
4	0-23	PZ, 10YR 4/1, dark brown	
	23-32	B horizon, 10YR 6/2, light brownish gray silt loam	
5	0-25	PZ, 10YR 4/1, dark brown, cobbles	
6	0-23	PZ, 10YR 4/1, dark brown	
	23-32	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-26	PZ, 10YR 4/1, dark brown	
	26-30	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-26	PZ, 10YR 4/1, dark brown	
	26-35	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: A
Survey Unit: Flat
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2, light brownish gray silt loam	
2	0-20	PZ, 10YR 4/1, dark gray	
	20-32	B horizon, 10YR 6/2, light brownish gray silt loam	
3	0-32	PZ, 10YR 4/1, dark gray	
	32-40	B horizon, 10YR 6/2, light brownish gray silt loam	
4		Disturbed, not completed	
5	0-35	B horizon, 10YR 6/2, light brownish gray silt loam,	
6	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2, light brownish gray silt loam	
7	0-20	PZ, 10YR 4/1, dark gray	
	20-28	B horizon, 10YR 6/2, light brownish gray silt loam	
8	0-30	PZ, 10YR 4/1, dark gray/cobble	
9		> 12% slope, not completed	
10	0-25	PZ, 10YR 4/1, dark gray	
	25-35	B horizon, 10YR 6/2, light brownish gray silt loam	
11		Large rock near surface	
12	0-28	PZ, 10YR 4/1, dark gray	
	28-35	B horizon, 10YR 6/2, light brownish gray silt loam	

Project: Wawayanda
Transect: B
Survey Unit: Flat
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-25	Mottled soil	Area at base of slope may have been modified for a farm road at one time.
2	0-5	Rocky	
3	0-37	Rocky	
4	0-5	Rocky	
5	0-20	Rocky	
6	0-27	Rocky	
7	0-20	Rocky	
8	0-20	Rocky	
9	0-25	Rocky	
10	0-30	Rocky	
11	0-28	Rocky	

Project: Wawayanda
Transect: C
Survey Unit: Flat
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2 light brownish gray silt loam	
2	0-10	Disturbed soil	
	10-30	Rocky	
3	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2 light brownish gray silt loam	
4	0-30	PZ, 10YR 4/1, dark gray	
	30-38	B horizon, 10YR 6/2 light brownish gray silt loam	
5	0-27	PZ, 10YR 4/1, dark gray	
	27-33	B horizon, 10YR 6/2 light brownish gray silt loam	
6	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2 light brownish gray silt loam	
7	0-30	PZ, 10YR 4/1, dark gray	
	30-37	B horizon, 10YR 6/2 light brownish gray silt loam	
8	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2 light brownish gray silt loam	
9	0-30	PZ, 10YR 4/1, dark gray	
	30-35	B horizon, 10YR 6/2 light brownish gray silt loam	
10	0-25	PZ, 10YR 4/1, dark gray	
	25-30	B horizon, 10YR 6/2 light brownish gray silt loam	
11	0-20	PZ, 10YR 4/1, dark gray	
	20-25	B horizon, 10YR 6/2 light brownish gray silt loam	

Project: Wawayanda
Transect: E
Survey Unit: Flat
Date: 10/19/00
Recorder: JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-35	PZ, 10YR 4/1, dark gray, mottled soil	

Project: Wawayanda
Transect: F
Survey Unit: Flat
Date: 10/19/00
Recorder: BB/NM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-40	Mottled soil	
2	0-37	Mottled soil	
3	0-32	Mottled soil, rocky on bottom	

Project: Wawayanda
Transect: G
Survey Unit: Flat
Date: 10/19/00
Recorder: RDH/TRG

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	Mottled soil, rocky	
2	0-25	Mottled soil, rocky	
3	0-30	Mottled soil, rocky	

Completed between June 10th and 17th, 2001:

Project: Wawayanda
Transect: A
Survey Unit: Backyard
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-28	10YR 4/1, dark gray, gravels and cobbles	
	28-37	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray, gravels and cobbles	
	20-40	10YR 5/8, yellow/brow clay	
3	0-30	10YR 4/1, dark gray, gravels	
	30-45	10YR 5/8, yellow/brown clay, gravels	
4	0-15	10YR 4/1, dark gray, gravels	
	15-26	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: B
Survey Unit: Backyard
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-34	10YR 4/1, dark gray	Several pieces of clear, modern glass, 3 rusted iron nails, several ceramic sherds, some slag, coal slag
	34-50	10YR 5/8, yellow/brown clay	
2	0-30	10YR 4/1, dark gray	Ceramic glass
	32-40	10YR 5/8, yellow/brown clay, consolidated tan silt	
3	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
4	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay, light brown silt	

Project: Wawayanda
Transect: C
Survey Unit: Backyard
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-17	10YR 4/1, dark gray, gravels and cobbles	
	17-30	10YR 5/8, yellow/brown clay	
2	0-25	10YR 4/1, dark gray, gravels	
	25-34	10YR 5/8, yellow/brown clay	
3	0-30	10YR 4/1, dark gray, gravels	
	30-40	10YR 5/8, yellow/brown clay	
4	0-36	10YR 4/1, dark gray with coal and bricks	Lithic debitage, earthenware
	36-60	10YR 5/8, yellow/brown clay, cobbles, gravels	
4-1	0-36	10YR 4/1, dark gray	Collected cream container fragment at 0.12, 10 small coat bits, 3 clear glass not collected-coal in walls to 30
	36-45	10YR 5/8, yellow/brown clay	
4-2	0-37	10YR 4/1, dark gray, few gravels	
	37-48	10YR 5/8, yellow/brown clay	Coal clink, brick distributed throughout, ceramics
4-3	0-40	10YR 4/1, dark gray, few gravels	
	40-50	10YR 5/8, yellow/brown clay	
4-4	0-40	10YR 4/1, dark gray, few gravels	Coal clink, ceramics, milk glass, brick bits distributed throughout
	40-50	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: D
Survey Unit: Flat
Date: 6/17/01
Recorder: DM/LL/MO/JA/TM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-35	10YR 4/1, dark gray, gravels	
	35-50	10YR 5/8, yellow/brown clay, few gravels	
2	0-42	10YR 4/1, dark gray, gravels	
	42-55	10YR 5/8, yellow/brow clay	
3	0-40	10YR 4/1, dark gray, gravels and cobbles	
	40-55	10YR 5/8, yellow/brown clay	
4	0-20	10YR 4/1, dark gray, gravels	
	20-35	10YR 5/8, yellow/brown clay	
5	0-50	10YR 4/1, dark gray, many gravels and cobbles	
			Test unit terminated due to shale bedrock
6	0-27	10YR 4/1, dark gray, gravels	
	27-35	10YR 5/8, yellow/brown clay	
7	0-54	10YR 4/1, dark gray, cobbles and gravels	
	54-60	10YR 5/8, yellow/brown clay	
8	0-28	10YR 4/1, dark gray, cobbles and gravels	
	28-42	10YR 5/8, yellow/brown clay	
9	0-15	10YR 4/1, dark gray, cobbles and gravels	
	15-29	10YR 5/8, yellow/brown clay	
10	0-18	10YR 4/1, dark gray, gravels	
	18-30	10YR 5/8, yellow/brown clay	
11	0-38	10YR 4/1, dark gray	
			Terminated due to large cobbles at 38 cm
12	0-23	10YR 4/1, dark gray, gravels and cobbles	
	23-37	10YR 5/8, yellow/brown clay	
13	0-30	10YR 4/1, dark gray, gravels	
	30-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: H
Survey Unit: Flat
Date: 6/17/01
Recorder: DM/LL/MO/JA/TM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	
2	0-25	10YR 4/1, dark gray, cobbles of shale	
	25-35	10YR 5/8, yellow/brown clay, no cobble	
3	0-30	10YR 4/1, dark gray	
	30-50	10YR 5/8, yellow/brown clay	Sterile hard packed clay
4	0-30	10YR 4/1, dark gray, many cobbles	
	30-40	10YR 5/8, yellow/brown clay, some cobbles	
5	0-20	10YR 4/1, dark gray	Brick, some coal slag
	20-50	10YR 5/8, yellow/brown clay	
6	0-35	10YR 4/1, dark gray, cobbles, brick fragments	Many small pieces of coal
	36-40	10YR 5/8, yellow/brown clay, few cobbles	
7	0-20	10YR 4/1, dark gray	Compacted HB/clay
	20-50	10YR 5/8, yellow/brown clay	
8	10-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	37-45, large cobbles, couldn't go deeper
9	0-20	10YR 4/1, dark gray	
	20-50	10YR 5/8, yellow/brown clay	
10	0-30	10YR 4/1, dark gray, many cobbles	
	30-45	10YR 5/8, yellow/brown clay, semi-compact	

Project: Wawayanda
Transect: I
Survey Unit: Flat
Date: 6/17/01
Recorder: DM/LL/MO/JA/TM

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-10	10YR 4/1, dark gray	Plastic cup
	20-35	10YR 5/8, yellow/brown clay	
2	0-28	10YR 4/1, dark gray, few gravels	In the field notes this unit had no letter designation
	28-40	10YR 5/8, yellow/brown clay, few gravels	
3	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
4	0-40	10YR 4/1, dark gray, very gravelly	
		10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: A
Section Unit: East of House
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
			Terminated due to large cobbles
2	0-25	10YR 4/1, dark gray, cobbles and gravels	
	25-35	10YR 5/8, yellow/brow clay	
3	0-20	10YR 4/1, dark gray	
			Terminated due to large cobbles
4	0-30	10YR 4/1, dark gray, gravels and cobbles	
	30-40	10YR 5/8, yellow/brown clay, and blue gray	
5	0-33	10YR 4/1, dark gray, large cobbles	
	33-45	10YR 5/8, yellow/brown clay	
6	0-30	10YR 4/1, dark gray, large cobbles	
	30-37	10YR 5/8, gray clay	
7	0-30	10YR 4/1, dark gray	2 pieces historic ceramic, 1 piece gray chert
	30-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: B
Section Unit: East of House
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	10-20	10YR 4/1, dark gray	1 piece corroded iron, 1 piece of coal slag
	20-50	10YR 5/8, yellow/brown clay	Silty clay with organic content
2	0-25	10YR 4/1, dark gray	
	25-50	10YR 5/8, yellow/brown clay	Dark gray, compact
3	0-30	10YR 4/1, dark gray	1 piece brick
	30-40	10YR 5/8, yellow/brown clay	
4	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
5	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
6	0-30	10YR 4/1, dark gray	Piece of gray chert, 15 mm
	30-40	10YR 5/8, yellow/brown clay	
7	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: C
Section Unit: East of House
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-31	10YR 4/1, dark gray, gravels	
	31-40	10YR 5/8, yellow/brown clay with cobbles	
2	0-21	10YR 4/1, dark gray, gravels	
	21-30	10YR 5/8, yellow/brown clay	
3	0-22	10YR 4/1, dark gray, gravels and cobbles	
	22-36	10YR 5/8, yellow/brown clay	
4	0-23	10YR 4/1, dark gray, gravels	
	23-34	10YR 5/8, yellow/brown clay	
5	0-35	10YR 4/1, dark gray with gravels	
	35-45	10YR 5/8, yellow/brown clay	
6	0-20	10YR 4/1, dark gray, gravels	Lithic debitage
	20-30	10YR 5/8, yellow/brown clay	
7	0-20	10YR 4/1, dark gray, gravels	
	20-40	Mix between 10YR 5/8 and 10YR 4/1, gravels	

Project: Wawayanda
Transect: D
Section Unit: East of House
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray, gravels	
			Terminated due to large cobbles
2	0-30	10YR 5/8, yellow/brown clay with gravels	
3	0-26	Mix of 10YR 4/1 and 10YR 5/8, gravels	
	26-32	10YR 5/8, yellow/brown clay	
4	0-32	10YR 4/1, dark gray, gravels	
	32-43	10YR 5/8, yellow/brown clay	
5	0-24	10YR 4/1, dark gray, gravels	
	24-35	10YR 5/8, yellow/brown clay	
6	0-26	10YR 4/1, dark gray, gravels	
	26-40	10YR 5/8, yellow/brown clay	
7	0-39	10YR 4/1, dark gray	
	39-50	10YR 5/8, yellow/brown clay, gravels	

Project: Wawayanda
Transect: E
Section Unit: East of House
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-32	10YR 4/1, dark gray, gravels	
	32-45	10YR 5/8, yellow/brown clay	
2	0-23	10YR 4/1, dark gray	
	23-32	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: A
Section Unit: West Wedge
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	5 pieces brick ceramic/porcelain
	20-50	10YR 5/8, yellow/brown clay	Small piece ceramic
2	0-30	10YR 4/1, dark gray	2 pieces red brick
	30-40	10YR 5/8, yellow/brown clay	
3	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	
4	0-20	10YR 4/1, dark gray, very rocky with many small pebbles	
	20-35	10YR 5/8, yellow/brown clay	
5	0-20	10YR 4/1, dark gray	
	20-35	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: B
Section Unit: West Wedge
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-40	10YR 4/1, dark gray, cobbles	
	40-60	10YR 5/8, yellow/brown clay, cobbles	
2	0-28	10YR 4/1, dark gray, gravels	
	28-40	10YR 5/8, yellow/brow clay	
3	0-25	10YR 4/1, dark gray	
	25-50	10YR 5/8, yellow/brown clay	
4	0-28	10YR 4/1, dark gray	
	28-40	10YR 5/8, yellow/brown clay	
5	0-20	10YR 4/1, dark gray	
	20-50	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: C
Section Unit: West Wedge
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-40	10YR 4/1, dark gray	1 piece red brick, 1 historic sherd, 1 flake large # of diff. sherds, shell, window and bottle glass
	40-50	10YR 5/8, yellow/brown clay, extremely rocky with large pebbles and cobbles	
2	0-30	10YR 4/1, dark gray	1 sherd
	30-50	10YR 5/8, yellow/brown clay	Ceramic (2 pieces)
3	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
4	0-30	10YR 4/1, dark gray	Large chunks broken brick (red), 1 at 7cm in size
	30-40	10YR 5/8, yellow/brown clay, compacted tan silt	

Project: Wawayanda
Transect: D
Section Unit: West Wedge
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-29	10YR 4/1, dark gray	
	29-40	10YR 5/8, yellow/brown clay	
2	0-45	10YR 4/1, dark gray, many gravels	
			Terminated due to large cobbles
3	0-25	10YR 4/1, dark gray	
	25-48	10YR 4/1 and 10YR 5/8 mix	

Project: Wawayanda
Transect: E
Section Unit: West Wedge
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-46	10YR 4/1, dark gray, gravels	
			Terminated due to large cobbles
2	0-37	10YR 4/1, dark gray, cobbles	
	37-50	10YR 5/8, yellow/brown clay	
3	0-28	10YR 4/1, dark gray	
	28-35	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: F
Section Unit: West Wedge
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	10YR 4/1, dark gray, heavy cobbles	Couldn't get shovel through
2	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: G
Section Unit: West Wedge
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-35	10YR 4/1, dark gray	
	35-45	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: A
Survey Unit: Gap
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-15	10YR 4/1, very gravelly	
	15-25	10YR 5/8, yellow/brown clay, very gravelly	
2	0-31	10YR 4/1, dark gray, few gravels	
	31-40	10YR 5/8, yellow/brow clay, few gravels	
3	0-20	10YR 4/1, dark gray, few gravels	
	20-30	10YR 5/8, yellow/brown clay, few gravels	
4	0-28	10YR 4/1, dark gray, few gravels	
	28-34	10YR 5/8, yellow/brown clay, few gravels	
5	0-28	10YR 4/1, dark gray, few gravels	
	28-33	10YR 5/8, yellow/brown clay, rocks	

Project: Wawayanda
Transect: B
Survey Unit: Gap
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
2	0-30	10YR 4/1, dark gray	Unit located on slight slope
	30-40	10YR 5/8, yellow/brown clay	
3	0-40	10YR 4/1, dark gray	
	40-50	10YR 5/8, yellow/brown clay	
4	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
5	0-18	10YR 4/1, dark gray, few gravels	
	18-30	10YR 5/8, yellow/brown clay, rocks	

Project: Wawayanda
Transect: A
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-29	10YR 4/1, dark gray, loamy gravels	
	29-37	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray, loamy gravels	
	20-30	10YR 5/8, yellow/brow clay	
3	0-28	10YR 4/1, dark gray, loam	
	28-35	10YR 5/8, yellow/brown clay	
4	0-24	10YR 4/1, dark gray, loam	
	24-35	10YR 5/8, yellow/brown clay	
5	0-21	10YR 4/1, dark gray, loam	
	21-32	10YR 5/8, yellow/brown clay	
6	0-24	10YR 4/1, dark gray, loam	
	24-37	10YR 5/8, yellow/brown clay	
7	0-26	10YR 4/1, dark gray, loam	
	26-35	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: B
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
	20-32	10YR 5/8, yellow/brown clay	
2	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
3	0-30	10YR 4/1, dark gray	1 piece of clear glass
	30-40	10YR 5/8, yellow/brown clay, huge cobble, 15 cm 1x15 deep x 8 cm w	
4	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	
5	0-30	10YR 4/1, dark gray	
	30-40	10YR 4/6, dark yellowish brown silty sand	
6	0-40	10YR 4/1, dark gray	
	40-55	10YR 5/8, yellow/brown clay	
7	0-30	10YR 4/1, dark gray	
	30-45	10YR 5/8, yellow/brown clay	
8	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
9	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
10	0-30	10YR 4/1, dark gray	
	30-40	10YR 4/6, dark yellowing brown silty sand	

Project: Wawayanda
Transect: C
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-45	10YR 4/1, dark gray, many gravels and cobbles	
2	0-32	10YR 4/1, dark gray, many gravels and cobbles	
			Test unit terminated due to large cobbles
3	0-30	10YR 4/1, dark gray, gravels	
	30-45	10YR 5/8, yellow/brown clay	
4	0-33	10YR 4/1, dark gray with gravels	
	33-47	10YR 5/8, yellow/brown clay	
5	0-46	10YR 4/1, dark gray, with gravels	
	46-50	10YR 5/8, yellow/brown clay	
6	0-25	10YR 4/1, dark gray, gravelly	
	25-55	10YR 5/8, yellow/brown, no inclusions	
7	0-30	10YR 4/1, dark gray	
	30-50	10YR 5/8, yellow/brown clay, gravels	
8	.0-30	10YR 4/1, dark gray, with gravels	
	30-40	10YR 5/8, yellow/brown clay	
9	0-32	10YR 4/1, dark gray, with gravels	
	32-42	10YR 5/8, yellow/brown clay	
10	0-30	10YR 4/1, dark gray, with gravels	
	30-43	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: E
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
2	0-30	10YR 4/1, dark gray	
	30-45	10YR 5/8, yellow/brown clay	
3	0-30	10YR 4/1, dark gray	
	30-45	10YR 5/8, yellow/brown clay	
4	0-30	10YR 4/1, dark gray, gravelly soil	
	30-35	10YR 5/8, yellow/brown clay	
5	0-20	10YR 4/1, dark gray	
	20-35	10YR 5/8, yellow/brown clay, sandy soil	
6	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
7	0-50	10YR 4/1, dark gray, dry, gravelly increasing into lower levels	
8	0-40	10YR 4/1, dark gray	
	40-50	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: F
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-18	10YR 4/1, dark gray, with gravels	
	18-30	10YR 4/6, yellowish silty sand	
2	0-28	10YR 4/1, dark gray, with gravels, rocks	
	28-35	10YR 4/6, yellowish silty sand	
3	0-26	10YR 4/1, dark gray, with gravels	
	26-35	10YR 5/8, yellow/brown clay	
4	0-15	10YR 4/1, dark gray, very gravelly	
	15-25	10YR 5/8, yellow/brown clay	
5	0-21	10YR 4/1, dark gray, very gravelly	
	21-30	10YR 5/8, yellow/brown clay	
6	0-40	10YR 4/1, dark gray, very gravelly, rocks	
	40-45	10YR 5/8, yellow/brown clay	
7	0-32	10YR 4/1, dark gray, very gravelly	
	32-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: G
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
	20-35	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
3	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
4	0-30	10YR 4/1, dark gray	1 piece coal clink
	30-40	10YR 5/8, yellow/brown clay	
5	0-20	10YR 4/1, dark gray	
	20-35	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: H
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-27	10YR 4/1, dark gray, gravelly	
	28-36	10YR 5/8, yellow/brown clay, few gravels	
2	0-20	10YR 4/1, dark gray, gravelly	
	20-28	10YR 5/8, yellow/brown clay, few gravels	
3	0-32	10YR 4/1, dark gray, few gravels	
	32-38	10YR 5/8, yellow/brown clay, few gravels	

Project: Wawayanda
Transect: I
Survey Unit: Behind Barn
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray, few gravels	
	20-30	10YR 5/8, yellow/brown clay, no gravels	

Project: Wawayanda
Transect: A
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-18	10YR 4/1, dark gray, gravels	
	18-30	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: B
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-25	10YR 4/1, dark gray, loamy gravels	
	25-35	10YR 5/8, yellow/brown clay, gravels	
2	0-24	10YR 4/1, dark gray, loamy gravels	
	24-35	10YR 5/8, yellow/brow clay, gravels	
3	0-23	10YR 4/1, dark gray, loamy gravels	
	23-30	10YR 5/8, yellow/brown clay, gravels	
4	0-24	10YR 4/1, dark gray, gravels	
	24-34	10YR 5/8, yellow/brown clay, gravels	

Project: Wawayanda
Transect: C
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay, gravelly	
2	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay, gravelly	
3	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay, hard packed, tan eolian silt	
4	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: D
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-24	10YR 4/1, dark gray, gravels	
	24-31	10YR 5/8, yellow/brown clay	
2	0-30	10YR 4/1, dark gray, loamy gravels	
	30-42	10YR 5/8, yellow/brown clay	
3	0-25	10YR 4/1, dark gray, loamy gravels	
	25-35	10YR 5/8, yellow/brown clay	
4	0-21	10YR 4/1, dark gray, gravels	Lithic debitage
	21-32	10YR 5/8, yellow/brown clay	
5	0-17	10YR 4/1, dark gray, loamy gravels	
	17-27	10YR 5/8, yellow/brown clay, cobbles	
6	0-18	10YR 4/1, dark gray	
	18-33	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: E
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
3	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
4	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
5	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: F
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-19	10YR 4/1, dark gray, loamy gravel	
	19-30	10YR 5/8, yellow/brown clay cobbles	
2	0-25	10YR 4/1, dark gray, gravel	
	25-35	10YR 5/8, yellow/brown clay, gravel	
3	0-18	10YR 4/1, dark gray, gravel	
	18-30	10YR 5/8, yellow/brown clay	
4	0-38	10YR 4/1, dark gray, gravels	
	38-45	10YR 5/8, yellow/brown clay, gravels	
5	0-26	10YR 4/1, dark gray, loamy gravels	
	26-40	10YR 5/8, yellow/brown clay, gravels	

Project: Wawayanda
Transect: G
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	Wrappers, modern trash
	20-30	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
3	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
4	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: H
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray, gravels and cobbles	
	20-30	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray, gravels and cobbles	
	20-30	10YR 5/8, yellow/brown clay	
3	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: I
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
2	0-18	10YR 4/1, dark gray	
	18-28	10YR 5/8, yellow/brown clay, gravels	
3	0-20	10YR 4/1, dark gray, gravels	
	20-32	10YR 5/8, yellow/brown clay, gravels	

Project: Wawayanda
Transect: J
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-20	10YR 4/1, dark gray	Modern brown glass
	20-40	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray	
	20-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: K
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-22	10YR 4/1, dark gray, gravels	
	22-32	10YR 5/8, yellow/brown clay, gravels	
2	0-21	10YR 4/1, dark gray, loamy gravels	
	21-30	10YR 5/8, yellow/brown clay, cobbles and gravels	

Project: Wawayanda
Transect: L
Survey Unit: Crest
Date: 6/17/01
Recorder: DM/LL/JA/MO

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-22	10YR 4/1, dark gray, gravels	
	22-34	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: M
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	10YR 4/1, dark gray loam	
	30-40	10YR 5/8, yellow/brown clay	
2	0-30	10YR 4/1, dark gray loam	
	30-50	10YR 5/8, yellow/brown clay	
3	0-30	10YR 4/1, dark gray loam	
	30-40	10YR 5/8, yellow/brown clay	
4	0-40	10YR 4/1, dark gray loam	
	40-50	10YR 5/8, yellow/brown clay	Bottom: dense gravel, little dirt with large cobbles
5	0-30	10YR 4/1, dark gray loam	
	30-40	10YR 5/8, yellow/brown clay	
6	0-40	10YR 4/1, dark gray loam	
	40-50	10YR 5/8, yellow/brown clay	
7	0-30	10YR 4/1, dark gray loam	
	30-50	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: N
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-25	10YR 4/1, dark gray, gravels	
	25-35	10YR 5/8, yellow/brown clay	
2	0-27	10YR 4/1, dark gray, gravels	
	27-35	10YR 5/8, yellow/brown clay	
3	0-40	10YR 4/1, dark gray loam, gravels	
	40-48	10YR 5/8, yellow/brown clay	
4	0-62	10YR 4/1, dark gray loam compact with gravels	
5	0-46	10YR 4/1, dark gray loam, gravels	
	46-52	10YR 5/8, yellow/brown clay, gravels	
6	0-37	10YR 4/1, dark gray loam compact with gravels	
	37-42	10YR 5/8, yellow/brown clay, compact	
7	0-30	10YR 4/1, dark gray loam compact with gravels	
	30-37	10YR 5/8, yellow/brown clay, compact	

Project: Wawayanda
Transect: O
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-26	10YR 4/1, dark gray loam, gravels	
	26-33	10YR 5/8, yellow/brown clay	
2	0-40	10YR 4/1, dark gray loam, gravels	
	40-45	10YR 5/8, yellow/brown clay, gravels	
3	0-28	10YR 4/1, dark gray loam compact with gravels	
	28-36	10YR 5/8, yellow/brown clay, gravels	
4	0-40	10YR 4/1, dark gray loam compact with gravels	
			Test terminated due to large cobbles at 40 cm
5	0-31	10YR 4/1, dark gray loam compact with gravels	
	31-40	10YR 5/8, yellow/brown clay, cobbles and gravels	

Project: Wawayanda
Transect: P
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-37	10YR 4/1, dark gray	
	37-46	10YR 5/8, yellow/brown clay	
2	0-60	10YR 4/1, dark gray loam, gravels	
3	0-23	10YR 4/1, dark gray loam, many gravels	
	23-35	10YR 5/8, yellow/brown clay, many gravels	
4	0-30	10YR 4/1, dark gray loam, many gravels	
	30-36	10YR 5/8, yellow/brown clay, many gravels	
5	0-31	10YR 4/1, dark gray loam compact with gravels	
	31-42	10YR 5/8, yellow/brown clay, many gravels	

Project: Wawayanda
Transect: Q
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-40	10YR 4/1, dark gray loam	
	40-45	10YR 5/8, yellow/brown clay	
2	0-40	10YR 4/1, dark gray loam	
	40-45	10YR 5/8, yellow/brown clay	
3	0-30	10YR 4/1, dark gray loam	
	30-40	10YR 5/8, yellow/brown clay, very dry, loose and sandy, very gravelly with small pebbles	
4	0-50	10YR 4/1, dark gray loam	
	50-60	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: R
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-60	10YR 4/1, dark gray loam compact with gravels and cobbles	
2	0-25	10YR 4/1, dark gray loam, many gravels	
	25-35	10YR 5/8, yellow/brown clay, many gravels	
3	0-30	10YR 4/1, dark gray loam, gravels	
	30-40	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: S
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	10YR 4/1, dark gray loam	
	30-40	10YR 5/8, yellow/brown clay	
2			Test terminated, wetlands

Project: Wawayanda
Transect: Z
Survey Unit: Below the Knoll
Date: 6/17/01
Recorder: DM/LL/MO/JA

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	10YR 4/1, dark gray	
	30-45	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Survey Unit: Water Line (next to farmhouse)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-21	10YR 4/1, dark gray, no gravels	
	21-33	10YR 5/8, yellow/brown clay, no gravels	
2	0-30	10YR 4/1, dark gray	
	30-40	10YR 5/8, yellow/brown clay	
3	0-22	10YR 4/1, dark gray, no gravels	
	22-30	10YR 5/8, yellow/brow clay, no gravels	
4	0-20	10YR 4/1, dark gray	2 ceramics
	20-35	10YR 5/8, yellow/brown clay	
5	0-21	10YR 4/1, dark gray, no gravels	
	21-30	10YR 5/8, yellow/brow clay, no gravels	
6	0-20	10YR 4/1, dark gray, no gravels	
	21-30	10YR 5/8, yellow/brow clay, no gravels	

Project: Wawayanda
Transect: A
Survey Unit: Water Line (in right-of-way)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1			Test terminated, wetlands
2	0-20	10YR 4/1, dark gray	
	20-30	10YR 5/8, yellow/brown clay	
3	0-12	10YR 4/1, dark gray, gravelly	
	12-20	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: B
Survey Unit: Water Line (in right-of-way)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1			Test terminated, wetlands
2	0-20	10YR 4/1, dark gray	Modern trash, bottle caps, pull tab soda cans, some glass
	20-30	10YR 5/8, yellow/brown clay	
3	0-13	10YR 4/1, dark gray	
	13-22	10YR 5/8, yellow/brown clay	

Project: Wawayanda
Transect: C
Survey Unit: Water Line (in right-of-way)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
2	0-20	10YR 4/1, dark gray	Trash compacted through entire unit for 20 cm, pull tabs, plastic wrappers, containers, glass
	20-30	10YR 5/8, yellow/brown clay	
3			In thicket, test terminated

Project: Wawayanda
Transect: D
Survey Unit: Water Line (in right-of-way)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-10	10YR 4/1, dark gray	Both levels very gravelly
	10-18	10YR 5/8, yellow/brown clay	
2	0-20	10YR 4/1, dark gray	25 cm of modern trash-plastic, glass, metal bits
	20-35	10YR 5/8, yellow/brown clay	
3			Test terminated, in thicket

Project: Wawayanda
Transect: E
Survey Unit: Water Line (in right-of-way)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1			Test terminated, in thicket
2	0-12	10YR 4/1, dark gray, gravelly	
	12-20	10YR 5/8, yellow/brown clay, gravelly	
3			Test terminated, in wetland

Project: Wawayanda
Transect: A-B
Survey Unit: Water Line (in right-of-way)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
3	0-16	10YR 4/1, dark gray, large asphalt chunks	
	16-23	10YR 5/8, yellow/brown clay, gravelly	

Project: Wawayanda
Survey Unit: Water Line (Sewer Plant)
Date: 6/17/01
Recorder: MO/JA/DM/LL

Shovel Test #	Depth (cm)	Soil Type(s) and Munsell Colors	Notes
1	0-30	10YR 5/8, yellow/brown clay	Clay is dry and extremely compact with large cobbles and concrete fragments, galvanized wire also.
2	0-30	10YR 5/8 yellow/brown clay, clay is dry and very compact, several large cobbles	scattered brick, glass, modern plastic, with many pieces of Styrofoam distributed throughout.
3	0-35	10YR5/8 yellow/brown clay, extremely compact with many gravels	Glass, plastic, panty hose, brick found in test unit.
4	0-33	10YR5/8 yellow/brown clay	Milk glass, large piece yellow foam in test unit bottom. Extremely compact with many gravels.

APPENDIX J UNANTICIPATED DISCOVERY PLAN

PLAN FOR UNANTICIPATED DISCOVERY OF HISTORIC PROPERTIES AND HUMAN REMAINS

1. Introduction

Wawayanda Energy Center, LLC (Calpine) is committed to the protection and preservation of cultural resources, in accordance with federal and state regulations. Calpine recognizes that, despite documented pre-construction efforts involving cultural resource field investigations, it is still possible that unanticipated cultural or historic resources, properties or remains could be discovered during construction.

This Plan for Unanticipated Discovery of Historic Properties and Human Remains (the Plan) presents Calpine's approach to address unanticipated discoveries during construction of the proposed Calpine Project (the Project) located on a site near the Interstate Highway 84/State Route 17M interchange, in the Town of Wawayanda, Orange County, New York. This Plan describes procedures to ensure that any potentially significant archaeological resources discovered during construction, including human remains, are dealt with in full compliance with applicable regulations. More specifically, this Plan describes procedures to:

- Ensure that personnel working on this Project are trained in basic archaeological site awareness, identification and related procedures.

- Ensure that any potentially significant archaeological resources discovered during construction, including human remains, are dealt with in full compliance with applicable regulations. The Plan is intended to be consistent with federal regulations at 36 CFR 800.11, Protection of Historic and Cultural Properties. Discussions with the Office of Parks, Recreation and Historic Preservation (OPRHP) and State Police reveal that there are no specific New York regulations or procedures applicable to this Plan. In New York State, accepted practice involves immediate notification of appropriate officials, and development of discovery-specific procedures in consultation with OPRHP, state and local police and medical officials.

- Ensure that procedures and lines of communication with the appropriate government officials are clearly established prior to the start of construction. In this manner, any discoveries can be addressed in a timely manner with minimal impact to construction schedules as well as cultural resources.

2. Training for Project Inspectors and Contract Construction Personnel

Basic training is required for inspectors and construction contractors to recognize potential discoveries of historic properties or human remains. Calpine requires field inspectors and construction contractors to have a basic understanding of, and sensitivity to, the possibility of discovering cultural and historic resources and human remains. The Project's Environmental Manager and the construction contractor's

Environmental Inspector will have primary responsibility for unanticipated discoveries and for related training.

Prior to commencement of construction activities, the Environmental Inspector will contract with a qualified archaeologist (Project Archaeologist). The Project Archaeologist will participate in initial training efforts and will also be available on an as-needed basis throughout the portion of the construction period involving excavation.

Also prior to commencement of construction activities, individual contacts will be identified at OPRHP and other organizations listed in Section 4, in order to ensure that a communications protocol is fully established in the event that unanticipated discoveries are encountered that would require consultation.

The purpose of the basic training is to review the Project's commitments regarding cultural resource compliance, and to provide an overview of the general cultural history of the Project area. Basic training will emphasize the procedures to be followed, as outlined in this Plan, regarding the actions to be taken, and notifications required in the event of a significant unanticipated discovery of an historic property or human remains. The Project Archaeologist will work with the Environmental Inspector to develop a training program that will involve more detailed training for inspectors and supervisors as well as written materials for any construction personnel likely to be involved in on-site excavation. This basic cultural resources training will be part of the overall environmental briefing that will be presented to Project inspectors and construction contractors prior to the start of construction. Following training, both construction contractors and Project inspectors are expected to be aware of the kinds of archaeological remains that may be encountered during construction. Trainees will be instructed to be conscious of cultural resource indicators during construction, such as recognizable quantities of bone, unusual stone or ash deposits, evidence of spoil piles, or trench and foundation walls.

The entire Project site, construction lay down areas and locations of interconnections were subject to a Phase I survey and no significant cultural resources were identified. Therefore, no known locations of cultural resources exist on the site and, pending OPRHP concurrence and the receipt of all applicable permits, the entire site will be considered to be "cleared" for construction.

3. Procedures for Unanticipated Discoveries

All construction personnel working at the Project construction site will be instructed to initiate the following procedures in the event that unanticipated historic properties or human remains are encountered during construction. Unanticipated discoveries that would trigger initiation of the following procedures include:

- Any human remains; and
- Any recognizable potentially significant concentrations of artifacts or evidence of human occupation.

Part of construction personnel's routine duties will involve examination of trenches, building excavations and/or spoil piles for evidence of artifacts or human remains. The following procedures will be initiated in the event of discovering unanticipated historical properties or human remains.

3.1 Discoveries of Artifacts or Historic Property Remains

3.1.1 Unanticipated Discovery, Suspension of Work and Field Notifications

Construction contractor personnel involved in unanticipated discoveries of historic properties immediately must suspend activities that could affect the integrity of the discovery, and must notify the Construction Manager or Environmental Inspector. The Construction Manager and/or Environmental Inspector, in turn, must notify Project personnel. Notification includes information about the specific location and construction area, and the nature of the discovery.

Project personnel involved in unanticipated discoveries of historic properties or human remains immediately must direct construction contractors to suspend activities that could affect the integrity of the discovery, and must notify the Construction Manger and/or Environmental Inspector. Notification includes information about the specific location and construction area, and the nature of the discovery.

3.1.2 Identification of Discovery Significance

Upon discovery or notification about an unanticipated discovery, the Project's Environmental Manager will be responsible for consulting with OPRHP to determine whether the discovery is a new potentially significant discovery. This will be accomplished by observing the type and nature of the discovery.

Any of the following would be considered potentially "significant" new discoveries of artifacts or historic property remains, and would trigger the actions listed below: any intact archaeological features; or evidence of a hearth or undisturbed occupation level, such as an organization of stones or burned earth. The location and date of the discovery will be identified on the Environmental Inspector's maps, and the Project Archaeologist will be notified by telephone. Based upon a verbal description of the finding, the Project Archaeologist will determine whether field inspection is warranted. Resolution of the discovery issue will be reported in the Environmental Inspector's daily reports and to OPRHP.

If it is determined that the findings do not represent a significant cultural resource that warrants additional investigation, the Environmental Inspector will inform any involved government monitors and construction personnel that no further work is required. Suspended construction activities may then proceed with the concurrence of the Project's Environmental Inspector, and with his or her notification of the Construction Manager.

3.1.3 Identification of Potentially Significant Discoveries

If any artifacts or historic property remains are discovered that, in the judgment of the Environmental Manager and OPRHP, warrant additional investigation, the contract archaeologist will be called to review the discovery. Project personnel will discuss the location and nature of the discovery with the archaeologist. Visual barriers will be installed around the discovery area to protect it from disturbance.

If an archaeologist is not immediately available, and further work in the discovery area is not imminent, then photographs or drawings of the discovery may be mailed, delivered or transmitted by facsimile to the archaeologist for review. Based on the information provided, the archaeologist will determine if a visit to the area is required. If a site visit is required, the archaeologist will be expected to be on-site within 24 hours after notification.

If on-site archaeological investigations are required, the Environmental Inspector will notify the Construction Manager. No work that could affect the discovery will be performed until the archaeologist reviews the discovery.

The archaeologist will determine, based on the artifacts or historic property remains discovered, and based on the cultural sensitivity of the area in general, whether the discovery is potentially significant, and whether it requires immediate notification to OPRHP and other agencies or parties by telephone. If immediate notification is not required, or if other written information is required, data regarding the discovery will be transmitted by facsimile or sent by express mail, or similar expedited delivery, to these parties.

The archaeologist will consult and coordinate with OPRHP and other parties to propose procedures for treating and handling the discovery, and to clear the discovery area while minimizing impacts to the construction schedule to the extent possible.

Suspended construction activities in the discovery area may not proceed until approval has been obtained from the OPRHP and other involved agencies and parties, as appropriate, following completion of the agreed discovery-specific procedures. The concurrence of the Project's Environmental Manager and his or her notification of the Construction Manager, in writing, is required to re-start suspended construction activities in the discovery area.

3.2 Discoveries of Human Remains

If any historic or prehistoric human remains are discovered, they will probably be discovered in excavations. The treatment of any historic or prehistoric human remains encountered during construction will be in consultation with OPRHP, New York State Police and other local officials and interested parties. OPRHP policy recommends that human remains and grave goods should not be disinterred unless required in advance of some kind of disturbance, such as construction. In the event such disinterment is necessary, the following would apply:

- Disinterment, when necessary, should be done carefully, respectfully, and completely, in accordance with proper archaeological methods;
- In general, human remains and grave goods should be reburied in consultation with the descendants of the dead;
- Prior to reburial, scientific studies should be performed as necessary to address justified research topics;

- Scientific studies and reburial should occur according to a definite, agreed-upon schedule; and

- Where scientific study is offensive to the descendants of the dead, and the need for such a study does not outweigh the need to respect the concerns of such descendents, reburial should occur without prior study. Conversely, where the scientific research value of human remains or grave goods is determined by OPRHP to outweigh any objections that descendants may have to their study, they should not be reburied but should be retained for study.

Discovery, suspension of work, notifications and procedures are as follows:

1. If human remains are discovered by any personnel on the construction site, all construction work in the immediate vicinity that could affect the integrity of the discovery will be suspended.

2. The Environmental Inspector and the Construction Manager will be informed immediately, and notified of the exact location of the remains, as well as the time of discovery.

3. The Project's Environmental Inspector will be responsible for informing the Project's Environmental Manager, who will be responsible for contacting the contracted archaeologist.

4. The Project's Environmental Manager will be responsible for notifying the appropriate government agency officials and other parties listed in this Plan within 24 hours of the discovery.

5. Human remains may be excavated, if approved, in consultation with the OPRHP, State Police, and other involved agencies and parties as appropriate, pursuant to a discovery-specific written agreement between the Project and the involved parties that specifies the excavation methods to be used and the data to be recovered.

6. All discoveries will be protected until all of the appropriate parties have been contacted.

7. If Native American remains are found, the Project's Environmental Manager will work with OPRHP to notify affiliated Indian Tribes. The New York State Police will have the primary responsibility for contacting the appropriate medical officials and next-of-kin for recent human remains discoveries.

8. The procedures outlined by OPRHP will be followed to excavate, transport and store any human remains in a manner that respects and protects the sacred significance of the remains.

9. Suspended construction activities in the discovery area may not proceed until approval has been obtained for the OPRHP and other involved agencies and parties as appropriate, following completion of the agreed discovery-specific procedures. The concurrence of the Project's Environmental Manager and his or her notification of the Construction Manager in writing is required to re-start suspended construction activities.

4. Agency Notification Telephone Numbers and Addresses

If human remains are discovered, the appropriate federal, state and local agencies and officials will be informed within 24 hours of discovery. These will be notified at the telephone numbers listed below. If notifications are made during weekends, or at other times when telephones may not be monitored, information will be transmitted by facsimile, if available, to the listed numbers. Other written information may be sent to the listed addressed by express mail or a similar method of expedited delivery.

These parties will also be notified as required regarding the discovery of other significant cultural resources and historic properties.

Donald R. Parker, Orange County Coroner
PO Box 722
Port Jervis, NY 122771
845-856-5191

New York State Police
Troop F – Headquarters
55 Crystal Run Road
Middletown, NY 10941
845-344-5300

OPRHP
Peebles Island
P.O. Box 189
Waterford, New York 12188
Telephone: 518-237-8643, extension 255
Fax: 518-233-9049

APPENDIX K VISUAL RESOURCES

PRE-APPLICATION VIEWPOINT CONSULTATION

MEMORANDUM

To: Christina Palmero and Richard Powell, DPS
Chistopher Hogan and Rick Benas, DEC
Dr. Robert Kuhn, OPRHP
Don Neal, Calpine
David Divine, Calpine
Tom De Block, Supervisor, Town of Wawayanda
Dr. Robert Henshaw, for Wawayanda Citizens Advisory Group
Richard Guertin, Corporation Counsel, City of Middletown
Peter Garrison, Orange County Planning Department

From: Craig Wolfgang and Ingrid Young, TRC Environmental Corporation

Date: May 25, 2001

Subject: Wawayanda Energy Center Visual Assessment Consultation

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This memorandum addresses the requirement that the Wawayanda Energy Center ("Project") Article X application include a consideration of aesthetics, and specifically viewpoint selection. Stipulation 11, Clause 3(d) requires consultation with DPS Staff, NYSDEC and the Office of Parks, Recreation and Historic Preservation (OPRHP) in selecting the visual assessment points to be used in the analysis of potential visual impacts. This clause also requires input from local officials and the Wawayanda Citizens Advisory Group. This memo provides the background and information necessary to undertake that consultation.

Aesthetics considerations are inherently part of the environmental review process under the Public Service Law, which requires the Siting Board to issue a Certificate only if it finds that the Project "minimizes adverse environmental impacts, considering the interest of the state with respect to aesthetics." PSL §168.2(c)(i). The Siting Board regulations explicitly require an analysis of visual resources. 16 NYCRR 1001.3(b)1(iii). NYSDEC also issued a policy memorandum in July 2000 entitled Assessing and Mitigating Visual Impacts. Stipulation 11, entered into by Calpine, NYSDEC, DPS Staff, Town of Wawayanda, and Wawayanda Citizens Advisory Group specifies the analyses of visual resources and aesthetics to be conducted for the Project.

Consistent with Stipulation No. 11, Clause 1, the visual impact assessment relies, as appropriate, upon definitions and procedures outlined in:

- *Smardon, R. C., et al., Visual Resources Assessment Procedure for US Army Corps of Engineers, Instruction Report EL-88-1, prepared by State University of New York, Syracuse, for US Army Engineer Waterways Experiment Station, Vicksburg, MS, 1988 ("VRAP"); and*

- *NYSDEC Program Policy: Assessing and Mitigating Visual Impacts, DEP-00-2, 7/31/2000*

Consistent with the procedures set forth in Stipulation No. 11, visual impact will be assessed in terms of the anticipated change in visual resource, including whether there will be a change in character or quality of the view. The Visual Resources Assessment Procedure (VRAP) focuses first on establishing the visual quality of the existing landscape and establishing similarity zones; choosing representative locations; and assessing impacts on the basis of the representative locations. The NYSDEC visual resources policy complements this procedure by establishing what areas in New York State may be significant aesthetic resources; and presenting a broad range of mitigation alternatives for each affected resource.

Character and Visual Quality of the Existing Landscape

The project site is located in the Town of Wawayanda at an approximate elevation of 460 feet above mean sea level (msl). The central and most developed area of nearby Middletown ranges from 500-600 feet msl. Ridges surround the town to the north and northwest, with peaks as high as 1,000 feet msl. The topography slopes downward south and east of the site (across I-84) where elevations range from 400-600 feet msl.

Three residences are adjacent to the southeast corner of the property near the intersection of Dolsontown Road and McVeigh Road. An additional residence abuts the property along Dolsontown Road approximately 0.3 miles west of McVeigh Road. The proposed development of the site is considered to be compatible with the visual character of the adjacent land to the north, which includes a wastewater treatment facility, an electric substation, a vacant area proposed for use as a trash to ethanol facility and an existing 36 MW electric generating facility.

In general, areas to the south and east of the Project site are relatively undeveloped and consist of woods and fields, some of which appears to be farmland. Areas to the north and west of the site are more developed than those to the south and east (consisting of commercial, institutional and residential areas), yet are also largely vegetated with shrubs and trees.

Other notable features include: I-84, which runs west-east to the south of the Project site; the Wallkill River, located to the east and south of the Project site; Randall Airport, located approximately 1 mile east of the Project site; and an old railroad grade located north of the Project site.

Digital Elevation Modeling and Viewpoint Selection

A Digital Elevation Model (DEM) was used to identify areas within 5 miles from which the stack or other elements of the facility would be visible on the basis of lines-of-sight. A 3-mile radius is also

marked on viewshed mapping for consistency with the stipulations. The model incorporated the proposed stack location based on facility arrangement drawings and a stack height of 225 feet. Preliminary screening did not incorporate the effects of vegetation on visibility. Further models were performed to incorporate vegetation and other important land factors.

Within 5 miles of the site, the selection of viewpoints will be the result of mapping the potential aesthetic resources together with the potential receptor areas identified by the DEM. A broad list of "candidate" viewpoints has been compiled from within areas that the DEM suggests should be studied further and that also carry potential for high frequency exposure. Viewpoints were also selected in areas where the Project is not predicted to be seen, in order to verify the computer-generated analysis and to present a balanced assessment of overall visual impact potential.

Viewshed Mapping Methodology

The stack locations were given in UTM coordinates and created a Shapefile using ArcView. An assigned height of 68.58 meters (225 ft) was provided to each stack. ArcView generated a 5-mile buffer around the north stack. This was assuming that the difference between a 5-mile buffer around the south stack would be negligible.

Aerial photos were then downloaded from the New York State GIS Clearinghouse website (<http://www.nysgis.state.ny.us/>). DEMs were ordered from the USGS (<http://edc.usgs.gov/webglis>) in their native "DEM" format. Cell (pixel) size = 10 meters. Utilizing ArcINFO, DEMs were converted to ArcINFO's proprietary "grid" format and pasted together in mosaic form, whereby adjacent DEMs were joined. The resulting grid was then clipped to the 5-mile buffer. A "visibility" command was issued (in ArcINFO) which assigns a value of "yes" or "no" to each pixel in the grid, based on the probable visibility from one or both stacks. If either stack (or both stacks) are visible from the pixel the result will be "yes," and if neither stack is visible, it will be "no." The grid was then converted to polygon coverage in ArcINFO which displays the visible areas with a transparent pattern rather than a solid color. (Typically ArcView will only display grids in solid colors.) Finally, a program software called ERMapper was utilized to mosaic the 32 aerial photos from the NYS GIS Clearinghouse website and convert the result to a compressed format that can be read by ArcView using an ERMapper plugin. The final map was created within ArcView and it incorporated the aerials along with the "visible areas" polygon coverage overlaid.

Landscape Similarity Zones

The VRAP Management Classification System methodology for identifying regional landscapes relies on existing data regarding large-scale physical domains, which, together with man-made alterations, form the overall visual quality of the surrounding landscape. Landscape character is

largely determined by the topography, land use, vegetation and water features that define and contribute to the available vistas and views.

Six landscape similarity zones have been identified for the area within a 5-mile radius of the Wawayanda Energy Center site. A map of the landscape similarity zones is provided as an attachment to this memorandum. The zones are as follows:

Rural Development/Forest: This zone is marked by low to moderate terrain, extensive tree cover obstructing distant views, nearby water resources, and low density rural development, typically limited to road frontage lots. This zone is traversed by secondary and local roads. Many of the local lakes that are surrounded by large portions of undisturbed forest areas are included in this zone.

Rural Development/Agriculture: This zone is marked by flat, mostly open land, with vegetation along the edges or between fields, helping to define the space. Associated low density, rural development along road frontages and at the various crossroads is included in this zone. Distant views are possible but may be limited by the interspersed pockets of forest vegetation. In the case of farmland and orchards near Interstate 84, high-voltage transmission lines are very prominently visible above the horizon.

Suburban Development: The suburban development zone is not uniform with respect to intensity of development or canopy cover, but is uniform with respect to residential and small-scale commercial land use, flat to moderately hilly terrain, and a general absence of water. Development patterns are typical of tract-type subdivisions along with older residential areas adjacent to the urban center of Middletown and multi-family complexes. Some community facilities such as neighborhood parks, schools and athletic fields are included in this zone. In the older communities, tree canopies are ubiquitous wherever the spacing of development allows. Distant views are limited by screening from vegetation and from other structures. In newer communities, screening occurs primarily from adjacent structures.

Urban Center: This zone includes the downtown areas of Middletown and Goshen, characterized by multi-story commercial, residential and municipal buildings. The density of development limits vegetation in these areas, and typical views are limited to the nearby streetscape.

Commercial/Industrial Corridor: Although residences can be located within this zone, commercial and retail uses predominate. There is little canopy cover, but views are mostly typically diverted to the development that lines the roadway. Terrain is typically flat; water – absent. Development is predominantly built around major two-lane thoroughfares. Commercial corridors include the area to the north of the I-84/Route 17 interchange, Route 211 to the east and west of Route 17, and Route 6/Route 17M to the north and south of I-84.

Highway Corridor: I-84 and Route 17 pass through a series of dissimilar landscapes. However, the width of these highways, the vegetation that lines the sides of the right-of-way, the speed of travel,

and the competing attention that is required of drivers combine to make the roadway itself the primary visual focus, and adjacent uses secondary, even when views are available.

Viewpoint Selection Process

Viewpoint selection will be based on several criteria outlined in the stipulation, each of which is addressed below.

- *Representative or typical views from unobstructed or direct line-of-sight views.* The purpose of this criterion, as well as of the VRAP procedure followed by this study, is to be able to make impact assessments that are representative of other, similar landscapes without visiting every point within the area of potential visibility.
- *Significance of viewpoints, especially historic sites, high public use areas, parks and scenic outlooks, including areas listed in the NYSDEC Policy.* Areas listed pursuant to federal and state policy (NYSDEC guidance) have all been included to the extent they fall within the potential viewshed area. Areas significant to NYSDEC guidance include; National or State Historic Register Places, State Parks, Urban Cultural Parks, State Forest Preserves, National Wildlife Refuges, National Natural Landmarks, National Park Areas, National or State Wild and Scenic Rivers, State Scenic Roads, Scenic Areas of Statewide Significance, Federally Designated Trail, Adirondack Park Scenic Vista, State Nature and Historic Preserve, Palisades Park, and Bond Act Property.
- *Level of viewer exposure, i.e., frequency of viewers or relative numbers, including residential areas, or high-volume roadways.* Three types of viewers have been identified. For through travelers, specific highway viewpoints will be assessed. For recreational users, viewpoints often coincide with those that would be required under the NYSDEC policy used in this study. For local residents, consideration will be given to building height (which increases potential number or frequency of viewers) and to density of development.
- *For views beyond 3 miles, the portion of the facility that may be visible.*
- *Proposed land uses.* Proposed land use trends are generally toward development. As previously stated, for any proposed viewpoint, the future land use is considered in order to assess whether proposed land use changes may render a location unrepresentative of its landscape zone.
- *Input from local public sources.* Consultation is the purpose of this memorandum, which is being sent to representatives of the Town of Wawayanda, City of Middletown, Wawayanda Citizens Advisory Group, and Orange County.

Potential visual resources were identified by consulting various on-line and agency databases as well as through field review. A review of the National Register of Historic Places (NRHP) and State Register of Historic Places (SRHP) indicates that there are ten listed historic sites within a 5-mile radius surrounding the Project site, as well as 22 sites deemed eligible for listing. In addition, this visual study includes viewpoints representative of all buildings within the Project viewshed that meet first-screen criteria, (ie. structures that are 50 years or older) for potential National Register eligibility.

A review of the area within 5 miles of the project site was conducted to determine the location of the nearby sensitive receptors such as residential areas. This review was conducted using the USGS Wawayanda Quadrangle, aerial photographs taken in 1994-1998, supplemental consultation with the City of Middletown, and a drive-by field reconnaissance. A number of local and county parks and recreation areas were also identified on the USGS Quadrangle map and field reconnaissance.

A total of 83 candidate viewpoints have been identified to ensure that an adequate representative pool exists from which viewpoints could be selected for further assessment and preparation of photosimulations (renderings). Table 1 is a list of all the proposed viewpoints, identified by landscape similarity zone(s), scenic resource (if any), viewer group, and amount of stack potentially visible.

Balloon Demonstrations

A balloon demonstration was conducted on Friday, April 20, 2001, to assist in the determination of potential project visibility from selected viewpoints. After a few technical difficulties in the morning, the balloon demonstration proceeded at approximately 10:30 am. The morning was clear, with a slight wind and a forecast for increasing clouds and wind. Visibility of the balloon along I-84 was confirmed and photographs were taken from both eastbound and westbound lanes. The northeast quadrant was visited next, and the lack of visibility was confirmed from the I-84/Route 17 interchange area and the residential areas to the east of Route 17. Similarly, the lack of potential visibility was confirmed from the Silver Lake area and several inventoried locations to the north of Middletown. TRC had received a faxed transmittal from the City of Middletown late the evening before, and specific efforts were made to get to those areas identified (mostly residential streets along ridge lines at higher elevations). Visibility from most of the locations is limited by mature, deciduous vegetation and distance. Potential visibility is severely limited from Kennedy Terrace, Euclid Avenue and Vincent Drive, and the balloon was not seen from any of these locations.

During this time, another reviewer headed to Goshen and other areas to the south of the project site. Photos were taken from a few areas where visibility was unimpeded, but these efforts again confirmed a lack of potential visibility from most of the outlying areas.

By 1:00 pm the field review effort had proceeded to Heidt Avenue, which offered a clear view of the balloon since the street is oriented directly toward the project site. As the balloon was observed, extreme movement was noted, caused by the winds that had picked up in intensity at this time. The reviewers returned to the Project site and observed the extreme movement caused by the wind, which at times pushed the balloon down to a height of less than 100 feet above the ground. It was concluded that further observations would be fruitless for determining potential visibility, and the balloon was taken down at approximately 2:00 pm.

Considering the limited success of the demonstration, it was decided to repeat this effort to complete the visual assessment and to obtain more photographs to provide a basis for photosimulations and further assessment. For the follow-up effort, it was decided that the field review would concentrate on the near-field areas where visibility will be most readily available to ensure an ample number of photographs to illustrate the potential visibility of the project.

The follow-up balloon demonstration was conducted on Tuesday, May 1. TRC arrived at the site at approximately 8:30 a.m. and had the balloon in the air by 9:30 a.m. TRC personnel proceeded to evaluate the identified visual assessment points. Simultaneously, due to the very high number of buildings in Middletown, Goshen, and the general vicinity that appeared to be more than 50 years old (a first-screen for potentially eligible historic resources), a TRC reviewer visited all such buildings and districts (several hundred sites) to ascertain any potential visibility from these areas. After an early-afternoon balloon failure, additional helium was obtained locally, and the back-up balloon was in the air at about 2:30 p.m. Assessment of additional visual assessment points was completed during the remainder of the afternoon. In response to comments provided by the Wawayanda Citizens Advisory Group, the balloon was kept aloft until approximately 8:00 p.m. to allow area residents to make their own observations following their workday.

Photograph Locations

The photographs taken during the balloon demonstrations on April 20 and May 1 have been assembled into Word documents for ease of electronic transmission (for those parties who desire to receive them electronically), and to serve as a basis for the required consultation meeting with agency staff and local representatives. The photograph locations are for the most part a subset of the 83 candidate viewpoints. Some additional locations from prominent viewpoints were taken in the field and have been included.

Wawayanda Energy Center

Table 1: Candidate Viewpoints for Pre-Application Consultation

ID	Description of Viewpoint	LSZ	Scenic/ Historic	Viewers	Visible	Analysis
1	Shannon Park	Rural/ Agriculture		Recreational & Local	None	
2	Minisink School Valley Facility	Rural/ Agriculture		Local	None	
3	Maple Hill Park	Suburban Residential		Recreational & Local	None	
4	Amchir Park	Suburban Residential		Recreational & Local	None	
5	Bennett Hill Park	Urban Center		Local	None	
6	Academy Park	Urban Center		Local	None	
7	Thrall Park	Urban Center		Local	None	
8	Beattie Hill Park	Urban Center		Local	None	
9	Orange County Golf Club	Rural/ Agriculture		Recreational	Stacks	
10	Un-named park	Suburban Residential		Recreational & Local	Stacks*	
11	Fancher-Davidge Park	Suburban Residential		Recreational & Local	None	
12	Watts Memorial Park	Suburban Residential		Local	None	
13	Sproat Street Park	Urban Center		Local	None	
14	Linden Ave Park	Urban Center		Local	None	
15	Jerry's Park	Urban Center		Local	None	
16	Chappell Park	Urban Center		Local	None	
17	County Fairgrounds	Suburban Residential		Recreational & Local	None	
18	Un-named Park	Residential		Local	None	
19	Monhagen Brook	Rural/ Agriculture	Scenic	Local	Bldgs + Stacks	
20	Wallkill River	Rural/ Agriculture	Scenic	Local	Bldgs + Stacks	
21	Orange County Community College	Urban Center		Local	Bldgs + Stacks *	

ID	Description of Viewpoint	LSZ	Scenic/ Historic	Viewers	Visible	Analysis
22	Lake Pocatello	Rural/ Forest	Scenic	Local	None	
23	Monhagen Lake	Rural/ Forest	Scenic	Local	None	
24	Highland Lake	Rural/ Forest	Scenic	Local	None	
25	Shawangunk Lake	Rural/ Forest	Scenic	Local	None	
26	Ridgebury Lake	Suburban Residential	Scenic	Local	None	
27	Hillside Cemetery	Suburban Residential	NRHR# 94001027	Local	Veg-Obstruct*	
28	St. Joseph's Cemetery	Urban Center		Local	None	
29	Morrison Hall/ Web Horton House	Urban Center	NRHR# 90000690	Recreational & local	Veg-Obstruct*	
30	Edwin Welling Van Duzer Memorial House	Urban Center		Local	None	
31	Oliver Ave Bridge	Suburban Residential	NRHR# 84002882	Local	None	
32	The First Baptist Church of Bloomfield	Rural/ Agriculture	NRHR# 76001260	Local	None	
33	1841 Goshen Courthouse	Urban Center	NRHR# 75001219	Local	None	
34	Historic Track	Urban Center	NRHR# 66000560	Local	None	
35	U.S. Post Office on Grand Street	Public Center	NRHR# 88002527	Local	None	
36	Church Park Historic District	Urban Center	NRHR# 80002735	Recreational & Local	None	
37	District School # 9, "Old Stone Schoolhouse"	Rural/ Agriculture	NRHR# 88001451	Local	None	
38	Dutchess Quarry Cave Site [1]	Rural/ Agriculture	NRHR# 74001289	Recreational/ archaeological	None	
39	Interstate 84 westbound	Highway Corridor		Motorists	Bldgs+ Stacks	
40	Interstate 84 eastbound	Highway Corridor		Motorists	Bldgs+ Stacks	

ID	Description of Viewpoint	LSZ	Scenic/ Historic	Viewers	Visible	Analysis
41	From Route 6 at 17M	Commercial Corridor		Motorists	Bldgs+ Stacks	
42	Eastern view from Canterbury Dr.	Suburban Residential		Local	Stacks	
43	From Golf Links Rd and 17 M looking north	Commercial Corridor		Local/motorists	None	
44	Randall Airport	Rural/ Agriculture		Local/motorists	Stacks	
45	Masada Project Site	Commercial Corridor		Local	Bldgs+ Stacks	
46	Highview Ave	Urban Center		Local	None	
47	De Block Road	Rural/ Agriculture		Local/motorists	None	
48	Route 17	Commercial Corridor		Motorists	Stacks*	
49	Middletown Psychiatric Historic District	Suburban Residential	Eligible NRHP Listed SRHP	Local/motorists	None	
50	Mid-Hudson Psychiatric Center Historic District	Rural/ Agriculture	Eligible NRHP Listed SRHP	Local/motorists	None	
51	94 Maples Road, Wallkill	Rural/ Forest	Eligible NRHP	Local/motorists	None	
52	105 Maples Road, Wallkill	Rural/ Forest	Eligible NRHP	Local/motorists	None	
53	220 Maples Road, Wallkill	Rural/ Forest	Eligible NRHP	Local/motorists	None	
54	Holmes Brookstaver House, Crotty Road, Wallkill	Rural/ Agriculture	Eligible NRHP	Local	None	
55	Frank Post House, Crotty Road	Rural/ Agriculture	Eligible NRHP	Local	None	
56	Joseph Slaughter House, Goshen Tkp, Wallkill	Suburban Residential	Eligible NRHP	Local/motorists	None	
57	11 Webster Ave, Goshen	Urban Center	Eligible NRHP	Local/motorists	None	

ID	Description of Viewpoint	LSZ	Scenic/ Historic	Viewers	Visible	Analysis
58	Bennett House 29 Court Lane, Goshen	Urban Center	Eligible NRHP	Local/Motorists	None	
59	County Trust Bank, West Main St, Goshen	Urban Center	Eligible NRHP	Local/motorists	None	
60	Gavin Building, Greenwich Ave, Goshen	Urban Center	Eligible NRHP	Local/motorists	None	
61	Goshen Town Hall, 15 Webster Ave	Urban Center	Eligible NRHP	Local/motorists	None	
62	Johnic Pharmacy, 62 West Main Street, Goshen	Urban Center	Eligible NRHP	Local/motorists	None	
63	Norstar Bank, 54 West Main Street, Goshen	Urban Center	Eligible NRHP	Local/motorists	None	
64	Houston House, NY 17A, Goshen	Rural/ Agriculture	Eligible NRHP	Local/motorists	None	
65	Sanford House, 4 West Street, Goshen	Urban Center	Eligible NRHP	Local/motorists	None	
66	Saver House, 9 New Street, Goshen	Urban Center	Eligible NRHP	Local/motorists	None	
67	John Wells Homestead, 6 ½ Station Rd	Rural/ Agriculture	Eligible NRHP	Local	None	
68	Route 17 at Wallkill River	Highway Corridor	Special visual area	Motorists	None	
69	Pyramid Mall, Interstate 84/Route 17	Commercial Corridor	Special visual area	Motorists/local	None	
70	State Route 84 east of Middletown	Highway Corridor	Special visual area	Motorists	None	
71	David Moore Heights on David Moore	Suburban Residential		Local	Stacks	
72	Horton Hospital	Urban Center		Local	Stacks	
73	Sutton Hill Apt on Cobb Lane	Suburban Residential		Local	Stacks	

ID	Description of Viewpoint	LSZ	Scenic/ Historic	Viewers	Visible	Analysis
74	Mountain Ave	Suburban Residential		Local	Stacks*	
75	Beers Drive	Suburban Residential		Local	Stacks	
76	Heidt Ave	Suburban Residential		Local	Stacks*	
77	Kennedy Terrace	Suburban Residential		Local	None	
78	Highland Ave	Urban Center		Local	Stacks*	
79	Euclid Ave	Suburban Residential		Local	Stacks*	
80	Dogwood Dr	Suburban Residential		Local	Stacks*	
81	Vincent Drive	Suburban Residential		Local	Stacks	
82	Ryerson Road	Rural/ Agriculture		Local/motorists	Bldgs+ Stacks	
83	Pinehill Cemetery	Commercial Corridor		Local/motorists	Stacks	

* Views of the entire facility would generally be obstructed by vegetation; however, isolated breaks in vegetation would allow view of portions of the facility.

[1] Location of viewpoint is restricted

MEMORANDUM

To: **Tina Palmero, NYSDPS**

From: **Ingrid Young, Craig Wolfgang**
TRC Environmental Corporation

Date: **June 6, 2001**

Subject: **Wawayanda Energy Center – Visual Assessment**
Response to Comments provided May 31, 2001

As we discussed during our phone conversation on June 1, 2001, the following responses are provided for your information and review.

Comment 1: [Please provide] All photos that were taken that show balloon (project) visibility. These photos should be numbered and keyed to a map if they do not correspond to Table 1 and the accompanying viewshed map already provided. On each photo, please indicate balloon location.

Response: The photos that were previously provided with the Memo on May 25, 2001 included all of the photos taken on either April 20, 2001 or May 1, 2001 that show the balloon.

Comment 2: [Please provide] For the 23 photos provided, a corresponding table that provides the type of information summarized in Table 1 (description, LSZ, Scenic/ Historic, Viewers, Visibility).

Response: A revised Table 1 providing the requested information is attached to this memo.

Comment 3: [Please provide] An indication of the photos that are being proposed for simulation and the rationale for each photo selected.

Response: The following photos have been selected for the preparation of photosimulations:

Photo # 1 Dolsontown Road adjacent to site approximately 100'west, in a rural/agricultural setting, with local and motorist viewers. Full visibility of project stacks and buildings.

Photo # 10 David Moore Apartments, approximately 3000' north of the site, in a suburban residential setting, with local viewers. Partial visibility of project stacks.

Photo # 22 Westbound Interstate 84, south of the site in a highway corridor, with motorist viewers. Partial visibility of project stacks and buildings.

Photo # 6 Playtogs Plaza, west of the site in a commercial/industrial corridor, with motorist viewers. Partial visibility of project stacks

Photo # 7 Route 17M, south of site in a commercial/industrial corridor, with motorist viewers. Partial visibility of project stacks.

The above-listed photographs were selected based on the following criteria;

- proximity to the proposed site
- represented LSZ
- represented viewer
- available project visibility

Comment 4: [Please provide] Further details on the method /models for incorporating areas of vegetation and other land factors into the viewshed.

Response: The locations of the stacks were provided in UTM coordinates (by Stephan) and from these coordinates a Shapefile was created using ArcView. A height of 68.58 meters (225 ft) was assigned to each stack. ArcView was then used to generate the 5-mile buffer around the north stack (It was assumed that the difference between a 5-mile buffer around the south stack would be negligible)

DEMs were ordered from the USGS (<http://edc.usgs.gov/webglis>) in their native "DEM" format. Cell (pixel) size = 10 meters.

Color aerial photos were downloaded from the New York State GIS Clearinghouse website (<http://www.nysgis.state.ny.us/>).

Using ERMapper, a mosaic of the aerial photos was assembled to create a single image. Then, using ENVI, a supervised classification of the image was performed in order to extract the "wooded" areas. The wooded areas were made into a new layer and assigned a height of 30 feet in rural areas and 20 feet in urban areas. (Urban areas were delineated using 1990 census data - block groups having population densities greater than 800 persons per sq mile were assigned urban)

Using ArcINFO, DEMs were converted to ArcINFO's proprietary "grid" format and mosaiced together (adjacent dems were joined). The resulting grid was then reprojected to UTM zone 18 NAD83 (to match the aerial) and clipped to the 5-mile buffer.

This clipped grid was then resampled to a 1 meter pixel resolution because the aerial photo has a 1 meter resolution and, therefore, so does the "wooded" layer that was extracted from it. This allowed the wooded layer to be properly overlayed on the DEM.

Next, the "visibility" command was issued (in ArcINFO) which assigns a value of 2, 1, or 0 to each pixel in the grid based on whether or not it can see at least one stack. If you can see both stacks from the pixel the resulting value will be 2, if you can see only one of the stacks the

resulting value will be 1 and so on. Most of the time if you could see one you could see both (i.e. hardly any "1" values) so the pixels representing visible areas were shaded all the same (red areas on the map).

The final map was created in ArcView incorporating the aerials (displayed in grayscale) along with the "visible areas" (red), and the areas assumed to be "wooded" (green).

Comment 5: [Please provide] An enlarged viewshed map without the effects of vegetation screening.

Response: The requested viewshed map will be provided at the scheduled June 14, 2001 meeting.

Wawayanda Energy Center

Table 1: Photo Locations and Corresponding Viewpoints

Photo Location Number	VAP Number	Description of Viewpoint	LSZ	Scenic/ Historic	Viewers	Visible
1	N/A	Dolstontown Rd.	Rural/Agriculture		Local/ motorists	Bldgs+ stacks
2	N/A	Dolstontown Rd.	Rural/Agriculture		Local/ motorists	Bldgs+ stacks
3	N/A	Dolstontown Rd.	Rural/ Agriculture		Local/ motorists	Bldgs+ stacks
4	N/A	Genung Street	Rural Agriculture		Motorists	Stacks
5	83	Pinehill Cemetery	Rural Agriculture		Local	Stacks
6	48	Playtogs Plaza	Commercial/ Industrial		Motorists	Stacks
7	N/A	Route 17M south of Interstate 84	Commercial/Industrial		Motorists	Stacks
8	45	Masada Project	Commercial/ Industrial		Local	Stacks
9	73	Sutton Hill Apartments	Suburban Residential		Local	Stacks
10	71	David Moore Apartments	Suburban Residential		Local	Stacks
11	75	Beers Drive	Suburban Residential		Local	None
12	74	Mountain Ave.	Suburban Residential		Local	Stacks*
13	76	Heidt Ave.	Suburban Residential		Local	Stacks*
14	80	Dogwood Drive	Suburban Residential		Local	Stacks*
15	72	Horton Memorial Hospital	Urban Center		Local	Stacks
16	29	Morrison Hall	Urban Center	NRHR# 90000690	Recreational & Local	None
17	3	Maple Hill Park	Suburban Residential		Recreational & Local	None
18	4	Amchir Park	Suburban Residential		Recreational & Local	None
19	9	Orange County Golf Club	Rural/ Agriculture		Recreational	None
20	10	Belmont Park	Suburban Residential		Recreational & Local	None
21	40	Interstate 84 Eastbound	Highway Corridor		Motorists	Bldgs+ Stacks
22	39	Interstate 84 Westbound	Highway Corridor		Motorists	Bldgs+Stacks
23	82	Ryerson Rd.	Rural/ Agriculture		Local/ Motorists	Stacks

*Views of the entire facility would generally be obstructed by vegetation: however, isolated breaks in vegetation would allow view of portions of the facility

Note: N/A implies that there is no VAP location to correspond with photo location

MEMORANDUM

To: Christina Palmero and Richard Powell, DPS
Chistopher Hogan and Rick Benas, DEC
Dr. Robert Kuhn, OPRHP
Don Neal and David Devine, Calpine
Tom De Block, Supervisor, Town of Wawayanda
Ann Yeats and Barbara Parsons, Wawayanda Planning Board
Deborah Glover (10 copies) for Wawayanda Citizens Advisory Group
Richard Guertin, Corporation Counsel, City of Middletown
Peter Garrison, Orange County Planning Department

From: Craig Wolfgang and Ingrid Young, TRC Environmental Corporation

Date: July 13, 2001

Subject: Wawayanda Energy Center Visual Assessment Consultation

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This memorandum describes Calpine's viewpoint selection process to date pursuant to Stipulation 11, Clause 3(d), which requires consultation with DPS Staff, NYSDEC and the Office of Parks, Recreation and Historic Preservation (OPRHP) is required in selecting the visual assessment points to be used in the analysis of potential visual impacts. This clause also requires input from local officials and the Wawayanda Citizens Advisory Group. The purpose of the memorandum is to inform state and local officials of additional viewpoints that have been considered through local input, and to outline the process for finalizing the viewpoint selection with state regulatory agencies.

On June 14, 2001 the NYSDEC hosted a meeting in Albany, NY for Calpine, DPS, Wawayanda Citizens Advisory Group and TRC. The meeting was forum to discuss the photo locations, the view-shed map, and incorporating the local concerns brought forth about the general facility views.

The following viewpoints were suggested by members of the DPS and the Wawayanda Citizens Advisory Group at the meeting on June 14, 2001.

- Southeast Towers Senior Citizens Apartments (near Southwinds building and Post Office)
- A northern view at the most open location along Greeves Road
- A northern view from the vicinity of Snake Hill
- A northern view from the vicinity of Guinea Hill
- An eastern view from Overlook Apartments off of Route 17M, south of Playtogs Plaza

- A southern view from the steps of the Bio-Science Building at the Orange County Community College (VAP 21)
- Northwest view from at an undetermined location along Route 17M

Photos to be revised and taken from a slightly different location include the following

- Photo 1 (Dolsontown Road) adjust angle to allow for a view of the whole facility (in this case the computer simulation)
- Photo 21 (Interstate 84 eastbound)
- Photo 22 (Interstate 84 westbound)

On June 27, 2001 a presentation was given in Middletown, NY to the Wawayanda Citizens Advisory Group. This presentation covered the viewpoints inventory, and a discussion on photo locations and photo-simulation options.

The following new viewpoints were suggested by members of the Wawayanda Citizens Advisory Group at the presentation on June 27.

- A northern view from Bates Gates Road.
- An eastern view from the corner of Apple Lane Drive and Kirby Town Road
- A northern view from the intersection of McVeigh and Ryerson Road
- Seward Rd near Elvree Farm

Other suggestions made by the WCAG request a discussion of the potential impacts of the electric transmission line connecting the proposed facility, and to incorporate these lines into the photo simulations. Additional photographs may be taken along Dolsontown Road to present potential views of the electric transmission line. In addition, we will be providing, in the Article X application, elevation drawings of the facility from each perspective (north, south, east and west).

A forthcoming field visit will be made to obtain additional photographs from the suggested viewpoints listed above. Following this additional field visit, a final determination will be made of the viewpoints selected for photosimulations. From the viewpoints selected for photosimulations, a subset of photos will be chosen for simulation of the proposed facility in conjunction with the Masada Project. Another subset of photos will be selected for simulation of the proposed facility showing typical stack plume.

VISUAL RESOURCES ASSESSMENT PROCEDURE FORMS

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System X
Used for Visual Impact Assessment —

Similarity Zone Highway Corridor — Inventory X
Basic X — Forecasting —
Detailed —
Location _____ — Date & Time August 2001
Viewpoint ___ Zone ___ — Weather _____
With Plan ___ W/o Plan ___ — Personnel Young

WATER Absent

Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	None	(Little)	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	(Rural)	(Suburban)	Urban
Type:	Recreational	Agricultural	Residential	Commercial	Industrial (Highway)
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	Primary Rd.	(Highway)
USER ACTIVITY					
Degree:	Low		Medium		(High)
Frequency:	Low		Medium		(High)
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	(Not)		Somewhat		Very
SOUNDS					
Degree:	Absent		Present		(Dominant) traffic noise
Type:	(Discordant)		Inconspicuous		Harmonious
SMELLS					
Degree:	(Absent)		Present		Dominant
Type:	Discordant		Inconspicuous		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

VISUAL RESOURCE SUMMARY/DESCRIPTION

FORM 1

Used for Management Classification System X
Used for Visual Impact Assessment ___

Similarity Zone Rural agriculture
Basic X
Detailed ___

Inventory ___
Forecasting ___

Location _____
Viewpoint ___ Zone ___
With Plan ___ W/o Plan ___

Date & Time August 2001
Weather _____
Personnel Young

In your own words, describe the visual resource of the zone. In doing so, try to describe the elements that unify the area so that it can be considered a zone. Make note of other aesthetic characteristics that are present.

Wallkill River present, Ridgebury lake (surrounded by subdivisions)
Agriculture dominates landuse, well-maintained landscapes, clustered residential development

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System X
Used for Visual Impact Assessment —

Similarity Zone Rural Agriculture — Inventory X
Basic ✓ — Forecasting —
Detailed —
Location _____ — Date & Time August 2001
Viewpoint ___ Zone ___ — Weather _____
With Plan ___ W/o Plan ___ — Personnel YOUNG

WATER					
Resource:	Stream	(River)	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	(Meander)	Swift	Rapid	Falls
Scale:	(Small)		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	<25%	25-50%	(50-75%)	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	(Rural)	Suburban	Urban
Type:	Recreational	(Agricultural)	Residential	Commercial	Industrial
ACESS					
Type:	Trail	Walkway	(Scndry. Rd.)	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	(Low)		Medium		High
Frequency:	Low		(Medium)		High
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
SMELLS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		Inconspicuous		(Harmonious)
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? (Yes) No

VISUAL RESOURCE SUMMARY/DESCRIPTION FORM 1

Used for Management Classification System X
Used for Visual Impact Assessment —

Similarity Zone	Rural forest	Inventory	X
Basic	X	Forecasting	—
Detailed	—		

Location	_____	Date & Time	August 2001
Viewpoint ___	Zone ___	Weather	_____
With Plan ___	W/o Plan ___	Personnel	YOUNG

In your own words, describe the visual resource of the zone. In doing so, try to describe the elements that unify the area so that it can be considered a zone. Make note of other aesthetic characteristics that are present.

Predominant uniform vegetation ~ 35-40' trees
diciduous forest
4 small lakes, minimal development, isolated
subdivisions

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System X
Used for Visual Impact Assessment —
Similarity Zone Rural Forest — Inventory X
Basic X — Forecasting —
Detailed —
Location _____ Date & Time August 2001
Viewpoint ___ Zone ___ Weather _____
With Plan ___ W/o Plan ___ Personnel YOUNG

WATER					
Resource:	Stream	(River)	(Lake/Rsrvr.)	Wetlands	Marine
Movement:	None	(Meander)	Swift	Rapid	Falls
Scale:	(Small)		Medium		Large
LANDFORM					
Type:	Coastal	Plains	Rolling Hills	(Hills)	Mountains
VEGETATION					
Cover:	0	<25%	25-50%	(50-75%)	75-100%
Diversity:	None	(Little)	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	(Rural)	Suburban	Urban
Type:	Recreational	Agricultural	(Residential)	Commercial	Industrial
ACESS					
Type:	Trail	Walkway	(Scndry. Rd.)	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	(Low)		Medium		High
Frequency:	(Low)		Medium		High
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	(Not)		Somewhat		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
SMELLS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
VISIBILITY					
Amount:	(Screened)		Partially Screened		Panorama
Position:	Inferior		Normal		(Superior)

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

VISUAL RESOURCE SUMMARY/DESCRIPTION

FORM 1

Used for Management Classification System X
Used for Visual Impact Assessment ___

Similarity Zone Suburban Residential Inventory ___
Basic X Forecasting ___
Detailed ___

Location _____ Date & Time August 2001
Viewpoint ___ Zone ___ Weather _____
With Plan ___ W/o Plan ___ Personnel YOUNG

In your own words, describe the visual resource of the zone. In doing so, try to describe the elements that unify the area so that it can be considered a zone. Make note of other aesthetic characteristics that are present.

Residential areas are well vegetated predominantly deciduous trees - some evergreens neighborhoods are well maintained

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System X
Used for Visual Impact Assessment
Similarity Zone Suburban Residential Inventory X
Basic X Forecasting —
Detailed —
Location _____ Date & Time August 2001
Viewpoint ___ Zone ___ Weather _____
With Plan ___ W/o Plan ___ Personnel Young

WATER Absent					
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	<25%	(25-50%)	50-75%	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	(Suburban)	Urban
Type:	Recreational	Agricultural	(Residential)	(Commercial)	Industrial
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	Low		Medium		(High)
Frequency:	Low		Medium		(High)
LITTER/POLLUTION					
Degree:	Low		(Medium)		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		Inconspicuous		(Harmonious)
SMELLS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		Normal		(Superior)

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? (Yes) No Oliver Ave Bridge. Hillside Cemetery

VISUAL RESOURCE SUMMARY/DESCRIPTION FORM 1

Used for Management Classification System X
Used for Visual Impact Assessment —

Similarity Zone Urban Center
Basic X
Detailed —

Inventory —
Forecasting —

Location _____
Viewpoint — Zone —
With Plan — W/o Plan —

Date & Time August 2001
Weather _____
Personnel YOUNG

In your own words, describe the visual resource of the zone. In doing so, try to describe the elements that unify the area so that it can be considered a zone. Make note of other aesthetic characteristics that are present.

Public Usese - Orange County Community College
major streets are generally narrow and congested.
Unkempt residential areas, older downtown buildings need renovation

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System X
Used for Visual Impact Assessment —

Similarity Zone Urban Center — Inventory X
Basic X — Forecasting —
Detailed —
Location _____ — Date & Time August 2001
Viewpoint ___ Zone ___ — Weather _____
With Plan ___ W/o Plan ___ — Personnel Young

WATER Absent					
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	<25%	(25-50%)	50-75%	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	Suburban	(Urban)
Type:	Recreational	Agricultural	(Residential)	Commercial	Industrial
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	Low		Medium		(High)
Frequency:	Low		Medium		(High)
LITTER/POLLUTION					
Degree:	Low		(Medium)		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	(Discordant)		Inconspicuous		Harmonious
SMELLS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		Normal		(Superior)

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? (Yes) No Morrison Hall

VISUAL RESOURCE SUMMARY/DESCRIPTION

FORM 1

Used for Management Classification System X
Used for Visual Impact Assessment —

Similarity Zone Commercial/Industrial
Basic X
Detailed —

Inventory —
Forecasting —

Location _____
Viewpoint ___ Zone ___
With Plan ___ W/o Plan ___

Date & Time August 2001
Weather _____
Personnel Young

In your own words, describe the visual resource of the zone. In doing so, try to describe the elements that unify the area so that it can be considered a zone. Make note of other aesthetic characteristics that are present.

Heavily traveled area with shopping plazas & malls, some light industry. Lack of vegetation screening - mostly paved areas & some open lots

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System X
Used for Visual Impact Assessment ___

Similarity Zone Commercial Industrial Inventory X
Basic X Forecasting ___
Detailed ___
Location _____ Date & Time August 2001
Viewpoint ___ Zone ___ Weather _____
With Plan ___ W/o Plan ___ Personnel Young

WATER Absent

Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	(Plains)	Rolling Hills	Hills	Mountains
VEGETATION					
Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	(None)	Little	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	Suburban	(Urban)
Type:	Recreational	Agricultural	Residential	(Commercial)	(Industrial)
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	Low		Medium		(High)
Frequency:	Low		Medium		(High)
LITTER/POLLUTION					
Degree:	Low		(Medium)		High
ADJACENT SCENERY					
Similarity:	(Not)		Somewhat		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	(Discordant)		Inconspicuous		Harmonious
SMELLS					
Degree:	Absent		(Present)		Dominant
Type:	(Discordant)		Inconspicuous		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

VISUAL RESOURCE SUMMARY/DESCRIPTION FORM 1

Used for Management Classification System X
Used for Visual Impact Assessment ___

Similarity Zone	Highway Corridor	Inventory	___
Basic	X	Forecasting	___
Detailed	___		

Location	_____	Date & Time	August 2001
Viewpoint ___	Zone ___	Weather	_____
With Plan ___	W/o Plan ___	Personnel	Young

In your own words, describe the visual resource of the zone. In doing so, try to describe the elements that unify the area so that it can be considered a zone. Make note of other aesthetic characteristics that are present.

Interstate 84 & Route 17, major 2-lane highways have well landscaped islands in the center, fairly clean (lack of stray litter) most highway perimeters are well screened with taller shrubs & trees

Wawayanda Energy Center, Visual Resources Assessment Procedure

ASSESSMENT SUMMARY **FORM 4**

Study Area _____ Date 8/3/01

Zone Rural/Agriculture Personnel C Wolfgang

Notes Wallkill River valley generally south of I-84

	Distinct 3	Average 2	Minimal 1	Comments
Water Resources	Wallkill River & tributaries			
Landform		Generally flat/rolling		
Vegetation		Farm fields w/ woodlots		
Landuse		Rural residential on road frontages		
User Activity		Secondary roadways		
Special Considerations*		Historic Resources		
Totals	3	10		

TOTAL ASSESSMENT VALUE 13

* The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

Yes-1 No-0

Does this zone contain any Cultural or Historical Landmarks? Yes

Is this zone, or areas within it, known for is distinct visual quality and/or wildlife observation? No

Is this zone free from pollution and litter? No

Are there other aesthetic elements that add to this resource? No

Wawayanda Energy Center, Visual Resources Assessment Procedure

ASSESSMENT SUMMARY **FORM 4**

Study Area _____ Date 8/3/01

Zone Rural/Forested Personnel C Wolfgang

Notes NW of Middletown / E. of Route 17

	Distinct 3	Average 2	Minimal 1	Comments
Water Resources	Isolated lakes & tributaries			
Landform	Hilly/Rolling			
Vegetation		Mixed deciduous		
Landuse		Rural residential isolated subdivisions		
User Activity		Secondary roadways		
Special Considerations*		Litter and pollution free		
Totals	6	8		

TOTAL ASSESSMENT VALUE 14

* The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

Yes-1 No-0

Does this zone contain any Cultural or Historical Landmarks? No

Is this zone, or areas within it, known for is distinct visual quality and/or wildlife observation? No

Is this zone free from pollution and litter? Yes (generally)

Are there other aesthetic elements that add to this resource? No

Wawayanda Energy Center, Visual Resources Assessment Procedure

ASSESSMENT SUMMARY **FORM 4**

Study Area _____ Date 8/3/01

Zone Suburban Residential Personnel C Wolfgang

Notes Surrounding 3 NE of Middletown/Goshen

	Distinct 3	Average 2	Minimal 1	Comments
Water Resources			Urban drainageways	
Landform		Rolling/flat		
Vegetation			Mature landscaping	
Landuse		Suburban development		
User Activity		Residential		
Special Considerations*		Historic Resources		
Totals		8	2	

TOTAL ASSESSMENT VALUE 10

* The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

Yes-1 No-0

Does this zone contain any Cultural or Historical Landmarks? Yes

Is this zone, or areas within it, known for is distinct visual quality and/or wildlife observation? No

Is this zone free from pollution and litter? yes (generally)

Are there other aesthetic elements that add to this resource? No

Wawayanda Energy Center, Visual Resources Assessment Procedure

ASSESSMENT SUMMARY **FORM 4**

Study Area _____ Date 8/3/01

Zone Urban Center Personnel C Wolfgang

Notes Middletown center/Goshen

	Distinct 3	Average 2	Minimal 1	Comments
Water Resources			None	
Landform		Rolling/ Hilly		
Vegetation			Urban landscaping	
Landuse		Mixed residential/ commercial		
User Activity		Residential/ business		
Special Considerations*		Historic resources		
Totals		8	2	

TOTAL ASSESSMENT VALUE 10

* The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

Yes-1 No-0

Does this zone contain any Cultural or Historical Landmarks? Yes

Is this zone, or areas within it, known for is distinct visual quality and/or wildlife observation? No

Is this zone free from pollution and litter? No

Are there other aesthetic elements that add to this resource? No

Wawayanda Energy Center, Visual Resources Assessment Procedure

ASSESSMENT SUMMARY

FORM 4

Study Area _____ Date 8/3/01

Zone Highway Corridor Personnel C Wolfgang

Notes I-84/Route 17 - limited access highways

	Distinct 3	Average 2	Minimal 1	Comments
Water Resources			None	
Landform		Rolling		
Vegetation		Roadside landscaping		
Landuse		Generally rural		Transmission line in foreground
User Activity		Interstate corridor high-speed travel		
Special Considerations*		litter and pollution free		
Totals		10	1	

TOTAL ASSESSMENT VALUE 11

* The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

Yes-1 No-0

Does this zone contain any Cultural or Historical Landmarks? No

Is this zone, or areas within it, known for is distinct visual quality and/or wildlife observation? No

Is this zone free from pollution and litter? Yes (generally)

Are there other aesthetic elements that add to this resource? No

Wawayanda Energy Center, Visual Resources Assessment Procedure

ASSESSMENT SUMMARY

FORM 4

Study Area _____ Date 8/3/01

Zone Commercial/Industrial Corridor Personnel C Wolfgang

Notes Route 17M/I-84-Route 17 Interchange

	Distinct 3	Average 2	Minimal 1	Comments
Water Resources			None	
Landform		Generally flat		
Vegetation			Generally absent	
Landuse			Highway Commercial	
User Activity			Congested traveways Commercial activity	
Special Considerations*			None	
Totals		2	5	

TOTAL ASSESSMENT VALUE 7

* The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

Yes-1 No-0

Does this zone contain any Cultural or Historical Landmarks? No

Is this zone, or areas within it, known for is distinct visual quality and/or wildlife observation? No

Is this zone free from pollution and litter? No

Are there other aesthetic elements that add to this resource? No

Wawayanda Energy Center, Visual Resources Assessment Procedure

MANAGEMENT CLASSIFICATION SUMMARY

FORM 5

Study Area _____ Date 8/3/01

TES _____ Personnel C Wolfgang

Management Class	Total Assessment Value
Preservation	17 and above
Retention	14-16
Partial Retention	11-13
Modification	8-10
Rehabilitation	7 and below

Zone	Classification	Comments
Rural/ Agriculture	Partial Retention	Value: 13
Rural/ Forested	Retention	Value: 14
Suburban Residential	Modification	Value: 10
Urban Center	Modification	Value: 10
Highway Corridor	Partial Retention	Value: 11
Commercial Corridor	Rehabilitation	Value: 7

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System ___
Used for Visual Impact Assessment X

Similarity Zone Highway Corridor — Inventory ___
Basic X — Forecasting ___
Detailed ___
Location Interstate 84 W — Date & Time August 8, 2001
Viewpoint 39 — Zone ___ — Weather Clear
With Plan ___ — W/o Plan ___ — Personnel J. Young

WATER Absent					
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	None	(Little)	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	(Rural)	Suburban	Urban
Type:	Recreational	Agricultural	Residential	Commercial	Industrial (Highway)
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	Primary Rd.	(Highway)
USER ACTIVITY					
Degree:	Low		(Medium)		High
Frequency:	Low		(Medium)		High
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	(Discordant)		Inconspicuous		Harmonious
SMELLS					
Degree:	Absent		~~Present~~		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
VISIBILITY					
Amount:	Screened		Partially Screened		(Panorama)
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System ___
Used for Visual Impact Assessment X

Similarity Zone: Suburban residential — Inventory: X
Basic: X — Forecasting: ___
Detailed: ___
Location: 71 David Moore High — Date & Time: August 8, 2001
Viewpoint X — Zone ___ — Weather: clear
With Plan ___ — W/o Plan ___ — Personnel: J. Young

WATER absent

Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	(Plains)	Rolling Hills	Hills	Mountains
VEGETATION					
Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	None	(Little)	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	(Suburban)	Urban
Type:	Recreational	Agricultural	(Residential)	Commercial	Industrial
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	(Low)		Medium		High
Frequency:	(Low)		Medium		High
LITTER/POLLUTION					
Degree:	Low		(Medium)		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
SMELLS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System ___
Used for Visual Impact Assessment X

Similarity Zone: Urban Center — Inventory ___
Basic: X — Forecasting ___
Detailed ___

Location: 72 Horton Hospital — Date & Time: August 8, 2001
Viewpoint X — Zone ___ — Weather: clear
With Plan ___ — W/o Plan ___ — Personnel: I. Young

WATER absent

Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large

LANDFORM

Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains

VEGETATION

Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	None	(Little)	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial

LAND/WATER USE

Intensity:	Wilderness	Undeveloped	Rural	Suburban	(Urban)
Type:	Recreational	Agricultural	Residential	Commercial	Industrial

ACESS

Type:	Trail	Walkway	Scndry. Rd.	(Primary Rd.)	Highway

USER ACTIVITY

Degree:	Low		(Medium)		High
Frequency:	Low		(Medium)		High

LITTER/POLLUTION

Degree:	(Low)		Medium		High

ADJACENT SCENERY

Similarity:	(Not)		Somewhat		Very

SOUNDS

Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious

SMELLS

Degree:	Absent		(Present)		Dominant
Type:	(Discordant)		Inconspicuous		Harmonious

VISIBILITY

Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		Normal		(Superior)

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System —
Used for Visual Impact Assessment X

Similarity Zone: Commercial/Industrial — Inventory X
Basic X — Forecasting —
Detailed —
Location: Overlook Apartment — Date & Time: Aug 8, 2001
Viewpoint 93 — Zone — — Weather: clear
With Plan — — W/o Plan — — Personnel: I. Young

WATER Absent

Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	None	(Little)	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	Suburban	(Urban)
Type:	Recreational	Agricultural	Residential	(Commercial)	Industrial
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	Low		(Medium)		High
Frequency:	(Low)		Medium		High
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	(Discordant)		Inconspicuous		Harmonious
SMELLS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		Normal		(Superior)

Does this area contain any other significant attributes? If Yes, explain in additional attachment.	Yes	(No)
Is this area known for its wildlife observation?	Yes	(No)
Does this area contain any cultural or historical landmarks?	Yes	(No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System ___
Used for Visual Impact Assessment X

Similarity Zone Rural / Aquaculture — Inventory ___
Basic X — Forecasting ___
Detailed ___
Location Genung Street — Date & Time August 8, 2001
Viewpoint 94 — Zone ___ — Weather Clear
With Plan ___ — W/o Plan ___ — Personnel T. Young

WATER NONE

Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large

LANDFORM

Type:	Coastal	(Plains)	Rolling Hills	Hills	Mountains

VEGETATION

Cover:	0	<25%	(25-50%)	50-75%	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial

LAND/WATER USE

Intensity:	Wilderness	Undeveloped	(Rural)	Suburban	Urban
Type:	Recreational	(Agricultural)	Residential	Commercial	Industrial

ACESS

Type:	Trail	Walkway	(Scndry. Rd.)	Primary Rd.	Highway

USER ACTIVITY

Degree:	(Low)		Medium		High
Frequency:	(Low)		Medium		High

LITTER/POLLUTION

Degree:	(Low)		Medium		High

ADJACENT SCENERY

Similarity:	Not		Somewhat		(Very)

SOUNDS

Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious

SMELLS

Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious

VISIBILITY

Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes?	Yes	(No)
If Yes, explain in additional attachment.		
Is this area known for its wildlife observation?	Yes	(No)
Does this area contain any cultural or historical landmarks?	Yes	(No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT **FORM 6**

BASIC X DETAILED ____

Project Name ____ Date August 8, 2001

Location Interstate 84W. Time ____

Viewpoint Map References 39 Weather clear

Alternative ____ Personnel I. Young

Project Details and Comments full project visibility

Use the letter 'A" for **with** plan condition.
Use the letter "B" for **without** plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe.	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		A/B		0	NC	MO	D	
Vegetation		B	A	-1	NC	MO	S	
Landuse		B	A	-1	NC	S	D	
User Activity		A/B		0	SC	MI	Sub	
Special Considerations				0	NA	NA	NA	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			✓
Without Plan		✓	

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?		0
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		0
Is this zone free from pollution and litter?		0
Are there other aesthetic elements that add to this resource?		0
Total:		0

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT **FORM 6**

BASIC X DETAILED ____

Project Name ____ Date August 8, 2001

Location David Moore Apts Time ~~late~~

Viewpoint Map References #71 Weather clear

Alternative ____ Personnel I. Young

Project Details and Comments stacks will be visible above trees

Use the letter 'A" for with plan condition.
Use the letter "B" for **without** plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		B	A	-1	NC	S	D	
Vegetation			A/B	0	NC	MO	CO	
Landuse		B	A	-1	SC	S	D	
User Activity		A/B		0	NC	MO	CO	
Special Considerations				0	0	0	0	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			✓
Without Plan		✓	

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?		0
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		0
Is this zone free from pollution and litter?		0
Are there other aesthetic elements that add to this resource?		0
Total:		0

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC X DETAILED ____

Project Name ____ Date August 8, 2001

Location Horton Hospital Time ____

Viewpoint Map References 72 Weather clear

Alternative ____ Personnel J. Young

Project Details and Comments stacks will be visible at ground level

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		B	A	-1	NC	MI	S	
Vegetation		A/B		0	SC	MI	S	
Landuse		B	A	-1	SC	MO	S	
User Activity		A/B		0	C	MI	S	
Special Considerations			A/B	0	NA	NA	NA	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			✓
Without Plan		✓	

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?		0
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		0
Is this zone free from pollution and litter?		0
Are there other aesthetic elements that add to this resource?		0
Total:		0

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC X DETAILED ____

Project Name ____ Date August 8, 2001

Location Overlook Apartments Time ____

Viewpoint Map References 93 Weather Clear

Alternative ____ Personnel I. Young

Project Details and Comments views of stacks will be available

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		A/B		0	SC	MI	C	
Vegetation		A/B		0	SC	MI	C	
Landuse		A/B		0	NC	MO	C	
User Activity		A/B		0	NC	MI	S	
Special Considerations				0	NA	NA	NA	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan		✓	
Without Plan		✓	

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?		0
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		0
Is this zone free from pollution and litter?		0
Are there other aesthetic elements that add to this resource?		0
Total:		0

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC Y DETAILED ____

Project Name ____ Date August 8, 2001

Location Genung Street Time ____

Viewpoint Map References 94 Weather clear

Alternative ____ Personnel I. Young

Project Details and Comments stacks will be visible above tree line

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		A/B		0	NC	MI	C	
Vegetation		A/B		0	SC	MI	S	
Landuse		A/B		0	NC	MO	C	
User Activity			A/B	0	C	MI	S	
Special Considerations				0	NA	NA	NA	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			✓
Without Plan		✓	

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?		0
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		0
Is this zone free from pollution and litter?		0
Are there other aesthetic elements that add to this resource?		0
Total:		0

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System —
Used for Visual Impact Assessment ✓
Similarity Zone Highway Corridor — Inventory ✓
Basic ✓ — Forecasting —
Detailed —
Location I-84 WB — Date & Time 8/9/01
Viewpoint 39 — Zone — — Weather
With Plan — — W/o Plan ✓ — Personnel CWolfgang

WATER Not present					
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	(Rural)	Suburban	Urban
Type:	Recreational	Agricultural	Residential	Commercial	Industrial / Highway Corridor
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	Primary Rd.	(Highway)
USER ACTIVITY					
Degree:	Low		Medium		(High)
Frequency:	Low		Medium		(High)
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		Present		(Dominant)
Type:	(Discordant)		Inconspicuous		Harmonious
SMELLS					
Degree:	(Absent)		Present		Dominant
Type:	Discordant		Inconspicuous		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System ___
Used for Visual Impact Assessment ___

Similarity Zone: Suburban Residential. Inventory: ✓
Basic: ✓ Forecasting: ___
Detailed: ___
Location: David Moore Heights Date & Time: 8/9/01
Viewpoint 71 Zone ___ Weather: ___
With Plan ___ W/o Plan ✓ Personnel: C Wolfgang

WATER	Not present				
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	<25%	(25-50%)	50-75%	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	(Suburban)	Urban
Type:	Recreational	Agricultural	(Residential)	Commercial	Industrial
ACESS					
Type:	Trail	Walkway	(Scndry. Rd)	Primary Rd.	Highway
USER ACTIVITY					
Degree:	Low		(Medium)		High
Frequency:	Low		(Medium)		High
LITTER/POLLUTION					
Degree:	Low		(Medium)		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
SMELLS					
Degree:	(Absent)		Present		Dominant
Type:	Discordant		Inconspicuous		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System —
Used for Visual Impact Assessment ✓

Similarity Zone	Urban Center	Inventory	✓
Basic	✓	Forecasting	—
Detailed	—		
Location	Horton Hospital	Date & Time	8/9/01
Viewpoint 72	Zone —	Weather	
With Plan —	W/o Plan ✓	Personnel	C. Wolfgang

WATER	Not present				
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	Rolling Hills	(Hills)	Mountains
VEGETATION					
Cover:	0	<25%	(25-50%)	50-75%	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	(Suburban)	(Urban)
Type:	Recreational	Agricultural	Residential	Commercial	Industrial
ACESS					
Type:	Trail	Walkway	(Scndry. Rd.)	Primary Rd.	Highway
USER ACTIVITY					
Degree:	Low		(Medium)		High
Frequency:	Low		(Medium)		High
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	(Not)		Somewhat		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
SMELLS					
Degree:	(Absent)		Present		Dominant
Type:	Discordant		Inconspicuous		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		Normal		(Superior)

Does this area contain any other significant attributes? If Yes, explain in additional attachment.	Yes	(No)
Is this area known for its wildlife observation?	Yes	(No)
Does this area contain any cultural or historical landmarks?	Yes	(No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST — FORM 2

Used for Management Classification System ___
Used for Visual Impact Assessment ✓
Similarity Zone Commercial Corridor — Inventory ___
Basic ✓ — Forecasting ___
Detailed ___
Location Overlook Apts — Date & Time 8/9/01
Viewpoint 93 — Zone ___ — Weather ___
With Plan ___ — W/o Plan ✓ — Personnel C Wolfgang

WATER	Not present				
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	Plains	(Rolling Hills)	Hills	Mountains
VEGETATION					
Cover:	0	(<25%)	25-50%	50-75%	75-100%
Diversity:	None	(Little)	Present	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	Rural	(Suburban)	(Urban)
Type:	Recreational	Agricultural	Residential	(Commercial)	Industrial
ACESS					
Type:	Trail	Walkway	Scndry. Rd.	(Primary Rd.)	Highway
USER ACTIVITY					
Degree:	Low		(Medium)		High
Frequency:	(Low)		Medium		High
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	(Not)		Somewhat		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	(Discordant)		Inconspicuous		Harmonious
SMELLS					
Degree:	(Absent)		Present		Dominant
Type:	Discordant		Inconspicuous		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL RESOURCE INVENTORY/FORECAST

FORM 2

Used for Management Classification System ___
Used for Visual Impact Assessment ___

Similarity Zone: Rural/Agriculture — Inventory: ✓
Basic: ✓ — Forecasting: ___
Detailed: ___
Location: Benning Street — Date & Time: 8/9/01
Viewpoint 94 — Zone ___ — Weather: ___
With Plan ___ — W/o Plan ✓ — Personnel: C Wolfgang

WATER	Not present				
Resource:	Stream	River	Lake/Rsrvr.	Wetlands	Marine
Movement:	None	Meander	Swift	Rapid	Falls
Scale:	Small		Medium		Large
LANDFORM					
Type:	Coastal	(Plains)	Rolling Hills	Hills	Mountains
VEGETATION					
Cover:	0	<25%	(25-50%)	50-75%	75-100%
Diversity:	None	Little	(Present)	Substantial	Extensive
Seas. Change:	None		(Present)		Substantial
LAND/WATER USE					
Intensity:	Wilderness	Undeveloped	(Rural)	Suburban	Urban
Type:	Recreational	(Agricultural)	Residential	Commercial	Industrial
ACESS					
Type:	Trail	Walkway	(Scndry. Rd.)	Primary Rd.	Highway
USER ACTIVITY					
Degree:	(Low)		Medium		High
Frequency:	(Low)		Medium		High
LITTER/POLLUTION					
Degree:	(Low)		Medium		High
ADJACENT SCENERY					
Similarity:	Not		(Somewhat)		Very
SOUNDS					
Degree:	Absent		(Present)		Dominant
Type:	Discordant		(Inconspicuous)		Harmonious
SMELLS					
Degree:	(Absent)		Present		Dominant
Type:	Discordant		Inconspicuous		Harmonious
VISIBILITY					
Amount:	Screened		(Partially Screened)		Panorama
Position:	Inferior		(Normal)		Superior

Does this area contain any other significant attributes? Yes (No)
If Yes, explain in additional attachment.
Is this area known for its wildlife observation? Yes (No)
Does this area contain any cultural or historical landmarks? Yes (No)

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC ____ DETAILED ____

Project Name Wawayanda Date 8/9/01

Location I-84 WB Time ____

Viewpoint Map References VP 39 Weather ____

Alternative ____ Personnel C. Wolfgang

Project Details and Comments ____

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		A/B		0	SC	Mod	Δ	
Vegetation		B	A	-1	NC	Mod	C	
Landuse		B	A	-1	NC	S	D	
User Activity		A/B		0	SC	Min	S	
Special Considerations		A/B		0	NC	NA	NA	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			✓
Without Plan		✓	

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?		✓
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		✓
Is this zone free from pollution and litter?	✓	
Are there other aesthetic elements that add to this resource?		✓
Total:	1	

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC ✓ DETAILED ____

Project Name Wawayanda Date 8/9/01

Location David Moore Hgts Time ____

Viewpoint Map References VP 7 Weather ____

Alternative ____ Personnel C Wolfgang

Project Details and Comments Stacks visible between apt. buildings

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		B	A	-1	NC	Mod	C	
Vegetation			A/B	0	NA	Min	C	
Landuse		B	A	-1	NC	Min	C	
User Activity		B	A	-1	NC	Min	C	
Special Considerations			A/B	0				

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			✓
Without Plan			✓

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?	✓	
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		✓
Is this zone free from pollution and litter?		✓
Are there other aesthetic elements that add to this resource?		✓
Total:	1	

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC ✓ DETAILED ____

Project Name Wawayanda Date 8/9/01

Location Horton Hospital Time ____

Viewpoint Map References VP 72 Weather ____

Alternative ____ Personnel C Wolfgang

Project Details and Comments Middle distant views of stacks

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		A/B		0	SC	Min	S	
Vegetation			A/B	0	SC	Min	S	
Landuse		A/B		0	SC	Min	S	
User Activity			A/B	0	SC	—	—	
Special Considerations			A/B	0	C	—	—	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan		✓	
Without Plan		✓	

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?	✓	
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		✓
Is this zone free from pollution and litter?		✓
Are there other aesthetic elements that add to this resource?		✓
Total:	1	

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC ✓ DETAILED ____

Project Name Wawayanda Date 8/9/01

Location Overlook Apts Time ____

Viewpoint Map References VP 93 Weather ____

Alternative ____ Personnel C Wolfgang

Project Details and Comments Background view from commercial corridor

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	
Landform		A/B		0	SC	Min	C	
Vegetation			A/B	0	C	Min	C	
Landuse			A/B	0	C	Min	C	
User Activity			A/B	0	C	Min	C	
Special Considerations			A/B	0	—	—	—	

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			
Without Plan			

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?		✓
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		✓
Is this zone free from pollution and litter?		✓
Are there other aesthetic elements that add to this resource?		✓
Total:		

Wawayanda Energy Center, Visual Resources Assessment Procedure

VIEWPOINT ASSESSMENT

FORM 6

BASIC ✓ DETAILED ____

Project Name Wawayanda Date 8/9/01

Location Canning St. Time ____

Viewpoint Map References VP 94 Weather ____

Alternative ____ Personnel C Wolfgang

Project Details and Comments Rural agricultural zone - middleground view

Use the letter 'A" for with plan condition.
Use the letter "B" for without plan condition.

	Distinct 3	Average 2	Minimal 1	Difference	Compatibility C Compatible SC Somewhat NC Not Compatible	Scale Contrast MI Minimal MO Moderate S Severe	Spatial Dominance S Subordinant C Co-subordinant D Dominant	Comments
Water Resources			A/B	0	NA	NA	NA	None present
Landform		A/B		0	NC	Mod	C	
Vegetation		A/B		0	SC	Mod	C	
Landuse		B	A	-1	SC	Mod	C	
User Activity		B	A	-1	NC	-	-	
Special Considerations			A/B	0				

Landscape Composition

	Inconspicuous	Significant	Prominent
With Plan			
Without Plan			

The following will give you the value for Special Considerations. A sum of 3 or more distinct, 1-2 average, and 0 minimal.

	Yes (1)	No (0)
Does this zone contain any Cultural or Historical Landmarks?	✓	
Is this zone, or area within it, known for its distinct visual quality and/or wildlife observation?		✓
Is this zone free from pollution and litter?		✓
Are there other aesthetic elements that add to this resource?		✓
Total:	1	

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL IMPACT ASSESSMENT SUMMARY

FORM 8

Project Name Wawayanda
Location I-84 WB
Alternative ____
With Plan ✓ Without Plan ✓
Project Details and Comments:

Basic ✓ Detailed ____
Date 8/9/01
Personnel C Wolfgang
A. Young

Visual Impact Assessment Value

	Evaluator # 1	Evaluator # 2	Evaluator #	Evaluator	Total # of Evaluators	Quotient
Water	0	0			2	
Landform	0	0			2	
Vegetation	-1	-1			2	-1
Landuse	-1	-1			2	-1
User Activity	0	0			2	
Special Considerations	0	0			2	

Visual Impact Assessment Value -2

Modifier Rating
CR= Compatibility Rating, SC= Scale Contrast Rating, SDR= Spatial Dominance Rating

	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	Majority Rating CR SCR SDR
Water						
Landform						
Vegetation						
Landuse						
User Activity						

Landscape Composition P Prominent S Significant I Inconspicuous						

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL IMPACT ASSESSMENT SUMMARY

FORM 8

Project Name Wawayanda
Location David Moore Height
Alternative _____
With Plan _____ Without Plan _____
Project Details and Comments:

Basic ✓ Detailed _____
Date 8/9/01
Personnel O Wolfgang
A. Young

Visual Impact Assessment Value

	Evaluator # 1	Evaluator # 2	Evaluator #	Evaluator	Total # of Evaluators	Quotient
Water	0	0			2	
Landform	-1	-1			2	-1
Vegetation	0	0			2	
Landuse	-1	-1			2	-1
User Activity	-1	0			2	-.5
Special Considerations	0	0			2	

Visual Impact Assessment Value = -2.5

Modifier Rating
CR= Compatibility Rating, SC= Scale Contrast Rating, SDR= Spatial Dominance Rating

	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	Majority Rating CR SCR SDR
Water						
Landform						
Vegetation						
Landuse						
User Activity						

Landscape Composition P Prominent S Significant I Inconspicuous						

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL IMPACT ASSESSMENT SUMMARY

FORM 8

Project Name Wawayanda
Location Horton Hospital
Alternative _____
With Plan _____ Without Plan _____
Project Details and Comments:

Basic ✓ Detailed _____
Date 8/9/01
Personnel C. Wolfgang
L. Young

Visual Impact Assessment Value

	Evaluator # 1	Evaluator # 2	Evaluator #	Evaluator	Total # of Evaluators	Quotient
Water	0	0			2	
Landform	0	-1			2	-.5
Vegetation	0	0			2	
Landuse	0	-1			2	-.5
User Activity	0	0			2	
Special Considerations	0	0			2	

Visual Impact Assessment Value -1

Modifier Rating
CR= Compatibility Rating, SC= Scale Contrast Rating, SDR= Spatial Dominance Rating

	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	Majority Rating CR SCR SDR
Water						
Landform						
Vegetation						
Landuse						
User Activity						

Landscape Composition P Prominent S Significant I Inconspicuous						

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL IMPACT ASSESSMENT SUMMARY

FORM 8

Project Name Wawayanda
Location Overlook Spot
Alternative _____
With Plan _____ Without Plan _____
Project Details and Comments:

Basic ✓ Detailed _____
Date 8/9/01
Personnel C. Wolfgang
G. Yoling

Visual Impact Assessment Value

	Evaluator # 1	Evaluator # 2	Evaluator #	Evaluator	Total # of Evaluators	Quotient
Water	0	0				
Landform	0	0				
Vegetation	0	0				
Landuse	0	0				
User Activity	0	0				
Special Considerations	0	0				

Visual Impact Assessment Value 0

Modifier Rating

CR= Compatibility Rating, SC= Scale Contrast Rating, SDR= Spatial Dominance Rating

	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	Majority Rating CR SCR SDR
Water						
Landform						
Vegetation						
Landuse						
User Activity						

Landscape Composition P Prominent S Significant I Inconspicuous						

Wawayanda Energy Center, Visual Resources Assessment Procedure

VISUAL IMPACT ASSESSMENT SUMMARY

FORM 8

Project Name Wawayanda
Location Glenning Rd.
Alternative _____
With Plan _____ Without Plan _____
Project Details and Comments:

Basic ✓ Detailed _____
Date 8/9/01
Personnel C. Wolfgang
S. Young

Visual Impact Assessment Value

	Evaluator # 1	Evaluator # 2	Evaluator #	Evaluator	Total # of Evaluators	Quotient
Water	0	0			2	
Landform	0	0			2	
Vegetation	0	0			2	
Landuse	-1	0			2	-.5
User Activity	-1	0			2	-.5
Special Considerations	0	0			2	

Visual Impact Assessment Value -1

Modifier Rating

CR= Compatibility Rating, SC= Scale Contrast Rating, SDR= Spatial Dominance Rating

	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	CR SCR SDR	Majority Rating CR SCR SDR
Water						
Landform						
Vegetation						
Landuse						
User Activity						

Landscape Composition P Prominent S Significant I Inconspicuous						

APPENDIX L LOCAL LAWS AND CORRESPONDENCE

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MICHAEL G. MURPHY
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April 30, 2001

Via FedEx

Christina Palmero
Department of Public Service
Board on Electric Generation Siting & the Environment
Three Empire State Plaza, 8th Floor
Albany, New York 12223

Re: Case 00-F-1256: In the Matter of the Application of Wawayanda Energy Center for a Certificate of Environmental Compatibility and Public Need

Dear Ms. Palmero:

Enclosed please find the following local law documents relating to the above-referenced project:

1. Town of Wawayanda Zoning Law, Chapter 195 (Draft 2/23/01).
2. DGEIS for Zoning Law, Chapter 195, 2001 Update.
3. City of Middletown Master Plan (January 2000).
4. City of Middletown Code.
5. Orange County Comprehensive Development Plan (1987).
6. Orange County Charter & Code.
7. Orange County Department of Public Works, Policy & Standards to permit work within County rights-of-way.

The foregoing documents are provided to ensure that Department staff have access to potentially applicable local laws. If you have any questions, please do not hesitate to contact me at this office.

Sincerely,

Michael Murphy

Enclosures

N:\21\88\10561\Ltr\mmm palmero re local laws.wpd

bcc: Stephan Solzenitsyn

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STEPHEN L. GORDON
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July 10, 2001

Via FedEx

Thomas DeBlock, Supervisor
Town of Wawayanda
80 Ridgebury Hill Road
Slate Hill, New York 10973

Re: Wawayanda Energy Center Project

Dear Mr. DeBlock:

One behalf of our client, Calpine Eastern Corp., we are forwarding a preliminary draft section (in memorandum form) of the "Local Laws" section of the forthcoming Wawayanda Energy Center ("WEC") Article X application to the New York State Siting Board, in accordance with the negotiated stipulations for the project. Prior to the submission of the Article X application, the stipulations require us to consult with the Town to identify all substantive local laws, ordinances and regulations that might apply to the project.

In advance of this consultation, we are forwarding the enclosed memorandum, which describes all the substantive local laws that we believe are substantively applicable to the project and then discusses the project's degree of compliance with each requirement. For completeness, both existing and proposed zoning requirements are addressed in the memorandum. A draft site plan and grading plan are also enclosed to facilitate the consultation process. Four copies of the memorandum and accompanying drawings are enclosed.

Please disseminate these copies to Town staff in whatever departments you believe are appropriate. Please feel free to contact us directly if you have any questions. We look forward to

conducting and completing our local law consultation with the Town staff once they have had an opportunity to review the enclosed.

Sincerely,

Stephen L. Gordon

Enclosures

cc: David Zuckerman, Esq.
Christina Palmero, NYSDPS
Stephan Solzhenitsyn, TRC
David A. Devine, Calpine
Don Neal, Calpine

N:\21\88\10561\Ltr\nmm local law letter to waway.wpd

Below, all provisions of the Wawayanda Code that apply to the proposed Project in any specific sense are briefly summarized, and a compliance statement or explanation is made. The discussion typically summarizes but does not quote the applicable local laws and regulations verbatim. The verbatim text of all provisions of applicable local law cited hereunder has been provided to the Department of Public Service. This pre-application consultation memorandum is being compiled in fulfillment of a requirement of the stipulations signed, *inter alia,* by Calpine, DPS Staff, and Town of Wawayanda officials.

The purpose of this memorandum is to prepare the parties to the consultation in advance of a meeting, where any clarifications regarding this memorandum can be discussed. The revised memorandum will then be submitted as part of the Article X Application for the Wawayanda Energy Center (provisionally numbered as Section 10.4 of the Application). Wawayanda is currently considered a new Chapter 195 (Zoning) to the Code. Therefore, for completeness, the memorandum first addresses the proposed zoning ordinance in anticipation of its adoption and then discusses the existing zoning.

10.4.1 Code of the Town of Wawayanda

Chapter 54: Building and Construction

Section 54-4. Permit required; certificate of occupancy required.

A, B, G, H & I. A building, structure, sign or installation of equipment, or sanitary facilities thereto, may not be constructed without a building permit. Once a building permit is issued, a set of the plans and specifications for the project must be kept at the site and made available for inspection. A building permit generally is effective for a period of one year, with two extensions each of six months allowed for good cause. All work performed must conform to the approved application, plans and specifications. A building, structure, sign or installation of equipment, or sanitary facilities thereto, may not be used or occupied without a certificate of occupancy.

Calpine anticipates that Project construction plans will be reviewed during the Article X process. The plans for the Project (some aspects of which, by necessity, are still conceptual) will be submitted to the Building Inspector for review and consultation. As design of each phase of the Project progresses and is finalized, plans and specifications will be submitted to the Building Inspector or designee for review and comment. Calpine will keep a set of all plans and specifications on-site available for inspection during construction, as required. Calpine anticipates that construction will last approximately 24 months. The Project will be constructed in accordance with finalized plans and specifications as required for the issuance of a certificate of occupancy.

Section 54-5. Building permit application; revocation.

B, E. Applications for building permits must be accompanied by duplicate copies of the building plans, specifications and a plot plan, showing information that will allow the Building Inspector to determine whether the project complies with applicable Town requirements. A building permit generally is effective for a period of one year, with two extensions each of three months allowed for good cause. Calpine would like to use this pre-application consultation to clarify whether extensions are given for 3 months, as stated here, or for 6 months, as stated in 54-4.

As noted above, the plans for the Project will be submitted to the Building Inspector for review and consultation. Plans and specifications included in the application are sufficiently detailed to demonstrate compliance with applicable local zoning requirements. All plans will be submitted in duplicate, as required. However, Calpine anticipates that preliminary Project construction plans primarily will be reviewed during the Article X review process. Many construction plans, by necessity, may not be finalized until after the Article X Certificate is issued. In these circumstances, Calpine anticipates submitting as-built plans to the Siting Board as compliance filings or directly to the Town. The time period during which a building permit is valid (including the two extensions, if they are three months long per Section 54-5) would be insufficient to allow construction of the Project. Two interpretations are thus possible, and Calpine seeks Town consultation on these: either no waiver from this requirement is necessary because it is not a substantive local law requirement; or a waiver from this requirement is necessary because the Town believes it is a substantive requirement, while construction of a power plant in so short a period is not possible with existing technology. In the latter case, an Article X waiver would be sought, based on the existing technology and on reasonably related local precedent.

Section 54-6. Certificate of occupancy; revocation.

A – D. The Building Inspector is required to conduct an inspection prior to the placement of any foundation or covering any water supply or sewage disposal systems or connections. The Building Inspector must be notified when the work is ready for inspection. Prior to the issuance of a certificate of occupancy, the Building Inspector must inspect the facility to ensure that the completed work is in compliance with applicable local requirements.

Calpine will provide the Building Inspector with the required notices regarding the availability of the work for inspection. Calpine anticipates that the Siting Board will grant Certificate of Occupancy approval.

Section 54-9. Adoption of standards by reference. New construction must comply with the New York State Uniform Fire Prevention and Building Code, which is adopted by reference.

Project construction will comply with applicable provisions of the New York State Fire Prevention and Building Code. The Project will be equipped with a comprehensive fire detection and protection system. Detailed design plans, when available, will be reviewed with local fire protection organizations and Calpine's insurer for compliance with applicable requirements.

Chapter 58: Buildings, Numbering of.

Section 58-3. Determination of building to be numbered. The local Emergency 911 Coordinator or the Building Inspector is authorized to decide which building or buildings on any particular lot must be numbered.

Calpine will consult with both to determine which buildings should be numbered.

Section 58-4. Designation of numbers; review of determination. The local Emergency 911 Coordinator or, in the absence of the local Emergency 911 Coordinator, the Building Inspector is authorized to designate street numbers.

Calpine intends to accept the designated number.

Section 58-5. Duty of building owners. Building owners are required to display the building number within 25 feet of the edge of the street of address.

Calpine will comply with this requirement by installing a lighted sign at the entrance to the Project. The area around the sign will be landscaped.

Section 58-6. Size and display of numbers. Numbers must be at least 6 inches in height placed on a post or building at least 4 feet (but not more than 10 feet) from the ground, unobstructed and, wherever practicable, readily seen at night.

As discussed under Section 58-5, the Project will comply with this requirement.

Section 58-7. Display of other numbers prohibited. The display of any house number other than the authorized number is prohibited.

As discussed under Section 58-5, the Project will comply with this requirement.

Chapter 82: Electrical Standards and Inspections. Chapter 82 regulates the manner in which electrical wiring is installed for light, heat, power and signal systems in the Town of Wawayanda. The Chapter requires electrical installations to conform to the requirements of the New York State Fire Prevention and Building Code and the National Electrical Code.

Section 82-7. Nonapplicability. The provisions of this Chapter do not apply to installations or equipment employed by an electric utility in the exercise of its

function as a utility. The provisions of this Chapter do no apply to the manufacture, assembly, testing or repair of electrical equipment by an entity engaged in electrical manufacturing as its principal business.

Calpine would like to use this pre-application consultation to confirm with the Town of Wawayanda that the Project falls within the "nonapplicability provision" of Section 82-7. Nevertheless, the Project will be constructed in compliance with applicable provisions of the New York State Fire Prevention and Building Code and the National Electrical Code.

Chapter 86. Environmental Quality Review. This chapter sets forth the Town of Wawayanda's procedures for complying with the State Environmental Qualify Review Act (SEQRA). Section 86-9 requires the preparation of an environmental impact statement (EIS) for any project that may have a significant impact on the environment.

Article X projects, however, are deemed Type II actions under SEQRA's regulations (not requiring the preparation of an EIS) because environmental review requirements are governed by Article X and the regulations promulgated thereunder. The studies performed and submitted as part of this Application, as well as the Application review process, effectively constitute compliance with this provision. Town officials, therefore, are being provided with copies of the Application.

Chapter 92. Flood Damage Prevention. This Chapter regulates areas of special flood hazards (i.e., one hundred-year flood plains). Reference is made to such areas shown on official maps prepared by the Federal Emergency Management Agency.

The Project site is outside the floodplain and no Project buildings will lie within any floodplain areas. Therefore, the provisions of this Chapter do not apply.

Chapter 138. Sewers.

Section 138-1. Compliance required; privies. No septic tanks, leaching pit, pipe or other means of disposal or discharge of sewage shall be installed except as provided in this Chapter. A temporary permit for privies used during construction is required. A fee of $2 is required for such temporary permit

The Project proposes to send wastewater to the Middletown POTW. The connection to the POTW will be detailed in Section 17 of the application. Applicable requirements of this Chapter concerning the connection to the POTW are discussed below. Calpine will forward the required fee for use of temporary privies during construction.

Section 138-2. Application for permit. No installation of septic tanks, leaching pit, pipe or other means of disposal or discharge of trade wastes, industrial wastes or

sewage shall be commenced until an application, and the drawings for same, are approved by the Sanitary Inspector.

Plans for Calpine's proposed connection to the Middletown POTW will be provided to the Sanitary Inspector for review to ensure compliance with Town standards, as applicable. These standards are discussed below. Further information relating to wastewater will also be detailed in Section 17.

Section 138-4. Placement of Systems. No sewer line shall pass closer than 25 feet to any well, 10 feet of any drinking water supply line, or 5 feet of any basement foundation. Any sewer pipe within 50 feet of any well or spring must have watertight piping.

Calpine is investigating the sewer line route to the Middletown POTW and all areas 50 feet to either side. It appears that there are no wells, drinking water lines, or basement foundations in this zone. Thus, the Project will comply with Section 138-4.

Section 138-5. Prohibited Acts. Any discharge from a property must not endanger any source of drinking water. The discharge of sewage or sewage effluent from a leaching pit, septic tank, sewage disposal system, pipe or drain to a watercourse, storm drain, or body of water is prohibited except as permitted by Public Health Law.

The Project will discharge wastewater to the Middletown POTW via a sewer connection. No septic or leaching system will be built. The only other discharge will be storm water from Project roofs and pavement, which will be appropriately treated on-site. Thus, no source of drinking water will be endangered.

Section 138-6. Water carriage systems. This Section primarily imposes requirements relating to the installation and use of septic tank systems. The Project will not have a septic tank system; therefore, most of the requirements in this Section do not apply to the Project.

H. Where wastes contain oil, such wastes must first pass through an oil separator.

All floor drains in buildings will pass through an oil/water separator. Roof and parking lot storm runoff will be treated in the storm water management system. Therefore, the Project will comply with this requirement.

Section 138-7. Subsurface tile field systems. A subsurface tile field system is not proposed. Therefore, this Section does not apply to the Project.

Section 138-8. Leaching pits. A leaching pit is not proposed for the Project. Therefore, this Section does not apply.

Section 138-9. Artificial subsurface sand filters. None are proposed; therefore, this Section does not apply.

Section 138-10. Non-water-carriage systems. No non-water sewers are proposed. Therefore, the requirements of this Section do not apply.

Section 138-16. Compliance required. Developers proposing to develop, alter, improve, or change in any manner property referred to in the Master Plan prepared by the engineering firm of Eustance and Horowitz must comply with the standards and requirements specified in the Master Plan.

Calpine has consulted with the Town of Wawayanda regarding the applicability of the above-referenced Master Plan to the Project. Town officials have indicated that the Master Plan referenced in this section is out-of-date in light of the recent adoption of the Town's Comprehensive Plan, which is discussed in Section 10.4.2.

Chapter 142: Signs.

Section 142-3. General standards.

A. Advertising signs not permitted by Chapter 142 require a building permit.

One construction sign is explicitly permitted under Section 142-5. One permanent sign is allowed with a special permit under Section 142-6. These are the only signs of an advertising or announcement nature that the Project will use.

B. Signs erected near a street intersection must not cause a traffic hazard. Signs may not be erected at any location so as to interfere with, obstruct or be confused with an authorized traffic sign.

Calpine proposes to erect no sign in the vicinity of any street intersection, except traffic signs if directed by Town of Wawayanda. The sign at the site entrance will not cause a traffic hazard or any interference with any authorized traffic sign. Temporary signs utilized during construction will be prepared in consultation with the Town to ensure that the signs do not interfere with, mislead or confuse traffic.

C. No sign may be erected or placed above the maximum roofline of a building.

The Project will comply with this requirement.

D. Any freestanding sign may not exceed 20 feet in height.

Freestanding signs will comply with this requirement.

E. Signs must be set back at least 10 feet from the property line.

The Project's signs will comply with this requirement.

H. Illumination of signs may not be intermittent or varying and may not produce glare beyond the property line.

Calpine proposes steady illumination. The application will include an iso-lumen plan demonstrating that glare will not be produced off-site.

I. Signs with moving parts are prohibited.

The Project will comply with this requirement.

J. Signs projecting onto a public right-of-way must have a clearance of not less than 10 feet. No signs are permitted over a public driveway or thoroughfare.

No signs projecting onto a public right-of-way are proposed at the site.

Section 142-5. Permitted signs.

A. One temporary non-illuminated construction sign not exceeding 32 square feet in size, not exceeding 8 feet in height, and, unless approval is obtained from the Building Inspector, not remaining on the property for more than 1 year, is permitted without a permit.

Calpine requires multiple construction signs for longer than one year to ensure efficient and safe movement of construction traffic, but there will be only one sign of an advertising or announcement nature. Calpine would like to use this consultation with Wawayanda to determine if non-advertising signs internal to or near the boundaries of the Project site are subject to Chapter 142. If so, Siting Board or Town approval for a sign permit will be requested.

Section 142-6. Signs subject to permit approval. Signs permitted in the LOR District (proposed IORB District, see below) require sign permit approval and payment of a fee.

Calpine will obtain approval for the permanent sign from the Town of Wawayanda or via a compliance filing with the Siting Board. Calpine requires multiple building signs during operations to ensure efficient and safe movement of deliveries and other traffic, but there will be only one sign of an advertising or announcement nature. Calpine would like to use this consultation with Wawayanda to determine if non-advertising signs internal to the Project site are subject to Chapter 142. If so approval for a sign permit will be requested from the Siting Board via a compliance filing or from the Town.

F. Only one sign is permitted for each tenant of each building. The aggregate area of all signs on a building must not exceed 1.5 square feet for each foot of length of the building. If the building is located more than 35 feet from the street line, one freestanding sign is permitted, as long as the sign is not closer than 10 feet to any building or property line and is not greater than 40 square feet.

The signs that Calpine will propose for the Project once operation commences will comply with the foregoing requirements. Depending on how building length is measured, approximately 400 s.f. of total sign area could potentially be allowed, more than is necessary.

Section 142-9. Permit application; issuance; fees. Applications for sign permits must contain information relating to the applicant, the location of the sign, and plans showing the details of the signs. Fees for sign permits correspond to fees for building permit applications.

Calpine will submit the required information and fees to the Building Inspector prior to the erection of any permanent signs. Approval will be sought through a Siting Board compliance filing or directly from the Town.

Section 142-10. Security deposit. Any signs for which the estimated cost exceeds $2,500 require a security deposit, the amount of which is determined by the official issuing the permit for the sign.

Calpine will provide the security, if required.

Chapter 152. Solid Waste.

Article I. Garbage, Rubbish and Refuse.

Section 152-3. Prohibited disposal. Garbage or any material, waste or offal of any kind may not be carried or left upon any premises within the Town so as to create a nuisance.

The waste disposal practices for the Project are detailed in Section 3.8 of the application. The Project will comply with this requirement.

Section 152-4. Littering prohibited. This Section prohibits littering on public or private lands within the Town.

The Project will comply with this requirement.

Article II. Waste Management. This Section prohibits the disposal of hazardous or industrial wastes within the Town. Calpine would like to use this preapplication consultation to verify that this prohibition does not apply to industries that send their

hazardous or industrial wastes to appropriately permitted facilities for disposal. Section 152-22 requires any carting business operating in the Town to obtain a permit from the Town Clerk.

Any waste generated at the Project site will be sent to appropriately permitted facilities. Any carters used by the Project will be required to have a permit issued by the Town Clerk.

Chapter 156. Streets and Sidewalks.

Section 156-8. Application; estimate; permit issuance. Prior to the commencement of construction activity in a Town road, street or right-of-way, a permit must be obtained from the Highway Superintendent. An application for such permit must be submitted to the Highway Superintendent and Town Clerk. An estimate of the costs of restoration must be submitted with the application. A security in an amount to be determined by the Highway Superintendent based upon the proposed construction must be posted.

Section 15.5 of the application describes the work that is proposed in Town roads, streets and rights-of-way. The work includes: water line (to be built whether or not Calpine's Project is built) and electric transmission overhead crossing. Calpine assumes that because its tap from the water line will not cross the Town highway, no plan approval is necessary, and seeks confirmation of this in the preapplication consultation. The electric transmission lines will comply with minimum vertical clearance standards. Calpine will provide conceptual plans as part of the Article X application and final as-built plans will also be submitted to the Siting Board and the Highway Superintendent as a compliance filing. The plans will include a cost estimate for restoration. Calpine will post the required security prior to construction.

Chapter 162. Subdivision of Land. One parcel of land obtained by Calpine must be subdivided from a larger tract. The subdivided parcel will also need to be consolidated with adjacent parcels as part of the single Project site. This minor subdivision/consolidation does not relate to the construction or operation of the Project and is not incorporated into the Article X review process. Subdivision approval will be sought from the Wawayanda Planning Board. Therefore, the specific requirements of this Chapter are not addressed here.

Chapter 180-25 Vehicles and Traffic.

Sections 180-9, 180-25. Trucks over certain weights excluded. These provisions prohibit trucks over certain weights on certain roads. The weight limitations, however, do not apply to trucks used for delivery and pickup of materials. Trucks that are not exempted are limited to 6 tons on Dolsontown Road between Route 17M and McVeigh Road, 5 tons on McVeigh Road between Route 50 and Echo Lake

Road, and 6 tons on McVeigh Road between Route 50 and Dolsontown Road. Town officials have indicated that this Chapter is not intended to limit local traffic on the restricted streets, i.e., vehicles going to or from businesses located on the restricted streets. Rather, the goal of this local law is to limit the amount of heavy vehicles using these streets as short cuts.

During operation, trucks in excess of the above-referenced weight limits will be used only for delivery and pickup of materials to/from the Project site (e.g., waste haulage and supplies). During construction, it is anticipated that most trucks will reach the Project site via I-84 to Route 17M to Dolsontown Road. During construction, trucks will be used only to deliver materials, facility equipment and construction equipment. Town officials have indicated that the delivery and pickup of these items fall within the exception to the 6-ton restriction on Dolsontown Road. Therefore, the Project will comply with this requirement.

Chapter 189. Water. This Chapter applies to all water districts (existing or to be established) in the Town. The Project is within Water and Sewer District 1. The Project anticipates obtaining process water from the Middletown POTW. Potable water and, if available, back-up process water supply will be obtained through Water and Sewer District 1, as described in the Town Comprehensive Plan 2000 Update (discussed in Section 10.4.3). The Project's water supply is to be detailed in Section 17 of the application. Relevant water district requirements are discussed below.

Section 189-3. Service pipe and fixtures.

A. Mains taps, service connections and service pipes from the mains must be installed at the expense of the customer.

The Project will comply with this requirement.

C. Service lines from the curb stop to the customer's building(s) or meter must be of Type K soft copper tubing, and only compressions fittings that have been approved by the district. Such lines must be installed at the expense of the customer.

The Project will comply with this requirement.

E. Service pipes must be laid not less than 4 feet below ground surface to within 12 inches of the cellar foundation and up to the water meter.

The Project will comply with this requirement.

F. In areas of rocky excavation, 4 inches of sand ballast below and 12 inches of sand above must protect the service line. Service lines must be inspected prior to backfilling.

The service line will be protected as required in the appropriate areas. Calpine will ensure that the required inspection is performed.

Section 189-4. Alternative sources of water. This provision prohibits the connection of any other source of water to a facility that is connected to the district.

Consultation with Town officials indicates that this provision does not apply if an appropriate device such as a backflow preventer is incorporated into the design. The Project will incorporate such a device. Therefore, the Project will comply with this requirement.

Section 189-9. Installation of new water mains. New water mains require the consent of the Town Board, and must be installed as directed by the district.

Potable water will be supplied to the Project through a previously planned water main extension (to serve Water and Sewer District 1), which will be built under the auspices of the Town, irrespective of whether or not the Project is built.

Section 189-12. Specifications for new installations. This Section sets forth, among other things, the specifications that must be followed for the new installation of mains and other infrastructure for new water districts. Such installations will be performed under the auspices of Water and Sewer District 1, and therefore, are not local requirements with which Calpine must comply.

Chapter 190. Water Pollution.

Section 190-1. Prohibited discharges; test samples.

A. The discharge of sewage and waste matter into any streams, watercourses or ditches of the Town is prohibited unless the same is (1) free of all noxious odors and gases which may be injurious, disturbing or offensive to people and (2) free of all germs, bacterial pollution and contamination which may impact the health and safety of people or be injurious or destructive to fish in the receiving stream or watercourse.

The Project will discharge all sewage into the Middletown POTW via a new sewer interconnection. These discharges must comply with applicable federal and state health and safety requirements, as described in Section 17.2 of the application. Project storm water will be collected and routed to a detention basin for solids removal prior to discharge toward adjacent wetlands. Therefore, the Project will comply with this requirement.

B. Tests samples required by state, local, and county laws must be performed.

Calpine will comply with this requirement by following any testing protocols mandated by its Article X Certificate after consultation with Middletown POTW.

Proposed Chapter 195. Zoning. This Section sets forth the proposed zoning requirements currently under consideration by the Wawayanda Town Board. Existing requirements are discussed below.

Article 3. Basic District Regulations.

Section 195-5. Enumeration of Districts. This Section lists the Zoning Districts into which the Town of Wawayanda is divided.

The Project is located in the IORB District.

Section 195-8. Schedule of District Regulations. Industrial Uses are listed as an allowed use by Special Use Permit in the IORB District. Off street parking, accessory garages, water and sewage treatment plants, pump houses, water towers, fire protection monitors, other auxiliary installations and signs are permitted as accessory uses. Uses must comply with applicable Development Standards.

The Project is located in the IORB District and is an allowed industrial use by Special Use permit. Industrial uses are defined as "uses involving manufacturing or processing involving changing the nature, size, or shape of substances or raw materials. Industrial uses may involve chemical applications, heat, pressure or other mechanical processing methods." See Section 195-4. Special Use permit requirements are addressed below. See Article 7 discussion below.

Development Standards.

Lot Area: A minimum lot area of 2 acres is required.

The Project site is several times larger that the minimum 2 acres. Therefore, the Project complies with this requirement.

Lot Width: A minimum lot width of 200 feet is required.

The Project site is several times wider that the minimum 200 feet. Therefore, the Project complies with this requirement.

Front Yard: A minimum front yard of 35 feet is required.

The Project frontage is many times longer that the minimum 35 feet. Therefore, the Project complies with this requirement.

Side Yard: Side yards must be a minimum of 30 feet.

The Project complies with this requirement.

Both Side Yards:

Both side yards combined must be equal to or greater than 80 feet. The Project complies with this requirement.

Rear Yard: A minimum rear yard of 30 feet is required.

The Project complies with this requirement.

Lot Coverage: Lot coverage of up to 60 percent is allowed.

Project buildings and impervious areas such as parking lots total approximately 10 acres or less than 20% percent of the total Project site (53 acres). Therefore, the Project complies with this requirement.

Building Coverage: Building coverage of up to 40 percent is allowed.

Project buildings are a subset of the above-cited less than 20% share of the overall site, and therefore, the Project complies with the 40% maximum limit for buildings.

Building Height: The maximum building height for principal buildings and structures is 35 feet.

The following structures are taller than 35 feet: air-cooled condenser, generation building; exhaust stacks; water tanks; and towers associated with

switchyard/transmission infrastructure. Section 195-11 provides exceptions from this requirement (discussed below).

Section 195-9. Applicability of Regulations

A. This Section provides that the zoning regulations apply when, among other things, the owner or occupant of property establishes a new use.

Calpine will establish a new use; therefore, the substantive provisions of this Chapter apply.

C. Noxious, offensive or objectionable uses are prohibited.

The Project will comply with all applicable standards designed to protect the health, safety and general welfare of the public. Therefore, the Project will comply with this requirement.

5. The permanent installation of mechanical, electrical or other sound amplifier device is prohibited. According to Town officials, this prohibition does not apply to alarm systems and public safety loudspeakers, and Calpine seeks confirmation of this during the pre-application consultation.

No such installation will be made, except for emergency installations noted above.

6. Artificial lights or reflecting devices that interfere with, compete for attention with, or be mistaken for, traffic signals are prohibited.

No such installation will be made, and thus the Project will comply with this requirement.

7. Blinking and flashing signs are prohibited except authorized traffic signals.

No such installation will be made, except as necessary to ensure traffic safety during construction and with the approval of the Town. Thus, the Project will comply with this requirement.

Section 195-10. Lot Development Standards.

A. The development standards contained in this Section are minimum standards.

None of the standards are applicable to the Project; therefore compliance is assured.

Section 195-11. Height Restrictions.

Buildings and structures generally must comply with the height limitation set forth in

the *Schedule of District Regulations*. However, otherwise applicable height limitations shall not apply to water towers, chimneys, smokestacks, transmission towers or other similar non-inhabited structures under 150 feet in height. Structures in excess of 150 feet in height may be permitted by Special Use permit if either (1) the structures are sufficiently set back to avoid any safety hazard to adjoining properties and will meet all applicable State and Federal air safety and electronic communications standards or (2) fire fighting capacity is not threatened by the structures as proposed, and set backs and buffers are proportionately greater.

As noted above, the following structures will exceed the 35 foot height restriction set forth in the *Schedule of District Regulations*: air-cooled condenser; generation building; exhaust stacks; water tanks; and towers associated with switchyard/transmission infrastructure. Of these, the air-cooled condenser, generation building, water tanks and all transmission towers will be less than 150 feet and are not inhabited buildings. The control room/warehouse/maintenance and administration area will be in a 35-foot building. The remaining structures – the two HRSG exhaust stacks and auxiliary boiler exhaust stack -- qualify under the height limitation exemptions above, as their height (225 and 180 feet, respectively) is less than the smallest stack setback (approximately 300 feet). Stack height also does not threaten firefighting capacity.

Special Use permit requirements are addressed below. See Article 7 below.

All Project buildings, whether inhabited or not, have been minimized as to their height while ensuring proper operation of this power plant. To the extent it is determined that any other structures do not qualify for exemption under this Section, Calpine will assert that the height restrictions are unreasonably restrictive in light of existing technology and will seek a waiver under PSL Section 168(2)(d).

Section 195-12. Yard Regulations. This Section, among other things, sets forth exceptions to yard requirements.

The Project will be in compliance with yard requirements, and therefore relief under this Section is not necessary.

Section 195-13. Accessory Structure and Use Standards.

A. Accessory buildings are not allowed in side or front yards, except as provided in Article 3.

No accessory buildings are proposed to be located in side or front yards, therefore the Project will comply with this requirement.

B. The area of accessory buildings in the rear yard may not exceed 50 percent of the rear yard area.

Accessory buildings are not proposed to be located in the rear yard. Therefore, the Project complies with this requirement.

C. Accessory buildings separate from a principal structure must not (1) be within 10 feet of any side or rear lot line, prevent emergency fire fighting access, or shade a residential structure on an adjoining lot, or (2) be closer to the street than a principal structure unless located more than 100 feet from a lot line.

Detached accessory buildings will not be located within 10 feet of side or rear lot lines, prevent emergency fire fighting access, or shade any residential structures, and will in fact be located more than 100 feet from all lot lines. Therefore, the Project will comply with this requirement.

D. Accessory buildings more than one story located within any side or rear yards are subject to Special Use review.

No accessory buildings are proposed to be located in any side or rear yards; therefore this provision does not apply.

G. Except as otherwise allowed through site plan approval, walls and fences must be no more than 6 feet tall when located in side or rear yards or more than 4 feet when located in the front yard. Retaining walls in excess of 4 feet require site plan approval and a building permit.

Site plan and building permit approvals are required for the Project, but are addressed through the Article X review process. Fences will the minimum height and design necessary to ensure safety.

Article 4. General Supplementary Regulations.

195-16. Parking, Loading, Access and Traffic Standards.

A. Parking needs with respect to nonresidential uses are to be determined in conjunction with site plan review, and are based on the following factors:

1. Industry studies of parking needs for the type of use proposed or actual case-study comparisons for projects of similar character.

The experience of other similar power plants is that between 20 and 30 parking spaces are typically required. The Project's proposed parking layout

is consistent with this industry standard.

2. The characteristics of the proposed customers, residents, occupants or visitors to a given facility.

The Project will not have on-site customers, residents, occupants or visitors, per se. Parking needs during operation generally will be limited to employee and delivery/pick-up vehicles.

3. Expected occupancy rates, traffic levels and number of employees in connection with the use, and the degree to which these directly relate to parking requirements.

The maximum number of employees during any shift is not anticipated to exceed 12 on a typical day, with a maximum of approximately 20. Calpine is proposing to provide 28 parking spaces. This corresponds to more than 2 parking spaces per peak shift employee.

4. Recommendations from other public agencies or information sources as to the appropriate parking.

Calpine anticipates that the Article X review process will provide interested or involved public agencies with an opportunity to make recommendations under this subparagraph.

5. Likelihood that parking will be shared with adjoining facilities.

Parking will not be shared with adjoining facilities.

6. Where standards are unavailable, industrial uses require 1 space for every 400 square feet of floor area.

The floor area of the Project will be slightly under 97,000 square feet, which corresponds to 242 parking spaces. This greatly exceeds the number of parking spaces required for the Project. However, a standard for power plants, both in use by Calpine, and in the industry generally, is that not more than approximately 30 spaces are required for a 500 MW natural gas fired combined cycle power plant.

7. Where the Planning Board approves fewer parking spaces than required under subparagraph 6 above, a landscaped set aside area reserved for future parking must be provided.

Given the nature of the facility and the standards discussed above, no landbanking of parking spaces is necessary. The Project requires only about 28 parking spaces. It would not be appropriate to require the reservation of additional land for parking. Any change to the Project that would require substantial new parking would be a major modification of the Article X certificate. Thus Calpine complies with the appropriate standard, and landbanking pursuant to paragraph 7 is not necessary.

B. Each parking space must not be less than 9 feet by 19 feet or an average of 270 square feet.

The Project will comply with this requirement.

C. Lighting to illuminate off-street parking must be arranged to reflect light away from adjoining properties and public rights-of-way.

The Project will comply with this requirement by limiting pole heights and providing shields for downward directivity of light. This will deflect light away from adjoining properties and generally avoid glare.

D. Parking areas designed to accommodate more than 12 vehicles must be landscaped using materials of sufficient growth and height to aesthetically balance the impact of the open paved area and provide effective storm water control. Unless waived by the Planning Board, no more than 12 parking spaces in a continuous row are allowed without landscaping. Parking areas should be designed to prevent vehicles backing out onto public highway or through roads. Traffic flows through a parking area should be minimized. Where appropriate, parking areas should be located in the rear or side yards in order to maintain continuity of the building line along highways.

The Project will be in general compliance with these requirements. Storm water controls are addressed in Section 17.5 of the application. In the case of the proposed Project, it is not appropriate to attempt to maintain continuity of the streetwall given the lack of building density along Dolsontown Road.

E. In addition to required off-street parking, adequate loading spaces must be provided. Public rights-of-way may not be used for loading or unloading. Loading spaces must be a minimum of 60 feet in depth and 12 feet in width, with an overhead clearance of 14 feet.

Loading spaces will be provided to adequately serve the needs of the Project's ammonia storage, water storage and treatment, and warehouse/shop areas. Public rights-of-way will not be used for loading or unloading. Loading spaces will meet required minimum dimensions.

F. Access to and from nonresidential off-street parking and loading must consist of well defined separate or common entrances and exits, and comply with the following requirements:

1. Access drives must not open onto any public right-of-way within 80 feet of the nearest right-of-way line of an intersecting public street or highway or where the sight distance in either direction is less than 200 feet.

The nearest intersections are with McVeigh Road and Route 17M – both being many times more distant than the minimum 80 feet. Sight distance at the driveway intersection with Dolsontown Road will be in excess of 700 feet. Therefore, the Project will comply with this requirement.

2. There shall be no more than one entrance and one exit unless safety considerations demand otherwise. Entrances and exits must be clearly defined with curbing, fencing or vegetative screening. One entrance and exit must not be located within 80 feet of another on the same property or adjoining property along the same public right-of-way.

The Project will comply with these requirements.

3. A road occupancy or street encroachment permit must be obtained for all access drives from the Town of Wawayanda Highway Department, the Orange County Department of Public Works, or NYS department of Transportation, as the case may be. Approvals hereunder are conditions upon receipt of the foregoing permit(s).

The required road occupancy or street encroachment permits will be addressed through the Article X review process, and the Siting Board's approval of this permit is sought. Utilities to cross highway lines are: water line (being built with or without the Calpine Project), and overhead electric transmission line (crossing Dolsontown Road).

4. No use which requires year-round access from the Town Highway designated as a low volume or minimal maintenance seasonal highway is permitted.

Access will be from Dolsontown Road, which is not designated as a low volume or minimal maintenance seasonal highway. Therefore this provision does not apply to the Project.

G. Parking and loading areas, and parallel circulation and service lanes must be separated from the paving edge of a public thoroughfare or adjoining property lines by a planting strip of at least 20 feet in depth with required landscaping.

The Project will comply with this requirement.

H. The Planning Board may require a traffic impact study where the proposed use involves an activity likely to generate more than 500 trip-ends per day.

A comprehensive traffic impact study will be provided in accordance with Article X requirements. See Section 15 of the Application. Therefore, the Project complies with this requirement.

195-17. Floodplain Development Standards. The Section imposes requirements for areas lying with Special Flood Hazard Areas on the Flood Hazard Boundary Maps for the Town of Wawayanda, as issued by the Federal Insurance Administration.

The Project site and buildings lie outside Special Hazard Flood Areas; therefore the requirements of this Section do not apply.

195-19. General Commercial and Industrial Standards.

A. For commercial or manufacturing uses contiguous to an existing residential use or any approved residential lot in a residential district, the Planning Board may require the minimum front, side and rear yards to be increased by 50 percent. The Planning Board also may require a buffer consisting of a solid fence and/or a 20-foot wide dense evergreen planting not less than 6 feet high "for the purposes of separating incompatible activities or shielding the residence from negative impacts."

Increasing the required yards by 50% yields: 53 foot front yard; 45 foot side and rear yards; 120 foot minimum combined side yards. All of these dimensions are met under the proposed plan, and therefore the Project can comply with any such requirement. Calpine's proposed landscaping will be presented in the Article X application.

B. Activities involving the manufacturing, production, storage, transfer or disposal of flammable and explosive materials must utilize adequate safety devices against hazard of fire and explosion. Appropriate fire-fighting and fire suppression equipment must be provided. Burning of waste is prohibited. Details of potential hazards and planned safety and accident response actions shall be provided and the Planning Board may require greater front, side, or rear yards or fencing.

The Project's firefighting system is described in Section 3.10 of the application. Chemicals that require separation will be segregated. The Project will be constructed in accordance with applicable State and Federal fire and electrical safety standards. No waste will be burned on site. Information concerning hazardous materials is provided in Section 3.9 of the application. Thus, the Project will comply with this requirement.

C. Activities involving the dangerous emission of radioactivity and electrical disturbance adversely affecting the operation of equipment other than the creator of such disturbance are prohibited.

The Project will not cause any emissions of radioactivity and will not cause any electrical disturbance that will adversely affect the operation of non-Project equipment, other than interference incidental to overhead transmission lines such as those near the site today. Electric transmission, reliability, and electric and magnetic field issues relating to the Project are comprehensively addressed in Section 8.

D. Noise may not exceed an intensity of 65 decibels as measured one hundred feet from the boundaries of the lot where such use is situated.

Noise impacts are addressed in Section 11. The Project will comply with this requirement.

E. No vibrations on a regular or continuous basis, which are detectable at the property line, are allowed.

Major Project equipment (i.e., turbines) will be tuned to prevent vibration, which is detrimental to facility operation. Minor incidental vibrations may occur during construction. No vibrations that are detectable at the property line are anticipated during operation. Therefore, the Project will comply with this requirement.

F. Lighting must be designed to avoid unnecessary and unsafe spillover of light and glare onto motor vehicles, pedestrians and land uses in proximity to the light source. Light sources must comply with the following standards.

Type of Light Source	Max. Illumination at Property Line	Max. Height of Light
Globe Light	0.20 foot-candles	15 feet
>90% cutoff	0.75 foot-candles	25 feet
<90% cutoff	2.00 foot-candles	30 feet

No direct or sky directed glare that is visible at the property line on a regular or continuing basis is permitted.

All property line illumination will comply with the foot-candle limits set forth above, to the degree consistent with Federal Aviation Administration (FAA), Occupational Health and Safety Administration (OSHA), and security requirements. An iso-lumen lighting plan will be presented in the Article X Application. Calpine would like to

clarify with Town of Wawayanda that this provision is not applicable to FAA-mandated aeronautical marker lights.

G. No emission is permitted on a regular or continuing basis from any chimney or otherwise, of visible gray smoke of a shade equal to or darker than No. 2 on the Power's Micro-Ringlemann Chart.

Project emissions will be subject to NYSDEC opacity standards, which will ensure compliance with this provision. Emissions of water vapor from the plant, when visible, will be white, much lighter than the referenced shading.

H. No emission of fly ash, dust, fumes vapors, gases and other forms of air pollution is permitted on a regular or continuing basis which can cause damage to health, animals, vegetation, or other forms of property, or which can cause excessive soiling.

The Project will comply with all applicable Federal and State air emissions standards, which are designed to protect human health and the environment. Therefore, the Project will comply with this requirement.

I. Activities involving possible contamination of surface or ground water must be provided with adequate safety devices to prevent such contamination.

Comprehensive measures to protect against surface and groundwater contamination are detailed in Section 17 of the application. Therefore, the Project will comply with this requirement.

K. All industrial uses, processing and storage shall be within fully enclosed structures. No tanks, cupolas, vents or other apparatus peculiar to the processing shall be visible outside approved buildings. The façade of buildings and structures must be compatible with adjacent development and must be landscaped in accordance with the Town's landscaping requirements.

The major processes at the plant include air intakes, fuel delivery/compression, combustion, heat recovery to generate steam, power generation by both combustion and steam turbines, steam cycle and turbine cooling, water demineralization, and bulk liquid storage (water, wastewater, and ammonia) in aboveground tanks. All of the activities that are reasonably placed indoors have been so placed – fuel delivery/compression, combustion, heat recovery to generate steam, power generation by both combustion and steam turbines, and water demineralization. The following activities, however, are properly placed outdoors: air intakes, steam cycle and turbine cooling, water demineralization, and bulk liquid storage in aboveground tanks.

Not only the building façade, but all outdoor structures such as tanks will be designed to fit appropriately with adjacent industrial and non-industrial uses. Issues related to color and texture are detailed in Section 16 of the Application. The Project is

compatible with uses allowed in the IORB District, and will not unreasonably interfere with existing nearby uses. See Section 10.3.

In light of the technological requirement that certain processes cannot be located in fully enclosed buildings, Calpine asserts that this provision is unreasonably restrictive with respect to those specific technologies, and seeks a waiver under PSL Section 168(2)(d).

195-20. Landscaping, Screening, Ridge Development and Buffer Regulations.

A. The standards set forth in this Section are intended to enhance the appearance and natural beauty of the Town and to protect property values.

B. General requirements.

1. Graded and seeded and other landscaping requirements must be completed prior to the issuance of a certificate of occupancy. An applicant must post a bond or file an irrevocable letter of credit if such work cannot be completed due to seasonal impracticalities.

If necessary due to seasonal factors, Calpine will post the required security. Calpine is in consultation with the Town regarding appropriate landscaping measures.

2. Landscaping, trees and plants must be planted and maintained in a healthy growing condition. If necessary, planting must be replaced during the next growing season. An applicant must post a bond or file an irrevocable letter of credit if such work cannot be completed due to seasonal impracticalities.

The Project will comply with this requirement and, if necessary, post the required security.

3. Required screening fences or walls must be maintained in a good condition.

The Project will comply with this requirement.

4. Where required by the Planning Board, landscaping, trees and planting material adjacent to parking areas, loading areas, or driveways, must be protected by protective barriers, curbs or other damage control and from storm water runoff.

Storm water control measures are described in Section 17.5. The Project will incorporate protective measures to protect landscaping and vegetation adjacent to parking areas, loading areas and driveways.

5. To the maximum practical extent, mature shade trees, ridgelines, vegetation and unique site features such as stone walls should be preserved. Such preservation measures may be considered by the Planning Board or Building Inspector in determining whether the intent of this Section is satisfied.

In order to accommodate the site topography, it is necessary to remove the boundary vegetation and structures of one of the interior lots within the Project site. However, all shade trees, ridgelines, vegetation and similar features around the site boundaries will be preserved to the maximum extent practical.

6. Where the lot size or shape or existing structures make it infeasible to comply with the requirements for a front landscaped area or landscaped parking area, the Planning Board may approve planters, plant boxes, or pots containing trees to comply with the intent if this Section.

The Project will not require the relief granted under this Section.

7. A buffer area is required along all boundaries of a non-residentially zoned or utilized lot abutting any lot in a residential district.

The Project site does not abut any lot in a residential district; therefore this provision does not apply to the Project.

C. Front landscaped areas. A front landscaped area is required in all districts. Front landscaped areas must be covered with grass or other appropriate trees or shrubs, unless maintained in the existing natural cover. For nonresidential uses, one shade tree (minimum caliper of three inches at four feet) must be planted for each 40 feet of lot frontage.

The Project's front lot will be covered with grass, trees or shrubs. The Wawayanda Planning Board is advising the Project regarding landscape design. The Project will comply with this requirement.

D. Landscaped parking areas. Where 20 or more parking spaces are required, at least 10 square feet of interior landscaping must be provided within the paved area for each parking space, and at least one tree must be provided for every ten parking spaces. Each landscaped area must be at least 100 square feet, planted with grass or shrubs, and contain at least one tree. A landscaping area must also be provided along the perimeter of the parking area, except where access is provided.

The Project will have in excess of 20 parking spaces, and landscape areas will be provided.

E. Planning. The Planning Board may require a landscape plan for any project requiring site plan or special use approval, or for a nonresidential use so as to buffer

parking areas and buildings from the highway, each other and other uses. If required, the landscape plan must specify the location of trees of six inches caliber or greater and indicate existing vegetation to be removed or preserved. The plan must demonstrate how building materials, textures and colors will blend in with the natural and manmade landscape. Visual depictions from the perspective of those who will view the site should be included. Prior to approving, approving with modifications or disapproving a special use, the Planning Board must also consider whether the plan (1) promotes attractive development, preserves existing vegetation to the maximum extent possible, enhances the appearance of the property and complements the character of the surrounding area; (2) uses landscaping to delineate or define vehicular and pedestrian ways and open space; (3) selects plant material complementary to facility structures and natural vegetation and of sufficient size and quality to accomplish the intended purpose; (4) effectively buffers the proposed activity from adjoining uses; and (5) is realistic in terms of maintenance, materials and location.

Details of the landscape plan are provided in Section 16 of the application. Compliance of the plan with these 5 standards is set forth in that section.

195-21. Water Supply Protection Overlay Zones. This Section sets forth requirements for uses proposed in water supply protection overlay zones. According to the existing and draft revised Zoning Map of the Town of Wawayanda (Alpine Environmental Consultants, last revised 4/28/00) as well as Orange County Water Authority wellhead protection zone mapping reviewed at Wawayanda Town Hall, the Project is not located in such a zone. Therefore the requirements of this Section do not apply.

Article 7. Special Use and Site Plan review Procedures. This Article sets forth the procedures and criteria for considering a Special Use or Site Plan application. Absent the state Article X process, the Project would be subject to Article 7 for the following purposes:

1. As an industrial use, the Project is permitted in the IORB District by Special Use permit. See Section 195-8 above.

2. Structures over 150 feet may be exempted from height restrictions under certain circumstances (which are applicable here) by Special Use permit. See Section 195-11 above.

195-58. Application and Site Plan Required. The following information must be provided with a site plan application:

A. The location of all existing watercourses, wooded areas, rights-of-way, roads, structures or any other significant man-made or natural feature, if such feature has an effect upon the use of said property.

B. The location, use and floor or ground area of each proposed building, structure or any other land use, including sewage disposal and water supply systems.

C. The location of all significant landscaping and ground cover features, both existing and proposed, including detailed planting plans and a visual depiction or rendering of the final appearance of the property after all landscaping and other physical improvements are completed.

D. The location, dimensions and capacity of any improved roads, off-street parking areas or loading berths, including typical cross-sections for all paving or regrading involved.

E. The location and treatment of proposed entrances and exits to public rights-of-way, including traffic signals, channelizations, acceleration, deceleration lanes, widening or any other measures having an impact on traffic safety conditions.

F. The location and identification of proposed open spaces, parks or other recreational uses.

G. The location and design of buffer areas and screening devices to be maintained.

H. The location of trails, walkways and all other areas proposed to be devoted to pedestrian use.

I. The location of public and private utilities, including maintenance facilities.

J. The specific locations of all signs existing and proposed, including a visual depiction of the latter.

K. Preliminary architectural plans for the proposed buildings or structures, indicating typical floor plans, elevations, height and general design or architectural styling.

L. A completed SEQRA environmental assessment.

M. Any other information required by the Planning Board which is clearly necessary to ascertain compliance with the provisions of this law and limited to such information.

All of the required information regarding dimensions, locations and associated information concerning the Project, including existing and proposed structures and features, will be shown in the *Site Development Plan* to be attached to the Application. Renderings of the Project when constructed can be found in Figure 16-2. Article X projects are exempted from SEQRA's requirements; however, the information provided with the Article X application essentially provides the same information that would be required under SEQRA.

195-61. Conditions. The Planning Board may impose reasonable conditions and restrictions on Site Plan approval as are directly related to and incidental to the proposed Special Use permit or Site Plan.

Calpine anticipates that such conditions will be accommodated through the Article X process with input from Wawayanda town officials.

195-66. Special Use Review Criteria. In reviewing a Site Plan application the Planning Board shall consider its conformity with the Town's Master Plan, other plans, and Town laws and ordinances. Conservation features, aesthetics, landscaping and impact on surrounding development and the Town as a whole must also be considered. Traffic flow, circulation and parking must be considered to ensure the safety of the public and the users of the facility and to ensure there is no unreasonable interference with traffic on surrounding streets.

The Project's conformity with the Wawayanda and Orange County comprehensive plans is addressed in subsequent Sections 10.4.2 and 10.4.7. Conservation features, aesthetics, landscaping and impact on surrounding development and the Town as a whole are addressed in Section 10.3. Traffic impacts and proposed mitigation measures are addressed in Section 15.

In addition the following factors are considered:

A. Building design and location. Building design and location should be suitable for the use intended and compatible with natural and man-made surroundings. New buildings, for example, should generally be placed along the edges and not in the middle of open fields. They should not be sited to protrude above treetops or ridgelines of hills seen from public places ands busy highways. Building color, materials and design should be adapted to surroundings.

Project buildings and structures generally are located away from the edges of the site to minimize aesthetic impacts. Calpine believes that the goal of this factor is to minimize aesthetic and visual impacts, and due to the industrial nature of the Project this is best served by locating the facility away from the edges of the site. Similarly, minimization of impacts from tall structures, including those in excess of 150 feet, is best accomplished by locating these structures away from the edges of the site. In

addition, the texture and color of the facility will be designed to be unobtrusive: non-reflective materials will be used, with neutral tones.

C. Lighting and signage. Improvements made to the property should not detract from the character of the neighborhood by producing excessive lighting or unnecessary signage. Recessed lighting and landscaped ground signs are preferred.

Lighting will be shielded to provide downward directivity, and will not be excessive. The front sign will be landscaped, as will the frontage of the property.

D. Parking and accessory buildings. Parking should be placed in the rear whenever possible and provide for connections to adjoining lots. Accessory buildings also should be located in rear with access from rear alleys. If placement in the rear is not possible, parking lots should be located to the side with screening from the street.

Parking has been placed into the interior of the site, complying with this guideline.

E. Drainage systems. Storm drainage, flooding and erosion and sedimentation controls should be employed to prevent injury to persons, water damage to property and siltation to streams and other water bodies.

The Project will be constructed and operated in full compliance with applicable local, state and Federal storm water, flooding, erosion and sedimentation control requirements. These requirements, and the storm water management system design, are detailed in Section 17.5.

F. Driveway and road construction. Whenever feasible, existing roads onto or across properties should be retained and reused instead of building new, so as to maximize the use of present features such as stone walls and tree borders and avoid unnecessary destruction of landscape and tree canopy. Developers building new driveways or roads through wooded areas should reduce removal of tree canopy by restricting clearing and pavement width to the minimum required for safely accommodating anticipated traffic flows.

The Project site currently is being used for agricultural purposes; therefore, no roads, stone walls, tree borders, landscaped areas or tree canopy exist. The Project will be constructed to minimize pavement and clearing and ensure safe traffic flow. No road through wooded areas are necessary.

G. Construction on slopes. The crossing of steep slopes with road and driveways should be minimized and building which does take place on slopes should be multi-storied with entrances at different levels as opposed to regrading the site flat.

On-site roads and driveways will not have steep slopes. Due to existing topography,

some on-site regrading will occur to accommodate Project structures. This effort will be localized, and the site, as a whole, will not be regraded flat.

H. Tree borders. New driveways onto principal thoroughfares should be minimized for both traffic safety and aesthetic purposes and interior access drives which preserve tree borders along highways should be used as an alternative. Developers who preserve tree borders should be permitted to recover density on the interior of their property through use of clustering.

There is very little tree border along Dolsontown Road and the site frontage, but vegetation along this border will be preserved to a maximum practicable extent. The Project is designed to have a single point of access to Dolsontown Road. Existing tree borders will not be disturbed.

I. Development at intersections. Building sites at prominent intersections of new developments should be reserved for equally prominent buildings or features, which will appropriately terminate the street vistas. All street corners should be defined with buildings, trees or sidewalks.

The Project site is not located at a prominent intersection; therefore this factor is not a major consideration.

J. Streets and sidewalks. Cul-de-sac and dead-end streets should be discouraged in favor of roads and drives which connect to existing streets on both ends. Streets within residentially developed areas should be accompanied by on-street parking and a sidewalk on at least one side of the street. Sidewalks should also be provided in connection with new commercial development adjacent to residential areas and pedestrian access should be encouraged.

No dead-ends streets or cul-de-sacs are proposed. Additional goals relate to residential development and therefore are inapplicable.

K. Setbacks. New buildings on a street should conform to the dominant setback line and be aligned parallel to the street so as to create a defined edge to the public space.

Due to the type of project being developed setbacks are maximized to the greatest extent practicable to minimize off-site impacts and exceed the requirements set forth in the Schedule of Districts Regulations for the IORB District. Due to the size of the Project site, alignment with other structures on adjacent properties is not a concern. This goal appears to be primarily focused on more dense development.

L. Adjacent properties. The proposed use should not have a detrimental impact on adjacent properties or the health, safety and welfare of the residents of the Town of

Wawayanda.

The Project will comply with all health, safety and welfare requirements. The Project is consistent with development allowed in the IORB District and the existing trend of development in the area. As documented throughout this Application, impacts to adjacent properties have been minimized to the greatest extent practicable.

M. Conditioned approval. If the proposed use is one judged to present detrimental impacts with respect to noise, lighting, surface runoff, emissions or other similar factors the Planning Board shall determine whether an approval could be conditioned in such a manner as to eliminate or substantially reduce those impacts.

The Project will mitigate the potential for detrimental impacts with respect to noise, lighting, surface runoff, emissions or other factors. Calpine anticipates that appropriate conditions will be developed during the Article X process, with input from Town of Wawayanda officials and other interested parties.

N. Community impacts. The Planning Board shall consider whether the use will have a positive or negative effect on the environment, job creation, the economy, housing availability or open space preservation. The granting of an approval should not cause an undue economic burden on community facilities or services, including but not limited to highways, sewage treatment facilities, water supplies, and fire-fighting capabilities. The applicant shall be responsible for providing such improvements or additional services as may be required to adequately serve the proposed use and any approval shall be so conditioned. The Town shall be authorized to demand fees in support of such services where they cannot be directly provided by the applicant. This shall apply, but not be limited to, additional fees to support fire-district expenses.

Section 12 analyzes and quantifies incremental costs as well as benefits to the Town, local school district, and other local service districts. The Project will demand few services from the Town and will contribute substantial tax revenue. Calpine is working with local emergency services providers to ensure their capability to respond in the unlikely event of an emergency. Otherwise, the Project will not cause an undue burden on highways, sewage treatment facilities, or other community services.

O. Hamlet areas. The hamlet areas of Wawayanda, specifically Ridgebury, Slate Hill and old New Hampton, are an important and integral part of the town's culture and heritage. The hamlets represent historic, compact, developed areas within the largely rural regions of the town. The character and quality of Wawayanda would be permanently diminished if these small settlements were to disappear from the landscape. New development should be integrated into the hamlet centers in such a way that it improves upon the positive aesthetic aspects of the hamlet centers and

ensures that these centers will be preserved. New buildings and additions to existing buildings should blend into the existing hamlet landscape to the maximum extent practical. In considering an application for a Special Use within the Town Commercial and Hamlet Business Districts, the Planning Board shall consider certain factors.

The Project site is not located in any of the Town's hamlet area, Therefore this factor is not a concern.

195-69. Permit Requirements.

A, E, F, G, H. No person shall construct, erect, alter, convert or use any building of structure, or part thereof, not change the use of land, until a building permit and/or Certificate of Occupancy is issued by the Building Inspector. A building permit or Certificate of Occupancy shall not be issued, or may be revoked, if the use is not in compliance with the zoning law.

The building permit and Certificate of Occupancy approval will be sought from the Siting Board or from the Town.

B. Prior to use of a new structure, a Certificate of Occupancy must be obtained from the Building Inspector.

The Certificate of Occupancy can be handled via a compliance filing with the Siting Board or directly with the Town.

D. The Building Inspector shall ensure that all water supply and sewage disposal facilities proposed in connection with any building permit or Certificate of Occupancy application shall conform with NYSDOH guidelines.

The Project will comply with applicable water supply and sewage disposal requirements.

K. A building permit, site plan approval, or Special Use permit shall expire after 24 months if the applicant fails to complete the improvements as approved. The Building Inspector may grant an extension if good cause (such as seasonal weather conditions) exists. Extensions beyond 12 months require Town Board approval.

Project construction is estimated to last approximately 24 months. Calpine seeks Siting Board approval for a 30-month construction period to allow for mobilization.

L. Building permits for accessory buildings shall not be issued in advance of permits for principal buildings or special uses or without an existing principal use in place and being operated on an ongoing basis.

The Project will comply with this requirement.

N. No permits shall be issued for any new uses where there are unremedied existing violations.

The Project will comply with this requirement.

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Existing Chapter 195. Zoning. This Section sets forth the existing zoning requirements, which will be replaced when the proposed zoning ordinance is adopted.

Article III. Establishment of Districts and Zoning Map. District Use, Lot and Bulk Regulations.

Section 195-7. Prohibited uses.

A. Uses that are dangerous or prejudicial to the health, safety or general welfare are prohibited.

The Project will comply with applicable health and safety requirements. Therefore, the Project is not prohibited under this Section.

B. The permanent installation or use of any sound amplifier device that is audible beyond the property on which it is located. According to Town officials, this prohibition does not apply to alarm systems and public safety loudspeakers, and Calpine seeks confirmation of this during the pre-application consultation.

No such installation will be made, except for emergency installations noted above.

Article IV. District Use, Lot and Bulk Regulations.

Section 195-18. LOR Light Industrial/Office/Research District. A number of uses are permitted as of right in the LOR District; others are allowed by special permit. The following two uses are allowed by special permit: (1) light industrial as per Section 195-36; and (2) railroad, public utility, radio and television transmission antennas, rights-of-way and structures necessary to serve the Town. Accessory uses are also allowed in the LOR District. They include off-street parking in accordance with Article VII (discussed below), accessory garages, pump houses, water towers, storage tanks for other liquefied materials, fire protection monitors and other auxiliary installations. An accessory use is defined as a "use clearly incidental and subordinate to and customary in connection with the principal building or use."

"Light industrial" is defined as "any process whereby the nature, size or shape of articles is assembled such that no chemical or compressive processes are required and

whose finished size does not exceed forty (40) cubic feet or weigh in excess of two thousand (2,000) pounds." The "article" produced by the Project – electricity – does not have any size or weight per se. Some chemical/compressive activities will occur, however. It is difficult to imagine any industrial activity, light or otherwise, that would not involve some chemical or compressive activity. Thus the scope of this definition needs to be clarified with the Town.

"Public utility" is defined as a "use necessary for the safe and efficient operation of a gas, water, communication, electric or sewage disposal system for the benefit of the public." The definition focuses on the use of land, and not the user. Thus, the definition does not limit permitted uses to electric systems that are owned or operated by entities such as Orange and Rockland Utilities or the New York Power Authority, as opposed to Calpine. Further, in the deregulated market, private companies such as Calpine, as opposed to older established utilities, will be primarily responsible for the development of new electric generating facilities in New York. The public will benefit from the addition the Project because it will facilitate the development of the emerging electric generation market in New York State. Regarding "safety" and "efficiency", the Project will be among the most safe and efficient electric generating facilities in the world, and its operation will help displace or reduce the operation of older more polluting and less efficient plants. Thus, the Project appears to fit within the definition of public utility, as that term is defined in the Code. Public utility structures are allowed, by special permit. The term structure is not separately defined but incorporated into the definition of building, which is defined as "any structure having a roof supported by such things as columns, posts, piers or walls and intended for the shelter, business, housing or enclosing of persons, animals, property or other materials, including any combination of materials forming any construction." The term building also includes, among other things, transmission towers. The foregoing does not appear to preclude the Project as a permitted use in the LOR District. Calpine will consult with the Town regarding the phrase "necessary to serve the Town," and in how it should be interpreted in light of the new unregulated market for wholesale electric generation in New York State, and how the Town and the general public is served under this new regime.

Assuming the Project is an allowed use, the principal buildings (those necessary for the process of combustion, steam production, electricity production and related industrial processes) would be the generation building, air-cooled condenser, wet surface air cooler, warehouse/maintenance building, water treatment building, gas compressor, water storage tanks, ammonia storage tank, etc. There are no buildings proposed on-site that are incidental to the designed power production process. All buildings on-site are integral to this process, and thus there are no buildings that would fit the definition of accessory buildings.

Schedule of Zoning District Regulations.

There are no bulk requirements set forth for public utility structures, therefore only light industrial requirements are discussed.

Lot Area: A minimum lot area of 5 acres is required.

The Project site is approximately 53 acres. Therefore, the Project complies with this requirement.

Lot Width: A minimum lot width of 400 feet is required.

The Project site is more than 1000 feet in width. Therefore, the Project complies with this requirement.

Front Yard: A minimum front yard of 100 feet is required.

The Project complies with this requirement.

Side Yard: Side yards must be a minimum of 50 feet.

The Project complies with this requirement.

Both Side Yards:

Both side yards combined must be equal to or greater than 100 feet.

The Project complies with this requirement.

Rear Yard: A minimum rear yard of 50 feet is required.

The Project complies with this requirement.

Lot Coverage: Lot coverage of up to 60 percent is allowed for lots greater than 10 acres.

Project buildings and impervious areas such as parking lots total approximately 10 acres or less than 20% percent of the total Project site (53 acres). Therefore, the Project complies with this requirement.

Building Height: The maximum building height for principal buildings and structures is 150 feet.

All principal buildings and structures meet this requirement. The air-cooled condenser is 120 feet tall, whereas the generation building (highest tier) is at 106 feet. Accessory buildings and structures are discussed under Section 195-43. Stacks may be exempted from this requirement under Section 195-44 (discussed below).

Article V. Special Permit Regulations.

Section 195-20. Special permit uses.

Uses requiring a special permit require approval from the Planning Board. In addition to the use and bulk requirements for uses in the LOR District, the Planning Board may impose additional conditions. Prior to approval, the Planning Board must make findings that the proposed use:

1. will be properly located with respect to supporting infrastructure;
2. will not create undue traffic hazards or congestion;
3. will not adversely affect value of property, the character of the neighborhood or pattern of development;
4. encourage appropriate land use consistent with the needs of the Town;
5. will not impair the public health, safety or welfare; and
6. meet applicable requirements.

Special permit requirements will be reviewed during the Article X review process. (PSL §172). A copy of the Article X Application, however, will be forwarded to the Planning Board for review. Necessary supporting infrastructure is addressed in detail in the Application, a copy of which is being forwarded to the Planning Board. Traffic issues are addressed in Section 15. The Project is consistent with the land uses and pattern of development proposed by the Town for this area, and as such is not expected to adversely impact property values. Calpine has undertaken comprehensive mitigation measures to minimize off-site impacts. The Project will comply with applicable health, safety and environmental requirements, ensuring the protection of the public health, safety and welfare. As noted above, the Project will comply with applicable use and bulk requirements. In addition, Calpine will accept any additional reasonable conditions imposed by the Planning Board. Based on the foregoing, Calpine believes that its Project meets the substantive requirements for granting special permit approval.

Section 195-36. Light industry.

To the extent that the Project is permitted as a light industrial use, this Section is applicable. Section 195-36 states that light industrial uses as defined herein shall be subject to the performance standards set forth in Section 195-55, and all uses, processing and storage shall be within fully enclosed structures, and no tanks, cupolas, vents or other apparatus to the processing shall be visible outside approved

buildings. The façade of buildings and structures shall be compatible with adjacent development and shall be fully landscaped in accordance with Section 195-51.

The major processes at the plant include air intakes, fuel delivery/compression, combustion, heat recovery to generate steam, power generation by both combustion and steam turbines, steam cycle and turbine cooling, water demineralization, and bulk liquid storage (water, wastewater, and ammonia) in aboveground tanks. All of the activities that are reasonably placed indoors have been so placed – fuel delivery/compression, combustion, heat recovery to generate steam, power generation by both combustion and steam turbines, and water demineralization. The following activities, however, are properly placed outdoors: air intakes, steam cycle and turbine cooling, water demineralization, and bulk liquid storage in aboveground tanks.

Thus, to the extent that Calpine needs to rely on the "light industry" use under existing zoning, a waiver from these requirements will be asserted under PSL Section 168(2)(d). The waiver would be sought in light of the technological requirement that certain processes cannot be located in fully enclosed buildings. Compliance with Sections 195-55 and 195-51 is addressed below.

Article VI. Supplementary Regulations.

Section 195-41. Buildings not on mapped streets. A building permit or certificate of occupancy may not be issued for a building located on property that does not have frontage on an existing or mapped road or street.

The Project site abuts a Town road. Therefore, the Project complies with this requirement.

Section 195-43. Accessory buildings. Other than buildings used for storage during construction, accessory buildings may not be erected prior to any principal building. Accessory buildings are not allowed in front or side yards. Accessory buildings generally may not exceed 10 feet in height.

All buildings on the property are integral to the designed power production process. As such, no accessory buildings for the Project will be constructed.

Section 195-44. Exceptions.

B. Height restrictions do not apply to chimneys or water or cooling towers, provided that such areas do not exceed 10 percent of the total roof area to which they are a part. Any such structure must be set back at least a distance equal to its height.

The only structures in excess of 150 feet are the HRSG and auxiliary exhaust stacks. The total area of the exhaust stacks is less than 1,000 s.f., whereas the area of the

generation building to which they are attached is in excess of 65,000 s.f – a ratio of less than 10 percent. Thus, the stacks qualify for this exception.

F. At least one hundred feet of street frontage is required.

The Project site has in excess of 100 feet of street frontage.

G. This provision sets forth a front yard requirement for properties abutting a state highway or county road.

The Project abuts Dolsontown Road, which is a Town road. Therefore, the requirements of this provision do not apply.

Section 195-46. Fences and walls. Except as otherwise allowed through site plan approval, fences and walls must not exceed 6 feet in height in side or rear yards or 3 feet in height in front yards.

Site plan and building permit approvals are required for the Project, but are addressed through the Article X review process. Fences will the minimum height and design necessary to ensure safety.

Section 195-47. Extractive operations preparatory to building construction. Preparatory excavation work for building construction is allowed once the site plan has been approved and building permit has been issued. Any areas from which topsoil has been removed or covered with fill must be seeded with a cover crop within one year following the start of operation.

Undeveloped disturbed areas will be seeded with a cover crop within one year of facility start-up.

Section 195-51. Landscaping, screening and buffer regulations.

B. General requirements. Lots must be graded and seeded prior to the issuance of a certificate of occupancy. An applicant must post a bond or file an irrevocable letter of credit if such work cannot be completed due to seasonal impracticalities. Landscaping, trees and plants must be planted and maintained in a healthy growing condition, and, when located next to parking areas, loading areas, or driveways, may be required to have protective barriers, curbs or other damage control. To the extent practical and possible, existing trees, vegetation, and unique site features must be retained and protected.

The Project will comply with this requirement and, if necessary, post the required security.

C. Front landscaped area. Front landscaped areas must be covered with grass or other appropriate trees or shrubs. For nonresidential uses, one shade tree (minimum caliper of two and one half inches at three feet) must be planted for each 40 feet of lot frontage. Existing trees, if properly located, may be used to meet this requirement.

The front lot will be covered with grass, shrubs and appropriately sized trees. The Project will comply with this requirement.

D. Landscaped parking areas. Where 20 or more parking spaces are required, at least 10 square feet of interior landscaping must be provided within the paved area for each parking space, and at least one tree must be provided for every ten parking spaces. Each landscaped area must be at least 100 square feet and contain at least one tree. A landscaping area must also be provided along the perimeter of the parking area, except where access is provided.

The maximum number of employees during any shift is not anticipated to exceed 12 on a typical day, with a maximum of approximately 20. Calpine is proposing to provide 28 parking spaces. This corresponds to more than 2 parking spaces per peak shift employee. Calpine will comply with the foregoing landscaping requirements.

Section 195-55. Performance standards in nonresidential districts.

A. Noise must not exceed an intensity, as measured 100 feet from the property boundary, of the average intensity, occurrence and duration of the noise of street traffic at adjoining streets.

Since this Performance Standard was considered ambiguous and difficult to apply quantitatively by the Town of Wawayanda Building Inspections Department, the Project has confirmed that it is no longer enforced.

B. No dust, dirt, smoke, odor, or noxious gases may be disseminated beyond the boundary of the property.

The prohibition is intended to apply only to nuisance emissions beyond the property line. The Project will comply with all applicable health and environmental standards and requirements. Therefore, no nuisance emissions will occur.

C. No glare or heat that is produced that is perceptible beyond the boundary of the property is allowed.

The location of heat generating equipment is sufficiently far away from property boundaries to ensure compliance. Issues relating to visibility, including avoidance of glare, are addressed in Section 16. Project buildings and structures will be painted with non-reflective material to minimize glare.

D. Disposal of solid or liquid wastes must be in compliance with applicable standards.

Waste disposal is addressed in Sections 3 and 17, for solid and liquid wastes, respectively. The Project will comply with applicable standards.

E & G. Adequate safety measures must be provided for use and storage of flammable and explosive materials. Industry standards must be followed. ... The processing, manufacture, disposal, transportation, storage, or dispensing of hazardous materials (as defined in 40 CFR 116) must follow applicable state and federal standards and regulations, or in a manner so as not to cause a hazard to public health, safety or welfare or to interfere with the use of adjoining property.

Compliance with safety guidelines is described in Section 3 of the application. Industry standards must be followed not only due to applicable regulations, but in order to be able to finance an undertaking of the Project's magnitude, as a requirement of insurance companies.

Article VII. Off-Street Parking, Driveways and Loading Areas.

Section 195-62. Required off-street parking. One parking space is required for each 200 square feet of gross floor area of office buildings. For industrial use buildings, reasonable and appropriate parking, as determined by the Planning Board, must be provided. Where 10 or more parking spaces are required, handicapped parking spaces are required. For the first 100 parking spaces, at least one handicapped parking must be included for every 25 parking spaces that are required. Handicapped parking spaces must be at least 13 feet wide and designed in accordance with the American National Standards Institute ANSI A117.1-1980, Specifications for Making Buildings and Facilities Accessible and Useable by Physically Handicapped People.

Calpine is proposing to provide 28 parking spaces. This corresponds to more than 2 parking spaces per employee during peak shift. Of those, two will be handicapped parking spaces. Designated handicapped spaces will be located closest to the administrative offices for the facility. Such parking spaces will comply with the referenced standard.

Section 195-63. Location of parking spaces. The Planning Board must approve the location of all proposed parking spaces. Off-street parking is not allowed in the required yards or buffer areas, within 30 feet of 2 intersecting streets or within the sight triangle of any driveway.

The location of the parking spaces complies with the aforementioned requirements. The closest intersection is several hundred feet away from the nearest parking space.

No parking spaces will be located within 30 feet of intersections or within the sight triangle of a driveway.

Section 195-64. Parking area design standards. Each parking space must be at least 10 feet in width by 20 feet in length. Aisle width depends on the parking angle, requiring a width of 12 feet for parallel parking and 24 feet where there is a parking angle of 90 degrees. Parking areas must be free and clear of obstruction. Parking area design must accommodate emergency service, delivery and waste haulage vehicles. Pedestrian circulation must, to the extent possible, be separated from vehicular traffic.

The Project will comply with the requirements of this provision.

Section 195-65. Driveways. Driveways must be located to maximize safety and minimize impacts to the free flow of traffic. Minimum sight distances are required depending on the maximum speed allowed on the road to which the driveway connects. For roads with a speed limit of 45 mph (the Dolsontown Road speed limit), the minimum sight distance is 400 feet. The design of the driveway must be governed by sound engineering principles and constructed with a stable surface in accordance with Town standards.

The Project entrance/exit driveway connects to Dolsontown Road, which has a speed limit of 45 miles per hour. Drivers will have a sight distance of 725 feet to 950 feet, depending upon the approach, as discussed in Section 15. These sight distances are well in excess of the required standard. Driveway construction will follow industry standards. Detailed plans and specifications regarding driveway construction will be provided to the Town for review prior to construction.

Section 195-66. Off-street loading areas. Off-street loading areas are not allowed in front yards. The number of required loading spaces for public utility structures are not specified. Light industrial uses require one loading space for 5000 square feet to 10,000 square feet of floor area, and one loading space for each additional 10,000 square feet. Enclosed loading spaces must be at least 15 feet wide by 45 feet long by 14 feet high. Street access (which may be combined with parking lot street access), at least 15 feet wide, must be provided. Loading areas must not be within 25 feet of any fire hydrant or 10 feet of any stairway, doorway, elevator or other means of entry, nor shall they interfere or block pedestrian traffic or other vehicles. Loading areas must be appropriately indicated.

Seven loading spaces are proposed for the site, which is more than enough to service the needs of the Project. Loading spaces are appropriately sized and located to avoid interference with pedestrian and other vehicular traffic. All loading areas will be appropriately indicated.

Section 195-67. Supplementary regulations for parking and loading. Parking spaces must be clearly marked and delineated. The Town may require that certain areas be demarcated for emergency use. Parking areas must be appropriately landscaped in accordance with Section 195-51. Parking and loading areas must be maintained, and be constructed to ensure that surface water is disposed of in a manner so as not to unreasonably impair the surroundings. Parking areas must be surfaced and curbed. Storage lanes for traffic must be provided to avoid obstructions to traffic on public roads. A waiver from parking requirements may be obtained from the Planning Board if the developer can demonstrate that the parking requirements are unnecessary given the nature of the use. If a waiver is granted, land must be set aside to meet the deficiency in the event that there is a change of use of the property such that additional parking becomes necessary.

All parking and loading areas will be clearly delineated. Parking areas will be landscaped and curbed and surfaced as required. Calpine will consult with the Town regarding delineation or designation requirements for emergencies. Since all parking is off-street, no storage lanes for traffic are necessary.

Landbanking is not necessary because of the nature of the facility and the standards for combined cycle power plants discussed above. The Project requires only about 28 parking spaces. It would not be appropriate to require the reservation of additional land for parking. Any change to the Project that would require substantial new parking would be a major modification of the Article X certificate.

Article IX. Site Plan and Special Permit Review and Approval. As noted above, site plan approval and special permit approval is incorporated into the Article X review process. Nevertheless, a copy of this Application is being forwarded to the attention of the Planning Board for review.

Section 195-75. Procedures. Site plan regulations require a presubmission conference with the Planning Board or designee. Waivers from site plan elements may be granted if such elements are deemed unnecessary or inappropriate. The Town Engineer must certify that the site plan complies with applicable zoning and site plan requirements. Twelve copies of the site plan must be provided. For a project that is within 500 feet of municipal boundary, a copy of the site plan must be forwarded to the Orange County Planning Department for review and recommendation. The procedures call for preliminary site plan approval followed by final site plan approval. Final site plan approval expires 18 months from the date it is granted unless the applicant obtains a building permit or site work permit or commences on-site work. Site plan approval may be extended for a period of one year.

As noted above, a copy of the Article X Application is being forwarded to the Planning Board. The Project Site is within 500 feet of a municipal boundary (the City of Middletown), and therefore copies of the application will be forwarded to the Orange County Planning Department and various City of Middletown officials. The Application will contain all of the required information to support site plan review. Finalized plans and specifications will be forwarded as Siting Board compliance filings or as arranged directly with local officials.

Section 195-76. Plan requirements. Site plan applications must include relevant legal data, natural features, existing structures, roadways and utilities, and the proposed development.

The Application will include all of the required information.

Section 195-77. Standards. Conditions and safeguards may be imposed on site plan approval to ensure that the project is developed in conformance with the Town's comprehensive plan, it is compatible with surrounding structures, proposed traffic accessways are adequate and not excessive, adequate off-street parking and loading areas are provided, parking areas are reasonably screened from nearby residential areas, paved areas intended for use by pedestrians incorporate appropriate features to avoid vast expanses of paved area, proposed lighting does not produce glare onto adjoining properties or streets, sound from a public address system is not audible from adjoining properties or streets, mechanical equipment for building services that is located on a roof is appropriately screened, the drainage, water and sewer systems are adequate, handicapped needs are adequately addressed, and energy conservation is maximized.

As noted above, the Planning Board will receive a copy of the Application to ensure that the above concerns are adequately addressed. Calpine anticipates that the Article X process will result in the imposition of appropriate conditions.

Section 195-78. Access from state, county and town roads. The Planning Board has the authority to approve the ingress and egress from state, county and town roads proposed in the site plan application. Where the Planning Board determines that the proposed route of ingress and egress will create or add to traffic congestion or hazards, the Planning Board may deny the proposed route and require the applicant to provide an alternative route.

Traffic and transportation issues are detailed in Section 15. Impacts to traffic are minimal, and the proposed route of ingress and egress via Dolsontown Road is not anticipated to be a source of traffic congestion or hazards.

Section 195-81. Building Permits. A building permit is effective for a period of one year, with two extensions each of six months allowed for good cause.

The Project cannot comply with the one-year requirement. Project construction is anticipated to last two years, which fits within the extension period. Toward the end of the two-year period, the buildings will be fully occupied, but the Project will not yet be in commercial operation.

10.4.2 Town of Wawayanda Comprehensive Plan

The Town of Wawayanda adopted an updated Comprehensive Plan in 2000. The Comprehensive Plan establishes goals for future development in the Town and contains a Proposed Land Use Element, an Open Space and Conservation Element, a Community Facilities and Utilities Element, a Transportation Element, and a Design Element. Each is addressed in turn below. The Comprehensive Plan notes that an "adequate mix of industrial, retail, office and agricultural uses are (sic.) necessary for a stable tax base and as the Town's role within the region grows, it is absolutely imperative Wawayanda strive to create a wider variety of land uses, particularly commercial, office and industrial."

The Comprehensive Plan adopts the following overall goals:

1. Stimulate economic development to produce a more balanced self-sustaining community with a broad tax base and lower taxes. Providing for more industrial and commercial development in certain core areas is identified as one of the components of this goal;

2. Maintain Wawayanda's character as a rural community;

3. Preserve the Town's natural environment and open space while providing for both active and passive recreational opportunities;

4. Preserve existing historical and natural landmarks;

5. Provide and improve public services, including working with the City of Middletown and other potential providers of sewer and water services to extend these public utilities to planned economic and residential core areas of the Town;

6. Continually improve the transportation system;

7. Minimize pollution of the Town's land, air and water;

8. Acquire and use the most current information about geology, hydrology, topography, and soils to influence future land development;

9. Prevent the loss of health, life, or property due to fire, floods, or other natural disasters; and

10. Otherwise promote the Town's public health, safety, and general welfare.

Proposed Land Use Element. The Comprehensive Plan calls for the redesignation of certain areas in the Town to an Industrial/Office/Research/Business (IORB) District. The Comprehensive Plan illustrates the proposed land use plan in the form of the proposed revised Zoning Districts Map (see Figure 8). The Project site falls within the IORB District, as proposed. According to the Comprehensive Plan, the proposed IORB District "which includes approximately 300 acres has excellent access and is not constrained environmentally." "In addition, the area has very little residential development which would be in conflict with large scale industrial, office or research uses." (The Town is currently in the process of rezoning the area that includes the Project site to IORB.)

Open Space and Conservation Element. The Open Space and Conservation Element identifies areas in the Town that should be "conserved to the greatest extent practicable." The Project site lies outside the designated areas (see Figure 9).

Communities Facilities and Utilities Element. The Communities Facilities and Utilities Element envisions, among other things, the extension/establishment of a water and sewer district in "more intensively developed areas." According to the Comprehensive Plan, "[e]xtensive planning has been on-going to extend the City of Middletown system along Route 17M, Dolsontown Road and Route 6 . . . to support the variety of development planned for this area." The Project site, which is adjacent to Dolsontown Road, lies within the area designated as "Water and Sewer District Number 1" (see Figure 10).

Transportation Element. This element addresses improvements and additions to the Wawayanda highway and street system "to satisfy immediate needs as well as the needs that will surely emerge as the Town continues to develop. The plan ... places particular emphasis on needed highway and roadway improvements in the New Hampton, Dolsontown Road and Slate Hill/Ridgebury areas." Dolsontown Road is designated as a major collector. Improvements are also proposed for McVeigh Road, which also is designated as a major collector. The plan calls for the limitation of access points to Dolsontown Road for development in the IORB District. The Project, which incorporates a significant parcel of land, will have 12 employees during peak shift operation. Therefore, as detailed in Section 15, the Project is not anticipated to have a significant adverse impact on Dolsontown Road or nearby intersections.

Design Element. According to the Comprehensive Plan, the "design element is intended to preserve and enhance those qualities which support the aesthetic, historic, rural and open character of the Town." This element "establishes a clear set of visual goals to be achieved as the development and conservation process proceeds" and is intended to provide tools for creating a satisfactory balance between pressures for new development and preservation and conservation. For the purposes of this element, the Project site is located in the Dolsontown Road district, which is described as "that area located to the east of Route 17M and north of I-84. This area is homogenous in its rolling hillsides and open space qualities due to a prevalence of agricultural uses in the area." Notwithstanding this description, the Town clearly envisions the development of this particular area for non-agricultural uses (see Proposed Land Use Element) by rezoning the area to be in the IORB District. The uses allowed in this district are generally compatible with existing uses to the north in the City of Middletown, the future availability of supporting services such as water and sewer within the Town, and the existing available traffic infrastructure.

Implementation of the Plan. Section J of the plan addresses implementation of the plan's goals. An express proposal is to combine the LORB District with the LOR District, and redesignate it to the IORB District. With respect to the Project site, the Town is in the process of rezoning the area to IORB.

10.4.3 Town of Wawayanda Zoning Update DGEIS –2001; Zoning Law, Chapter 195 2001 Update

On or about March 8, 2001, the Town of Wawayanda issued a Zoning Update DGEIS (Zoning DGEIS) to accompany its proposal to revise Chapter 195 of the Wawayanda Code, relating to zoning regulations. The SEQRA hearing has been closed and the FEIS is under review. The Zoning DGEIS generally describes the proposed changes to Chapter 195 to bring into conformance with the Town's comprehensive plan. The Zoning DGEIS also examines the impacts of the proposed changes on the environment.

Zoning DGEIS notes that the newly created IORB District will incorporate four areas of the Town. The first area, which includes the Project site, is located "along the Town's border to the City of Middletown and Town of Wallkill, east of Route 17M and North of I-84." This area is described as having "excellent access and is not constrained environmentally" and "is located in close proximity to a major highway interchange and within the proposed Town sewer district."

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July 24, 2001

Via FedEx

Richard J. Guertin, Commissioner
Department of Public Works
City of Middletown
16 James Street
Middletown, NY 10940

Re: Wawayanda Energy Center Project

Dear Commissioner Guertin:

As you are aware, our client, Calpine Eastern Corp., is proposing to construct and operate an electric generating facility, known as the Wawayanda Energy Center ("WEC"), in the Town of Wawayanda, Orange County. At this time, we are forwarding a preliminary draft section (in memorandum form) of the "Middletown Local Laws" section of the forthcoming WEC Article X application to the New York State Siting Board, in accordance with the negotiated stipulations for the project. Prior to the submission of the Article X application, the stipulations expressly require us to consult with the Town of Wawayanda and the County to identify all substantive local laws, ordinances and regulations that might apply to the project. However, in light of the fact that the facility may utilize treated effluent from, and discharge facility wastewater to, the Middletown POTW, we believe consultation with City of Middletown is also prudent.

In advance of this consultation, we are forwarding the enclosed memorandum, which describes our preliminary analysis regarding the applicability of Middletown laws that we believe are relevant to the Project. A draft site plan and grading plan are also enclosed to facilitate the consultation process. Also, in order to provide additional details concerning the Project, a copy of the corresponding memorandum addressing compliance with the Town of Wawayanda Code is enclosed. Two copies of the enclosed documents are enclosed.

Please disseminate these copies to City staff as you feel appropriate. Please feel free to contact us directly if you have any questions. We look forward to conducting and completing our local law consultation with City staff once they have had an opportunity to review the enclosed.

Sincerely,

Michael Murphy

Enclosures

cc:	Joseph DeStefano, Mayor	(w/enc.)
	Christina Palmero, NYSDPS	(w/enc.)
	Stephan Solzhenitsyn, TRC	(w/enc.)
	David A. Devine, Calpine	(w/enc.)
	Don Neal, Calpine	(w/enc.)

N:\21\88\10561\Ltr\mmm llocal law letter to middletown.wpd

Below, all provisions of the City of Middletown Charter and Code (reviewed on the basis of version obtained October 2000), Calpine believes might have some applicability to the proposed Wawayanda Energy Center are summarized, and a compliance statement or explanation is made. The discussion typically summarizes but does not quote each provision. The verbatim text of all provisions of applicable local laws cited hereunder has been provided to the Department of Public Service (DPS). A discussion of the City of Middletown Master Plan is also presented.

This pre-application consultation memorandum is being compiled in fulfillment of a requirement of the stipulations signed, *inter alia,* by Calpine, DPS Staff, and Town of Wawayanda officials pursuant to Article X of the Public Service Law. The stipulations outline the studies/reviews that must be completed and included in the Project's Article X application to the New York State Siting Board. The Stipulations focused on identifying local substantive requirements of the Town of Wawayanda and Orange County because the facility is to be located in Wawayanda. However, because Calpine anticipates that it will enter into an agreement with the City of Middletown whereby Calpine would receive treated effluent from the Middletown publicly-owned treatment works (POTW) for use as process water and send the facility's wastewater back to the Middletown POTW along the same corridor, Calpine has prepared this memorandum concerning potentially applicable City of Middletown requirements.

The purpose of this memorandum is to prepare the parties to the consultation in advance of a meeting, where any clarifications regarding this memorandum can be discussed. In order to provide additional details concerning the Project, a copy of the corresponding memorandum addressing compliance with the Town of Wawayanda Code is enclosed. The revised memorandum will then be submitted as part of the Article X Application for the Wawayanda Energy Center (provisionally numbered as Section 10.4 of the Application).

10.4.3 City of Middletown Charter and Code

Chapter 89: Sewers

Chapter 89 sets forth comprehensive requirements relating to the City of Middletown sewer system and the discharge of wastewater into that system.

As noted above, Calpine is currently negotiating an agreement with the City of Middletown whereby it would receive treated effluent from the Middletown POTW for use as process water at the facility and return the facility's wastewater to the POTW. It is currently contemplated that the process water and wastewater lines between the POTW and the facility would follow the same corridor. Calpine would be responsible for the costs of installing these lines; however, the work would be done under the auspices of the City of Middletown. Therefore, Calpine will not be

required to obtain any approvals to install the process water supply or wastewater lines. However, as Calpine will be discharging wastewater into the City of Middletown system, certain requirements of Chapter 89 do apply. These requirements are addressed below.

Article IV: Building Sewers and Connections.

89-13: Permit required.

No unauthorized person shall uncover, make any connection with or opening into, use, alter or disturb any public sewer or appurtenance thereof without first obtaining a written permit from the Commissioner of Public Works (Superintendent).

Calpine will comply with this requirement.

89-14: Building sewer permits: classes; application; fee.

There are two classes of building sewer permits: (1) residential and commercial; and (2) industrial. An application for a permit must be made on a form furnished by the city, accompanied by a permit and inspection fee of $15.

Calpine will apply for the permit and provide the required fee.

89-15. Installation costs and expenses.

The applicant shall be responsible for costs and expenses associated with installation and connection to the sewer system. The applicant must indemnify the City for any loss or damage that may directly or indirectly be occasioned by the installation of the building sewer.

Calpine will comply with this requirement.

89-16: Separate sewer required for each building; exception.

A separate building sewer must be provided for every building; except where one building stands at the rear of another on an interior lot and no private sewer is available or can be constructed to the rear building through and adjoining alley, court, yard or driveway, the building sewer from the front building may be extended to the rear building and the whole considered as one building sewer.

Calpine seeks clarification that it can assume that the Wawayanda Energy Center is to be considered one building for the purposes of this provision because, even though it consists of several structures, these structures are all interconnected and part of one operation and facility. If so, Calpine will comply with this requirement.

89-18: Material.

The sewer must be cast iron soil pipe, vitrified clay sewer pipe, approved asphalt pipe meeting specified ASTM specifications, or equal, or another suitable material approved by the Superintendent. Joints shall be tight and waterproof. Sewers located within 3 feet of a water service pipe must be constructed of cast iron pipe with lead joints. Cast iron pipes may also be required where the sewer is exposed to damage by roots.

Calpine will comply with this requirement.

89-19: Size and slope.

The size and slope of the building sewer shall be subject to the approval of the Superintendent, but in no event shall the diameter be less than 6 inches and the slope be less than ¼ inch per foot.

The Project sewer interconnection will be a force main, and hence the size and slope requirements are not relevant.

89-20. Elevation of connection; direction.

Where possible, the sewer line shall be brought to the building at an elevation below the basement floor. The sewer shall not be laid parallel to or within 3 feet of any bearing wall which might be thereby weakened. The sewer must be laid at a depth to protect against frost, and of uniform grade and in straight alignment to the extent possible. Proper pipes and fittings must be used for changes in direction.

The Project will comply with this requirement. The sewer line will avoid load-bearing areas, will be laid at sufficient depth to protect against frost, and will hold to a generally straight alignment within existing rights-of-way. Proper pipes and fittings will be installed.

89-21: Gravity flow preferred.

In buildings where elevation does not provide for gravity flow, wastewater must be lifted by approved artificial means and discharged to the building sewer.

Because the Project and the POTW are at relatively even elevation, and Project wastewater will originate from a sump, from the Project site to the POTW will be necessary. The design of the pumping system will be approved by the Superintendent.

89-22: Excavation.

Excavations for sewers must be open trench work unless otherwise approved. Pipe laying and backfill shall be in accordance with specified ASTM standards. Work must be inspected before backfill is placed.

Calpine will comply with this requirement.

89-23: Joints and connections.

Joints and connections must be gastight and watertight with certain specified materials used to seal joints unless otherwise approved by the Superintendent.

The Project will have gastight and watertight connections as directed by the Superintendent, and hence will comply with this requirement.

89-24: Connection specifications.

This section sets forth specifications for connecting the building sewer to the public sewer system. A dedicated sewer line will run from the Project site to the POTW; therefore, this section does not apply directly to the Project.

89-25: Inspection Notice.

The applicant must notify the Superintendent when the building is available for inspection. The connection to the public sewer shall be made under the supervision of the Superintendent or his representative.

Calpine will comply with this requirement.

89-26. Excavations: safety devices; restoration.

Excavations must be adequately barricaded and lighted for public safety. Disturbed public areas must be restored to a condition satisfactory to the City and in accordance with the Street Excavation Ordinance.

It is currently contemplated that the all work relating to the sewer line up to the Project site boundary will be conducted under the auspices of the City. Therefore, this requirement does not appear to apply directly to Calpine. However, excavations will be adequately barricaded and lighted for public safety, and the right-of-way will be restored to its previous condition.

Article V: Use of Public Sewers.

89-27 and 89-28: Prohibited discharge to sanitary sewers. Disposition of unpolluted waters.

No person shall discharge or cause to be discharged any stormwater, surface water, groundwater, roof run-off, subsurfance drainage, cooling water or unpolluted process waters to any sanitary sewer. Stormwater and other unpolluted waters must be discharged to specially designated sewers. Industrial cooling water may be discharged upon approval of the Superintendent. Dischargers of cooling water to state waters must obtain a SPDES permit.

Calpine will not discharge any stormwater, surface water, groundwater, roof runoff, or subsurface drainage to the POTW. Stormwater will be treated on site in a detention basin then discharged to a tributary to Monhagen Brook. The project will employ a wet surface air cooler (WSAC) and will discharge blowdown (i.e., industrial wastewater that is reused as concentrated cooling water) to the POTW. The blowdown is "polluted" water and therefore eligible for discharge. Calpine will seek approval for this discharge from the Superintendent.

89-29: Enumeration of prohibited waters and wastes.

Except as hereinafter provided, no person shall discharge or cause to be discharged any of the following to any public sewer:

A. Any liquid of vapor having a temperature higher than 150°F.

B. Any water or waste which may contain more than 100 ppm, by weight, of fat, oil or grease.

C. Any gasoline, benzene, naphtha, fuel oil or other flammable or explosive liquid.

D. Any garbage that has not been properly shredded.

E. Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, paunch manure or any other solid or viscous substance capable of causing obstruction to the flow in sewers or other interference with the proper operation of sewage works.

F. Any waters or wastes having a pH lower than 5.5 or higher than 9.0, or having corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage work.

G. Any waters wastes containing toxic or poisonous substances released at a flow rate or concentration which would cause interference with any sewage treatment process or constitute a hazard to humans or animals or create a hazard in the receiving waters of the POTW.

H. Any waters or wastes containing suspended solids of such character and quantity that unusual attention or expense is required to handle such materials at the POTW.

I. Any noxious of malodorous substance capable of creating a public nuisance.

J. Any wastewater which will result in a temperature exceeding 104°F at the influent to the POTW.

K. Any pollutant in excess of values in excess of the values specified in the Categorical Pretreatment Standards.

The Project will comply with these requirements including the Categorical Pretreatment Standards for Steam Electric Power Generating Point Source Category (40 CFR 423.17), as applicable.

89-30: Grease, oil and sand receptors.

Grease, oil and sand receptors shall be provided where the Superintendent deems necessary in order to provide for the proper handling of wastes containing grease in excessive amounts or flammable wastes sand, and other harmful ingredients. Interceptors shall be of a type and capacity approved by the Superintendent, and shall be readily accessible for cleaning and inspection. Grease and oil interceptors shall be constructed of impervious materials capable of withstanding abrupt and extreme changes in temperature. These interceptors shall be gastight and watertight with easily removable covers.

Calpine will install oil/water separators for all potentially oily areas, and therefore installation of grease, oil and sand receptors in the sewer line will not be necessary. Calpine will allow access for oil/water separator inspection on any Calpine property or right-of-way.

89-31: Maintenance of interceptors.

Interceptors must be maintained by the owner at the owner's expense, and in continuously efficient operation at all times.

Calpine will comply with this requirement.

89-31.1: Notice of slug discharge.

Immediate notice to the Superintendent is required when any slug discharge to the system occurs.

There will be communications between Calpine and POTW operations on an as-needed basis, including any discharges that are greater than the normal range, on a gallons per minute or similar basis. Thus, Calpine will be in compliance.

89-32: Waters and wastes subject to approval; preliminary treatment facilities.

A.1. Discharges of waters or wastes having the following characteristics are subject to the review and approval of the Superintendent:

A. 5 day BOD greater than 300 ppm by weight.

B. Containing more than 350 ppm by weight of suspended solids.

C. Containing any quantity of substances having the characteristics described in Section 89-29B, D, or H.

D. Having an average daily flow greater than 2% of the average daily sewage flow of the City.

E. Containing more than 100 ppm, by weight, of fat, oil or grease.

F. Any garbage that has not been properly shredded.

G. Containing suspended solids of such character and quantity that unusual attention or expense is required at the POTW.

H. Any noxious or malodorous gas or substance capable of creating a public nuisance.

The Project will comply with these requirements. With respect to subparagraph D regarding average flow, the Project will discharge an average of 54,000 gpd, which is 0.8% of the POTW's capacity (7 mgd), and 1.0% of its average daily flow (i.e., 5.2 mgd in 1998 and 1999). Assuming flow in future years is equivalent or greater to 1998-99 flow, the 2% threshold will not be triggered. However, as a practical matter, Calpine is also required to characterize all potentially relevant wastewater characteristics as part of the Article X application, which will be sent to the Superintendent.

A.2. Only the waters and wastes listed in Section 89-32(A)1.B, D, and I may be discharged if reviewed and approved by the Superintendent; and these are the only water and wastes from Section 89-29 that may be discharged if approved.

As described above, the Project will comply with this requirement.

B. Where necessary, in the opinion of the Superintendent, the owner shall provide, at his expense, such preliminary treatment as may be necessary to reduce BOD to 300 ppm, reduce objectionable characteristics or constituents to within limits provided for in Section 89-29; or control the quantities or rates of such waters or wastes.

Because the majority of the wastewater flow will be industrial process water, BOD levels of 300 ppm are not expected. Likewise, such objectionable characteristics as garbage, fats, oil and grease will not be of concern given the nature of the industrial processes at the Project.

C. When preliminary treatment, flow-equalizing facilities or monitoring stations are provided for any waters or wastes, they shall be constructed and maintained continuously in satisfactory and effective operation by the owner at his expense. Where an industrial user has such treatment, equalization or monitoring facilities at the time these regulations are enacted, the Superintendent shall have the power to approve or disapprove of the adequacy of such facilities. Where construction of new or upgraded facilities for treatment, equalization or monitoring is required, plans and specifications prepared by a licensed professional engineer for such facilities shall be submitted to the Superintendent. No construction of such new or upgraded facilities shall commence until approval of the Superintendent is obtained in writing.

The Project will comply with this requirement.

89-34: Control manholes.

When required by the Superintendent, the owner of any property served by a building sewer carrying industrial wastes shall install a suitable control manhole in the building sewer to facilitate observation, sampling and measurement of the wastes. Such manhole, when required, shall be accessibly and safely located and shall be constructed in accordance with plans approved by the Superintendent. The manhole shall be installed by the owner at his expense and shall be maintained by him so as to be safe and accessible at all times.

Calpine will comply with this requirement.

89-35: Measurements, tests and analyses; accidental discharges

A. All measurements, tests and analyses of the characteristics of waters and wastes required in any section of this ordinance shall be carried out in accordance with the most recent edition of Standard Methods for the Examination of Water and Wastewater, and in accordance with regulations promulgated by the USEPA in 40 CFR 163, Guidelines Establishing Test Procedures for the Analysis of Pollutants. Such samples shall be taken at the approved monitoring stations described in Section 89-32C, if such a station exists. If an approved monitoring station is not required, samples shall be taken from another manhole or other structure on the industrial

sewer lateral before discharge to the public sewer. Unless specifically requested otherwise or unless specifically not allowed in federal regulations, samples shall be gathered as composite samples made up of individual samples taken not less than once per hour for a period of time equal to the duration of industrial waste discharge during daily operations.

Calpine will comply with this requirement.

B. Each user shall provide for protection from accidental discharges - charges of prohibited materials or of materials in volume or concentration exceeding limitations of this ordinance or of an industrial wastewater permit. Detailed plans and procedures to provide for this protection shall be submitted to the Superintendent when so requested. Users shall immediately notify the Superintendent of the discharge of wastes in violation of this ordinance or a permit resulting from breakdown of pretreatment equipment; accidents caused by human error or negligence or mechanical failure; or other causes, such as acts of nature, to allow the city to take countermeasures. The Superintendent shall be notified within five (5) days of such occurrence by a detailed written statement describing the causes of the discharge and the measures being taken to prevent future occurrences.

Calpine will comply with this requirement.

C. In order that employees of industrial users are informed of city requirements, a notice shall be permanently posted on appropriate bulletin boards within the user's facility advising employees of city requirements and whom to call in case of an accidental discharge in violation of this ordinance.

Calpine will comply with this requirement.

89-36: Special agreements not precluded.

A. No statement contained in this Article shall be construed as preventing any special agreement or arrangement between the city and any industrial concern whereby an industrial waste of unusual strength or character may be accepted by the city for treatment, subject to payment therefor by the industrial concern.

Calpine anticipates entering into an agreement with Middletown concerning process water supply and wastewater discharge. Calpine does not believe that its wastewater will have "unusual strength or character" that would trigger the need to rely on this provision.

B. No special agreements shall circumvent federal categorical pretreatment standards.

Calpine will comply with this requirement.

Article VII: Out-of-City Users: Rates and Charges

89-45: Quarterly assessment.

All nonresident property owners emptying sewage into the city sewage facilities, where connections with the city-owned sewer are outside the corporate limits of the City of Middletown shall pay the same rate as charged inside-the-city users and shall be billed at the same times and concurrently with the water billing.

Calpine will comply with this requirement.

89-46. Minimum charge.

In the event a nonresident of the City of Middletown connects with the city sewage facilities outside the corporate limits of the City of Middletown and does not use city water, then and in that event said user shall pay quarterly to the City of Middletown on the first days of March, June, September and December a minimum charge of five dollars ($5.00) each quarter, in the case of residence use, and ten dollars ($10.00) for business and industrial users.

Calpine will comply with this requirement.

89-47. Installation fees.

All applicants for the use of city sewage facilities outside the corporate limits of the City of Middletown shall pay an installation fee of eight hundred dollars ($800.00), if for residence sue, and one thousand dollars ($1,000.00), if for business, industrial or other uses of a similar character.

Calpine will comply with this requirement.

Article VIII: Discharge Permits; Pretreatment Requirements.

89-51: Wastewater discharge reports.

As a means of determining compliance with these rules and regulations, with applicable SPDES permit conditions and with applicable state and federal laws, each industrial user shall be required to notify the Superintendent of any new or existing discharges to the POTW by submitting a completed industrial chemical survey form and industrial wastewater survey form to the Superintendent. The Superintendent may require any user discharging wastewater into the POTW to file wastewater discharge reports and to supplement such reports as the Superintendent deems necessary. All information required by the Superintendent shall be furnished by the user in complete cooperation with the Superintendent.

Industrial chemical survey and industrial wastewater survey forms will be submitted as part of the Article X application. Calpine will comply with this requirement on a continuing basis.

89-53: Wastewater discharge permit required.

A. No significant industrial user shall discharge wastewater to the POTW without having a valid wastewater discharge permit issued by the Superintendent. Significant industrial users shall comply fully with the terms and conditions of their permits in addition to the provisions of this ordinance. Violation of a permit term or condition is deemed a violation of this ordinance.

Calpine will obtain the required permit from the City and comply with its terms.

B. All significant industrial users proposing to connect to or to contribute to the POTW shall obtain a wastewater discharge permit before connecting to or contributing to the POTW. All existing significant industrial users connected to or contributing to the POTW shall obtain a wastewater discharge permit within one hundred eighty (180) days after the effective date of this Article.

Calpine will comply with this requirement.

89-54: Application for permit; terms and conditions.

A. Permit application. Users required to obtain a wastewater discharge permit shall complete and file with the Superintendent an application in the form prescribed by the city and accompanied by a fee set forth by the city not to exceed $200.00. Existing users shall apply for a wastewater discharge permit within thirty (30) days after the effective date of this Article, and proposed new users shall apply at least ninety (90) days prior to connecting to or contributing to the POTW. Certain information set forth in Section 89-54 must be provided.

The Project will file an application with the Superintendent.

C. Permit conditions. Wastewater discharge permits shall be expressly subject to all provisions of this ordinance and all other applicable regulations, user charges and fees established by the City. Permits may contain the following:

(1) The unit charge or schedule of user charges and fees for the wastewater to be discharged to a public sewer.
(2) Limits on the average and maximum wastewater constituents and characteristics.
(3) Limits on average and maximum rate and time of discharge or requirements for flow regulations and equalization.
(4) Requirements for installation and maintenance of inspection and sampling facilities.

(5) Specifications for monitoring programs which may include sampling locations, frequency of sampling, number, types and standards for tests and reporting schedule.
(6) Compliance schedules.
(7) Requirements for submission of technical reports or discharge reports.
(8) Requirements for maintaining and retaining plant records relating to wastewater discharge as specified by the city, and affording the Superintendent access thereto.
(9) Requirements for notification of the city of any new introduction of wastewater constituents or any substantial change in the volume or character of the wastewater constituents being introduced into the wastewater treatment system.
(10) Requirements for notification of the city of change in the process used by the permittees.
(11) Requirements for notification of excessive, accidental or slug discharges.
(12) Other conditions as deemed appropriate by the city to ensure compliance with this ordinance and federal and state laws, rules and regulations.

Calpine will comply with its Article X certificate and discharge permit conditions.

89-55: Reporting requirements.

A. Baseline report. Within one hundred eighty (180) days after promulgation of an applicable federal categorical pretreatment standard, a user subject to that standard shall submit to the Commissioner the information required by 89-54A(1)(h) and (i).

Calpine will submit such reports, as necessary.

B. Compliance date report. Within ninety (90) days following the date for final compliance with applicable pretreatment standards or, in the case of a new source, following commencement of the introduction of wastewater into the POTW, any user subject to pretreatment standards and requirements shall submit to the Commissioner a report indicating the nature and concentration of all pollutants in the discharge from the regulated process which are limited by pretreatment standards and requirements and the average and maximum daily flow for these process units in the user facility which are limited by such pretreatment standards or requirements. The report shall state whether the applicable pretreatment standards or requirements are being met on a consistent basis and, if not, what additional operations and maintenance, and/or pretreatment, is necessary to bring the user into compliance with the applicable pretreatment standards or requirements. This statement shall be signed by an authorized representative of the industrial user, and certified to by a qualified professional.

Calpine will submit such reports, as necessary.

C. Periodic compliance reports. The subsection triggers certain additional prospective reporting requirements under certain circumstances with which Calpine will comply as necessary.

89-57: Discharge limitations.

No person shall discharge directly or indirectly into the POTW wastewater containing any of the following substances in concentrations exceeding those specified below on either a daily or instantaneous basis. Concentration limits are applicable to wastewater effluents at a point just prior to discharge into the POTW. (Specific values are to be determined at a later date.)

	Concentration in Industrial Effluent	
Substance	**Daily Maximum (mg/1)**	**Maximum Monthly Average (mg/1)**
Arsenic		
Barium		
Cadmium (T)	0.69	0.26
Chlorine		
Chromium (Hex) (T)	2.77	1.71
Copper (T)	3.38	2.07
Cyanide (complex)		
Cyanide (Free)		
Fluorides		
Gold		
Iron		
Lead (T)	0.69	0.26
Manganese		
Mercury		
Nickel (T)	3.98	2.38
Phenol		
Selenium		
Silver (T)	0.43	0.24
Sulfides		
Zinc (T)	2.61	1.48

As will be demonstrated in the Article X application, the Project will comply with all these discharge limits.

Chapter 121: Water.

Chapter 121 sets forth specific requirements concerning the acquisition of water from the City. It is Calpine's understanding that these requirements apply to the acquisition of potable water from the City. As Calpine will be obtaining treated

effluent from the POTW for use as process water at the Project, Calpine does not believe that these provisions specifically apply to the Project and that the terms and conditions under which Calpine will obtain treated effluent from the City will be set forth in an agreement between Calpine and the City. Small amounts of potable water will be purchased not from the City but from the Wawayanda Water & Sewer District no. 1.

Chapter 122: Water, Sewer and Wastewater charges.

Chapter 122 sets forth certain requirements associated with charges for water, sewer and wastewater services. As an industrial discharger, Calpine will be subject to, and will comply with, the applicable charges/requirements set forth in this chapter. It is anticipated that charges for treated effluent from the POTW will be addressed in an agreement between Calpine and the City.

10.4.4 City of Middletown Master Plan

The City of Middletown 2000 Master Plan also was reviewed. As this Plan is not directly applicable to the Project, only a few issues are addressed. Section 1.4.2 of the Plan addresses projected growth in residential, commercial and industrial uses for the City. One of the areas considered for possible future industrial development is the annexed Kosuga Property, which is proximate to the LOR (proposed to be IORB) District in which the Project site is located. According to the plan, the "City hopes to induce industry with the available infrastructure needed to support industry" in these areas.

The Plan also notes that recent improvements to the City's sewage treatment plant has increased capacity to 7.0 million gallons per day, with surplus capacity of one million gallons per day. Thus, the upgraded plant should be easily able to accommodate operational discharges from the Project.

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July 10, 2001

Via FedEx

Maxcy J. Smith, M.D., Commissioner
Orange County Health Department
124 Main Street
Goshen, New York 10924

Peter Garrison, Commissioner
Orange County Planning Department
124 Main Street
Goshen, New York 10924

Re: Wawayanda Energy Center Project

Dear Commissioners Smith and Garrison:

Our client, Calpine Eastern Corp., is proposing to construct and operate an electric generating facility, known as the Wawayanda Energy Center ("WEC"), in the Town of Wawayanda, Orange County. By letter dated May 14, 2001, Calpine forwarded copies its application for Department of Environmental Conservation air permits for the project to Orange County's Health and Planning Departments. At this time, we are forwarding a preliminary draft section (in memorandum form) of the "Local Laws" section of the forthcoming WEC Article X application to the New York State Siting Board, in accordance with the negotiated stipulations for the project. Prior to the submission of the Article X application, the stipulations require us to consult with the County to identify all substantive local laws, ordinances and regulations that might apply to the project.

In advance of this consultation, we are forwarding the enclosed memorandum, which describes our preliminary analysis regarding the applicability of County laws that we believe are relevant to the Project. A draft site plan and grading plan are also enclosed to facilitate the consultation process. Also, in order to provide additional details concerning the Project, a copy

of the corresponding memorandum addressing compliance with the Town of Wawayanda Code is enclosed. Four copies of the enclosed documents are enclosed.

Please disseminate these copies to County staff as you feel appropriate. Please feel free to contact us directly if you have any questions. We look forward to conducting and completing our local law consultation with the County staff once they have had an opportunity to review the enclosed.

Sincerely,

Stephen L. Gordon

Enclosures

cc: Hon. Joseph G. Rampe, County Executive (w/enc.)
Richard B. Golden, County Attorney (w/enc.)
Christina Palmero, NYSDPS (w/enc.)
Stephan Solzhenitsyn, TRC (w/enc.)
David A. Devine, Calpine (w/enc.)
Don Neal, Calpine (w/enc.)

N:\21\88\10561\Lit\mmm local law letter to county.wpd

Below, all provisions of the Orange County Charter and Code that Calpine believes might have some applicability to the proposed Wawayanda Energy Center are briefly summarized, and a compliance statement or explanation is made. The discussion typically summarizes but does not quote each provision. The verbatim text of all provisions of applicable local laws cited hereunder has been provided to the Department of Public Service (DPS). A discussion of the Orange County Comprehensive Plan is also presented.

This pre-application consultation memorandum is being compiled in fulfillment of a requirement of the stipulations signed, *inter alia,* by Calpine, DPS Staff, and Town of Wawayanda officials pursuant to Article X of the Public Service Law. The stipulations outline the studies/reviews that must be completed and included in the Project's Article X application to the New York State Siting Board.

The purpose of this memorandum is to prepare the parties to the consultation in advance of a meeting, where any clarifications regarding this memorandum can be discussed. In order to provide additional details concerning the Project, a copy of the corresponding memorandum addressing compliance with the Town of Wawayanda Code is enclosed. The revised memorandum will then be submitted as part of the Article X Application for the Wawayanda Energy Center (provisionally numbered as Section 10.4 of the Application).

10.4.6 Orange County Charter and Code

Charter/Code Article VII: Department of Health

Article VII provides that the Commissioner of Health shall have "all the powers and perform all the duties conferred or imposed by law. Subject to the provisions of Public Health Law and the State Sanitary Code, the Board of Health may, among other things, establish a County Sanitary Code governing activities within the jurisdiction of County Health Department. County officials have indicated that a County Sanitary Code applicable to the Project has not been adopted. Instead, the County implements the State Sanitary Code within its jurisdiction ("health district"). Thus, there are no local substantive requirements associated with the County Health Department, with which the Project must comply.

Notwithstanding the fact that there are no substantive county health requirements with which the Project must comply, the state Public Health Law applies, and a complete copy of the Application will be forwarded to the County Health Department for review.

Charter/Code Article IX: Department of Planning and Development

Article IX imposes no substantive requirements with which the Project must comply. Procedurally, the County Planning Commissioner is authorized, among other things, to "make available to cities, towns and villages in Orange County, at their request, advice and assistance on matters related to the planning function" (Charter, section 9.02) and, "upon request or, as required by law, act as a resource to planning and zoning boards to enhance their knowledge in matters pertaining to the planning and development of their communities" (Code, section 9.02(d)). General Municipal Law §239-m requires any local special use permit or site plan approval involving a project that lies within 500 feet of a municipal boundary to be referred to the County Planning Department for review and recommendation.

There are no substantive provisions relating to County Planning Department authority with which the Project must comply. The Project, however, is located within 500 feet of the city of Middletown boundary. A copy of the application, therefore, will be forwarded to the County Planning Department for review.

10.4.7 Orange County Comprehensive Plan

Urban-Rural Concept. Orange County last updated its comprehensive plan (County Plan) in 1987. The 1987 County Plan reaffirms an Urban-Rural Concept that the County had previously adopted. Under the Urban-Rural Concept, most new development is encouraged in those areas where supporting infrastructure exists or is planned by dividing the County into "Urban Areas" and "Rural Areas".

According to the plan, the "primary function of the Urban Areas is to serve as the centers, or focal points, of future growth." "These areas are further defined as 'Serviced Areas' in that they would be programmed for full development of all essential services" such as water supply and water treatment systems. The primary goal for Rural Areas (the major portion of the County), is to keep them green by limiting public services. Rural Areas should serve as the base for agricultural uses and large lot residential uses. The County Plan recognizes that the burden of implementing the Urban-Rural Concept falls mostly on local municipalities.

The County Plan includes a map of the county on which Urban Areas and Rural Areas are depicted. An extensive portion of the northeast section of Wawayanda, including the Project Site, is in a designated Urban Area. This area surrounds or incorporates the city of Middletown and straddles the Interstate 84 corridor.

Supporting Infrastructure. With respect to commerce and industry (Section 3), the plan notes that most industry "needs central water and sewer services, highways and

good road access, railroad sidings, housing, an employment base, suitable land for building and expansion, a favorable tax situation, some visibility, and availability of emergency services. Not all industry needs all these items, but most industry needs the bulk of them."

The Article X application will demonstrate that all of the supporting infrastructure for the Project is either already available or will be available when the facility becomes operational. (Please refer to the Town of Wawayanda compliance memorandum for additional details).

The County Plan views streets and services as critical components to the success of Urban Areas, including the cost, installation and maintenance of such infrastructure (see Section 4). However, the presence or absence of water and sewer services are considered "the two biggest factors in determining growth patterns." According to the plan (see Section 6), "[o]ur common problem now is to find and deliver enough water to [Urban Areas] for future development." Fortunately, plans for supplying potable water to the section of the Urban Area in which the Project Site is located are under way. It should be noted that the Project's potable water needs are relatively small; most of the Project's water requirements relate to operations, which do not require water meeting potable standards. Therefore, Calpine is currently negotiating an agreement with the City of Middletown whereby it would be able to use treated effluent from the City of Middletown POTW to meet the Project's process water needs, and return the Project's wastewater to the POTW.

With respect to transportation needs, the plan notes that Route 211 in Wallkill and Route 17M in Middletown (near the Project Site), among others, "must keep pace with the demands of commercial development along the roadside, not for fast travel but for convenient and safe turning movements and reasonably free flow of traffic." As will be detailed in Section 15 of the Application, improvements to the Route 17M/Dolsontown Road intersection, designed to facilitate turning movements, are planned, independent of the Project. The traffic study in Section 15 will confirm that highway and road infrastructure is adequate to serve both the construction and operation period needs of the Project.

Land Use Plan Map. The County Plan also includes a Land Use Plan Map, which is identified as an element of the County Plan. The map is different than the Urban Area/Rural Area map referenced above, as it is reflective of then existing conditions rather than proposed conditions. The following categories of land uses are identified on the Land Use Plan Map: Rural-Unserviced (rural residential); Urban-Serviced (urban and suburban residential, commercial, industrial and public-institutional); and Open Space (reservoirs, parks and recreation) areas.

The Project site appears to be located near the transition between an industrial area and a rural residential area. The rural residential area in question, however, is

completely surrounded by Urban-Serviced Areas, and lies within an Urban Area under the Urban-Rural Concept. It is also noted that this rural residential area, as depicted on the 1987 Land Use Plan Map is now located in the Town of Wawayanda's proposed IORB Zoning District, which allows industrial uses.

Conclusion. The Project fits within the County's Urban-Rural Concept. Under the County Plan, the Project Site lies within a designated Urban Area where supporting services are available or proposed. All needed infrastructure will be available to the Project. The Project is close to a NYPA transmission line. It will obtain natural gas from a planned natural gas pipeline extension. Potable water will be from the City of Middletown supplies made available to the Town of Wawayanda, and process water, pending agreement, will be from the nearby Middletown POTW. The Project will also send its wastewater to the Middletown POTW. In addition, the Project site lies close to Route 17M along the Interstate 84 corridor. Therefore, the development of the Project is consistent with the County Plan.

COUNTY OF ORANGE **DEPARTMENT OF PLANNING**

JOSEPH G. RAMPE
COUNTY EXECUTIVE

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TEL: (845)291-2318 FAX: (845)291-2533

PETER GARRISON
COMMISSIONER

August 3, 2001

Stephen Gordon
Beveridge & Diamond, P.C.
15th Floor
477 Madison Avenue
New York, NY 10022-5802

Dear Mr. Gordon:

Our office has received the mailing concerning the applicability of County laws on the approval process and construction of the Wawayanda Energy Center Project. The assessment made concerning the Orange County Comprehensive Plan and the Department's review responsibilities is accurate, but needs some updating or revising.

The County of Orange is entertaining a final version of a new Comprehensive Plan and will hopefully have a final version available to the public by the end of the year. Although the approach is different from the 1980 plan, it still recognizes the importance of locating large projects in areas where adequate infrastructure is available. Secondly the new Plan and the Department highly values the remaining agricultural lands in the County. As you are aware Section 239 includes agricultural lands as a reason for the County to become involved in reviewing development projects. The proposed project is located on lands in active agriculture and in an Agricultural District.

Finally, the municipality is responsible for submitting plans to the Department not the applicant. This is done in accordance with Section 239 l,m&n of the General Municipal Law and avoids premature review of applications before the local Board has time to initially process the application.

If you have any additional questions or concerns, contact Peter Garrison or me at 845 291 2318.

Very truly yours,

Richard J. Jones, Planner

APPENDIX M ELECTRIC AND MAGNETIC FIELDS

Electric and Magnetic Field Evaluation:

Wawayanda Energy Center, LLC

Prepared for

TRC Environmental Corporation
Boott Mills South, Foot of John Street
Lowell, MA 01852

Prepared by

Exponent
420 Lexington Avenue, Suite 408
New York, NY 10170

August 2001

Submitted by:

Duncan Glover, Ph.D.,
P.E. (MA #30136 & NY – pending)

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EXECUTIVE SUMMARY

The effect of the Wawayanda Energy Center on existing levels of electric and magnetic fields (EMF) in the vicinity of the proposed site has been evaluated pursuant to Stipulation 3, clause 21. Currently, the sources of these fields are a 138-kV transmission line immediately north of the site and two 345-kV lines south of the site (the Marcy South lines). The power generated by the project will be transferred to one of the 345-kV transmission lines (Line # 42) over a short loop interconnection. Background EMF was measured and the impacts of the interconnection on EMF were modeled. The Wawayanda Energy Center itself will not significantly increase electric or magnetic field levels at the boundaries of the site. Furthermore, the proposed interconnection will not increase field levels on the right-of-way above the limits set by the New York State Public Service Commission.

1. 0 INTRODUCTION

Wawayanda Energy Center, LLC, a subsidiary of Calpine Corporation, has proposed to construct a 540-megawatt (MW) combined-cycle electric generating plant at a location north of Dolsontown Road in the town of Wawayanda, New York in Orange County. The location of the 53-acre site is shown in Figure 1. The site is bounded to the east by an abandoned railroad right-of-way, to the west by residences, and transmission lines and an Orange & Rockland (O & R) substation to the north. The southern border of the site abuts Dolsontown Road. A proposed 345-kV transmission line would exit from the site, cross Dolsontown Road and traverse southwest over open fields (a proposed construction, parking, and laydown site) to connect to the 345-kV circuit #42 operated by the New York Power Authority (NYPA). The #42 line and the 345-kV #34 line comprise the Marcy South line.

The interconnection between the plant switchyard and the existing 345-kV transmission line corridor will affect existing levels of electric and magnetic fields (EMF). The purpose of this report is to assess whether this interconnection would cause electric or magnetic fields at the edges of the new right-of-way (ROW) or public roads to exceed the limits established by the New York Department of Public Service (NYDPS) as called for by Stipulation 3, clause 21.[1]

[1] *Stipulation 3, clause 21.* The Application to be submitted will include an analysis with all input and output data showing that operation of the proposed interconnection to the electric grid under summer normal, winter normal, and short term emergency (STE) loading conditions will comply with (a) the Public Service Commission's applicable electric field strength standards, as set forth in Opinion 78-13, and (b) the applicable provisions of the Commission's Interim Policy Statement on Magnetic Fields, dated September 11, 1990. "Input data," means a tabular listing of all the input parameters necessary to model the EMF levels in computer simulations. "Output data," means all the printed graphs and tabular data produced as a result of performing computer simulations in support of the Application.

2.0 ELECTRIC AND MAGNETIC FIELDS FROM POWER TRANSMISSION AND OTHER SOURCES

Electricity in our homes and workplaces is transmitted over considerable distances from generation sources to distribution systems as alternating current (AC). The power provided by electric utilities in North America oscillates 60 times per second, i.e., at frequency of 60 hertz (Hz).

Electric fields are the result of voltages applied to electrical conductors and equipment. The electric field is expressed in measurement units of volts per meter (V/m) or kilovolts per meter kV/m (a kilovolt per meter is equal to 1000 V/m). Most objects including fences, shrubs, and buildings easily block electric fields.

Magnetic fields are produced by the flow of electric currents, however, unlike electric fields, magnetic fields are not readily blocked by most materials. The strength of magnetic fields is commonly expressed as magnetic flux density in units called gauss, or in milligauss (mG), where 1 G = 1000 mG.[2] The strength of the magnetic field at any point depends on characteristics of the source, including the arrangement of conductors, the amount of current flow through the source, and its distance from the point of measurement. The intensity of both electric and magnetic fields diminishes with increasing distance from the source.

In most of our homes, background AC magnetic field levels average about 1 mG, when not near a particular source such as an appliance (Zaffanella, 1993). Higher magnetic field levels are measured in the vicinity of distribution lines and transmission lines. A strong source of AC magnetic fields are electrical appliances. Fields near appliances vary over a wide range, from a fraction of a milligauss to a thousand milligauss or more. For example, Gauger (1985) reports the maximum AC magnetic field at 3 cm from a sampling of appliances as 3000 mG (can opener), 2000 mG (hair dryer), 5 mG (oven), and 0.7mG (refrigerator).

[2]Scientists more commonly refer to magnetic flux density at these levels in units of microtesla (μT). Magnetic flux density in milligauss units can be converted to μT by dividing by 10, i.e., 1 milligauss = 0.1 μT.

3.0 APPLICABLE REGULATORY GUIDANCE

Exposure limits for power frequency fields have been defined by various organizations including the International Commission on Nonionizing Radiation Protection (ICNIRP, 1988) and the American Conference of Governmental Industrial Hygienists (ACGIH, 1999). These guidelines limit exposures in order to prevent known short-term adverse effects. These effects occur at levels well above those found in residential, public environments, and almost all occupational environments as well. The Federal Government has not promulgated health-based standards for electric and magnetic fields at the levels found in residential environments.

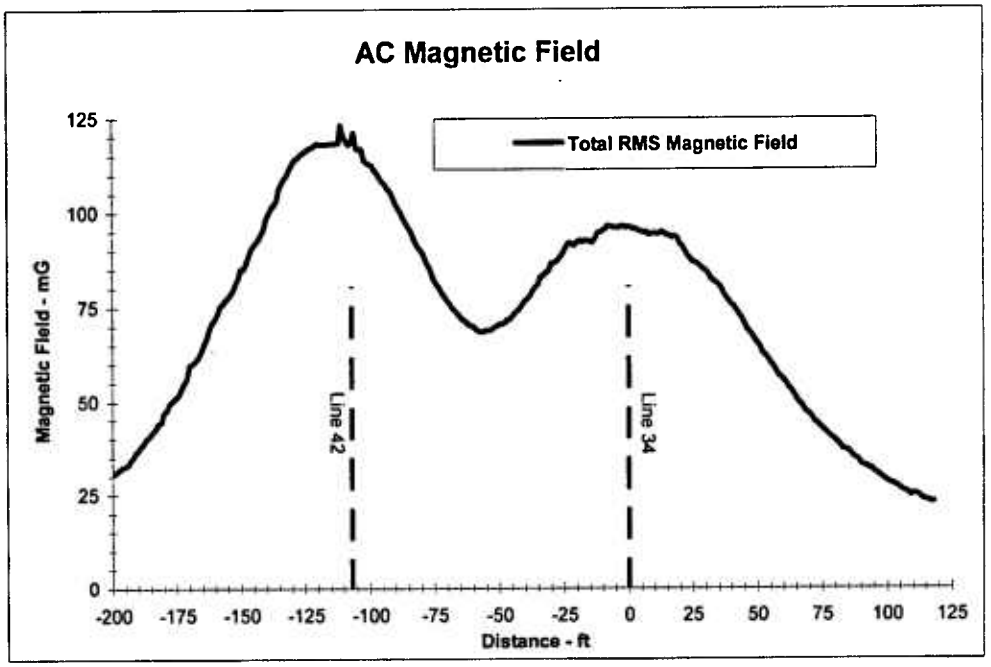
New York is one of seven states that have set guidelines for electric and magnetic fields from transmission lines. In New York, the limits for electric fields at the edge-of-right-of way are 1.6 kilovolts per meter (kV/m) as described in PSC Opinion 78-13 (NYPSC, 1978). A limit of 200 milligauss at the edge-of-right-of-way is specified in an interim policy on magnetic fields (NYPSC, 1990).

4.0 PROJECT EFFECT ON ELECTRIC AND MAGNETIC FIELDS

4.1 Sources of Electric and Magnetic Fields at the Wawayanda Site

Existing levels of EMF along the northern border of the portion of the site north of Dolsontown Road are influenced by a 138-kV transmission line (Line 27) that enters the site from the O & R Shoemaker substation to the north and continues east parallel to the northern boundary *en route* to the Sugarloaf substation. A second circuit (Line 29) on the opposite side of the pole structure that connects to the Middletown Tap substation is expected to be energized in October 2001.

The plant switchyard and the proposed 345-kV interconnection to the NYPA transmission line will be located in the southern portion of the site. The switchyard equipment is too far from the borders of the site (≥ 175 ft) to significantly affect existing levels of EMF and was therefore not formally evaluated. The proposed interconnection will consist of a pair of 345-kV lines supported on H-



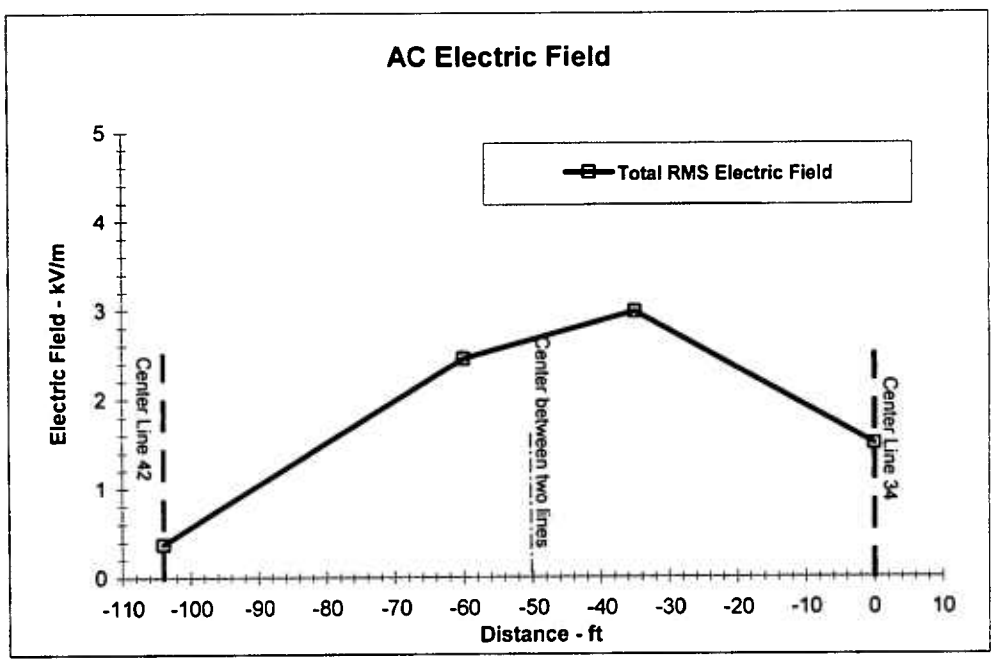


Figure 5 **Electric and Magnetic field profile under 345-kV transmission lines south of Dolsontown Road. Profile was made west of structures E5 and W5 (between W5/E5 and W4/E4). High brush and weeds limited the extent of the electric field measurements.**

4.4 Calculated Electric and Magnetic Fields

EMFs were calculated along a north-south profile perpendicular to the proposed interconnection at midspan in Figure 6 for an assumed minimum conductor height for a STE loading condition. For magnetic field calculations, current flow equal to the Winter Normal conductor rating was assumed. As would be expected, the field levels are highest under each conductor. These levels are calculated to diminish to less than 0.99 kV/m and 125 mG at the edges of the 288-ft wide right-of-way. Where the right-of-way narrows to a width of 240 ft in the last span before the connection to the existing angle structures of the NYPA lines #34 and #42, the calculated field levels are higher (1.52 kV/m and 170 mG). These values are below the limits of 1.6 kV/m and 200 mG set by the NYPSC (1978, 1990). In practice, the fields will be even lower because the short spans between the plant switchyard and the Marcy South line terminus will cause the minimum conductor heights to be considerably greater than 52 feet. The maximum electric field permitted by the NYPSC (1978) on a public road, 7 kV/m, would not be exceeded where the interconnection crosses Dolsontown Road. Winter Normal conductor loadings are specified for use in demonstrating compliance with the NYPSC interim magnetic field limit (NYSPSC, 1990) but calculated values of both magnetic and electric fields are provided as well for lower Summer Normal and higher STE conductor loadings. (See Attachment 1).

5.0 EFFECT OF THE INTERCONNECTION ON ELECTRIC AND MAGNETIC FIELD LEVELS

The interconnection of the Wawayanda generating plant to the NYPA Marcy South line #42 will increase the EMF over a very short length of the new right-of-way. EMF levels on part of the site and on part of the proposed interconnection route are already elevated because of the presence of existing transmission lines. However, the operation of the Wawayanda Energy Center Project would not cause field levels at the boundaries of the site to be significantly increased except where crossed by the interconnection. The field levels on Dolsontown Road and at the edges of the proposed right-of-way would be lower than values of specified by the NYPSC.

In conclusion, the project and the new interconnection comply with: (a) the Commission's applicable electric field strength standards, as set forth in Opinion 78-13, and (b) the applicable provisions of the Commission's Interim Statement on Magnetic Fields, dated September 11, 1990.

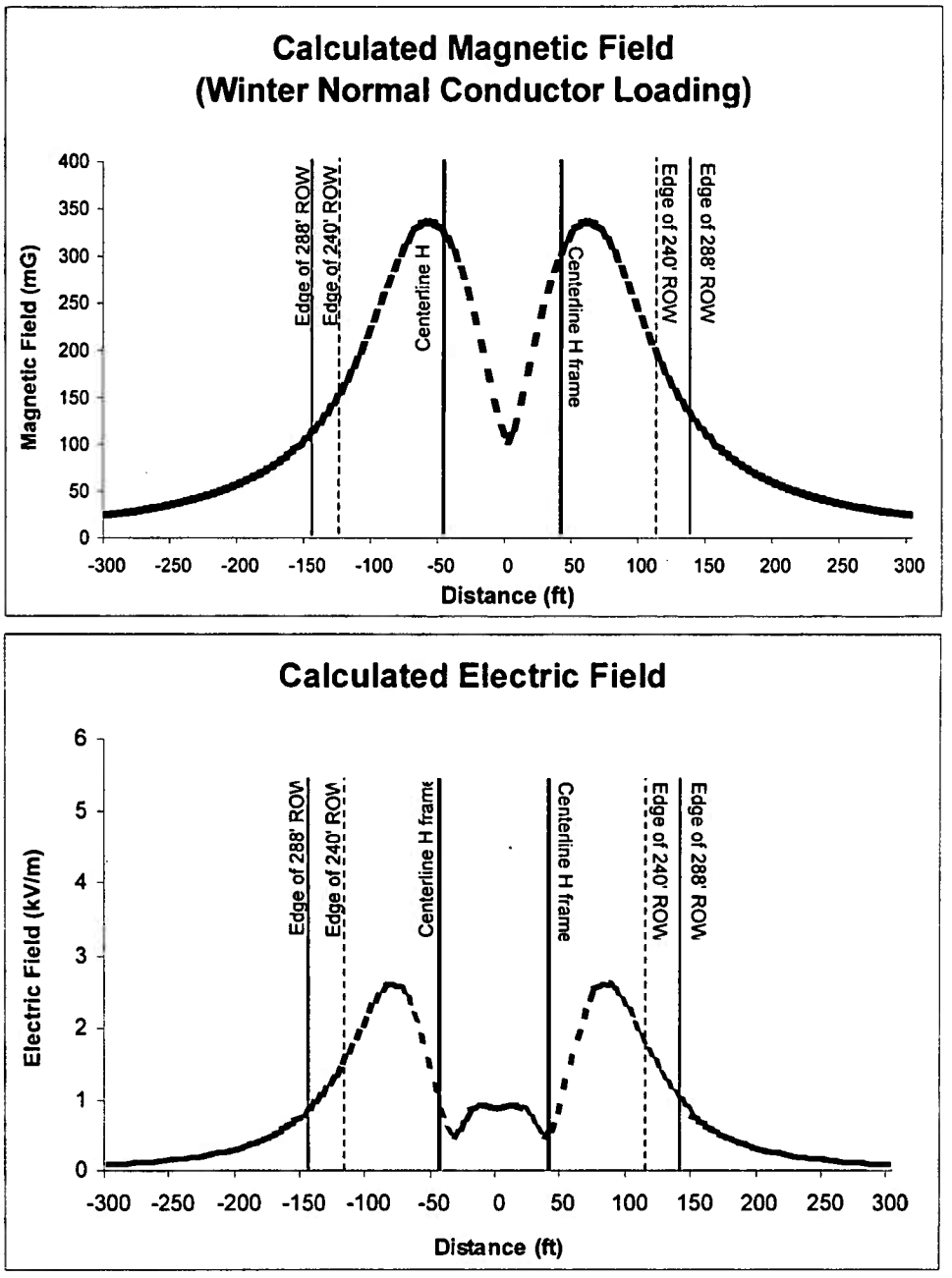


Figure 6. Calculated electric and magnetic fields associated with the proposed 345-kV interconnection

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Attachment 1

Wawayanda Energy Center, LLC.

Input Data
Calculated Electric and Magnetic Fields for Proposed 345-kV Interconnection

Transmission Line	Conductor Number and Type	Subconductor Diameter (in)	Number of subconductors	Position (ft)		Line-Neutral Voltage	Phase Angle (degrees)	Rating Current (amperes)*		
				x	y			WN	SN	STE
345-kV (proposed)	PH-A1	1.4	2	-70	52	209	0	3769	3072	4640
	PH-B1	1.4	2	-45	52	209	120	3769	3072	4640
	PH-C1	1.4	2	-20	52	209	240	3769	3072	4640
345-kV (proposed)	PH-C2	1.4	2	20	52	209	0	3769	3072	4640
	PH-B2	1.4	2	45	52	209	120	3769	3072	4640
	PH-A2	1.4	2	70	52	209	240	3769	3072	4640
Overhead ground wires	OHGW-1	0.4	1	-57.5	72	0	0	0	0	0
	OHGW-2	0.4	1	-32.5	72	0	0	0	0	0
	OHGW-3	0.4	1	32.5	72	0	0	0	0	0
	OHGW-4	0.4	1	57.5	72	0	0	0	0	0

* WN - Winter Normal; SN - Summer Normal; STE - Short Term Emergency

Wawayanda Energy Center, LLC.

Output Data

Calculated Electric and Magnetic Fields for Proposed 345-kV Interconnection

Field Point Location (ft)	Winter Normal		Summer Normal		Short Term Emergency	
	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
-300	0.09	24.89	0.09	20.29	0.09	30.64
-295	0.09	25.77	0.09	21.01	0.09	31.73
-290	0.10	26.71	0.10	21.77	0.10	32.88
-285	0.11	27.70	0.11	22.58	0.11	34.10
-280	0.11	28.74	0.11	23.43	0.11	35.38
-275	0.12	29.85	0.12	24.33	0.12	36.74
-270	0.12	31.01	0.12	25.28	0.12	38.18
-265	0.13	32.25	0.13	26.29	0.13	39.71
-260	0.14	33.57	0.14	27.36	0.14	41.33
-255	0.15	34.97	0.15	28.50	0.15	43.05
-250	0.16	36.46	0.16	29.72	0.16	44.88
-245	0.17	38.04	0.17	31.01	0.17	46.84
-240	0.18	39.74	0.18	32.39	0.18	48.92
-235	0.19	41.55	0.19	33.86	0.19	51.15
-230	0.21	43.48	0.21	35.44	0.21	53.53
-225	0.22	45.55	0.22	37.13	0.22	56.08
-220	0.24	47.78	0.24	38.94	0.24	58.82
-215	0.26	50.17	0.26	40.89	0.26	61.76
-210	0.28	52.75	0.28	42.99	0.28	64.94
-205	0.30	55.52	0.30	45.26	0.30	68.36
-200	0.32	58.53	0.32	47.70	0.32	72.05
-195	0.35	61.78	0.35	50.35	0.35	76.05
-190	0.38	65.30	0.38	53.23	0.38	80.39
-185	0.41	69.13	0.41	56.35	0.41	85.11
-180	0.45	73.30	0.45	59.75	0.45	90.24
-175	0.50	77.85	0.50	63.46	0.50	95.85
-170	0.54	82.83	0.54	67.51	0.54	101.97
-165	0.60	88.28	0.60	71.95	0.60	108.68
-160	0.66	94.25	0.66	76.82	0.66	116.03
-155	0.73	100.82	0.73	82.18	0.73	124.12
-150	0.80	108.06	0.80	88.07	0.80	133.03
-145	0.89	116.03	0.89	94.57	0.89	142.84
-140	0.99	124.83	0.99	101.74	0.99	153.67
-135	1.10	134.54	1.10	109.66	1.10	165.63
-130	1.23	145.25	1.23	118.39	1.23	178.82
-125	1.37	157.05	1.37	128.01	1.37	193.35
-120	1.52	170.02	1.52	138.58	1.52	209.31
-115	1.69	184.19	1.69	150.13	1.69	226.76
-110	1.86	199.57	1.86	162.67	1.86	245.69
-105	2.04	216.08	2.04	176.12	2.04	266.01
-100	2.22	233.53	2.22	190.34	2.22	287.49
-95	2.39	251.58	2.39	205.06	2.39	309.72
-90	2.52	269.73	2.52	219.85	2.52	332.07
-85	2.60	287.29	2.60	234.16	2.60	353.68
-80	2.62	303.40	2.62	247.30	2.62	373.52

Field Point Location (ft)	Winter Normal		Summer Normal		Short Term Emergency	
	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
-75	2.55	317.16	2.55	258.51	2.55	390.45
-70	2.40	327.70	2.40	267.10	2.40	403.43
-65	2.16	334.36	2.16	272.53	2.16	411.63
-60	1.86	336.78	1.86	274.50	1.86	414.61
-55	1.53	334.88	1.53	272.95	1.53	412.26
-50	1.18	328.75	1.18	267.96	1.18	404.73
-45	0.85	318.56	0.85	259.65	0.85	392.18
-40	0.58	304.35	0.58	248.07	0.58	374.68
-35	0.48	286.09	0.48	233.18	0.48	352.20
-30	0.60	263.76	0.60	214.98	0.60	324.72
-25	0.76	237.62	0.76	193.68	0.76	292.53
-20	0.88	208.31	0.88	169.79	0.88	256.45
-15	0.94	177.03	0.94	144.29	0.94	217.94
-10	0.94	145.68	0.94	118.74	0.94	179.34
-5	0.91	117.64	0.91	95.89	0.91	144.83
0	0.90	103.34	0.90	84.23	0.90	127.22
5	0.91	117.64	0.91	95.89	0.91	144.83
10	0.94	145.68	0.94	118.74	0.94	179.34
15	0.94	177.03	0.94	144.29	0.94	217.94
20	0.88	208.31	0.88	169.79	0.88	256.45
25	0.76	237.62	0.76	193.68	0.76	292.53
30	0.60	263.76	0.60	214.98	0.60	324.72
35	0.48	286.09	0.48	233.18	0.48	352.20
40	0.58	304.35	0.58	248.07	0.58	374.68
45	0.85	318.56	0.85	259.65	0.85	392.18
50	1.18	328.75	1.18	267.96	1.18	404.73
55	1.53	334.88	1.53	272.95	1.53	412.26
60	1.86	336.78	1.86	274.50	1.86	414.61
65	2.16	334.36	2.16	272.53	2.16	411.63
70	2.40	327.70	2.40	267.10	2.40	403.43
75	2.55	317.16	2.55	258.51	2.55	390.45
80	2.62	303.40	2.62	247.30	2.62	373.52
85	2.60	287.29	2.60	234.16	2.60	353.68
90	2.52	269.73	2.52	219.85	2.52	332.07
95	2.39	251.58	2.39	205.06	2.39	309.72
100	2.22	233.53	2.22	190.34	2.22	287.49
105	2.04	216.08	2.04	176.12	2.04	266.01
110	1.86	199.57	1.86	162.67	1.86	245.69
115	1.69	184.19	1.69	150.13	1.69	226.76
120	1.52	170.02	1.52	138.58	1.52	209.31
125	1.37	157.05	1.37	128.01	1.37	193.35
130	1.23	145.25	1.23	118.39	1.23	178.82
135	1.10	134.54	1.10	109.66	1.10	165.63
140	0.99	124.83	0.99	101.74	0.99	153.67
145	0.89	116.03	0.89	94.57	0.89	142.84
150	0.80	108.06	0.80	88.07	0.80	133.03
155	0.73	100.82	0.73	82.18	0.73	124.12
160	0.66	94.25	0.66	76.82	0.66	116.03
165	0.60	88.28	0.60	71.95	0.60	108.68
170	0.54	82.83	0.54	67.51	0.54	101.97
175	0.50	77.85	0.50	63.46	0.50	95.85
180	0.45	73.30	0.45	59.75	0.45	90.24

Field Point Location (ft)	Winter Normal		Summer Normal		Short Term Emergency	
	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
185	0.41	69.13	0.41	56.35	0.41	85.11
190	0.38	65.30	0.38	53.23	0.38	80.39
195	0.35	61.78	0.35	50.35	0.35	76.05
200	0.32	58.53	0.32	47.70	0.32	72.05
205	0.30	55.52	0.30	45.26	0.30	68.36
210	0.28	52.75	0.28	42.99	0.28	64.94
215	0.26	50.17	0.26	40.89	0.26	61.76
220	0.24	47.78	0.24	38.94	0.24	58.82
225	0.22	45.55	0.22	37.13	0.22	56.08
230	0.21	43.48	0.21	35.44	0.21	53.53
235	0.19	41.55	0.19	33.86	0.19	51.15
240	0.18	39.74	0.18	32.39	0.18	48.92
245	0.17	38.04	0.17	31.01	0.17	46.84
250	0.16	36.46	0.16	29.72	0.16	44.88
255	0.15	34.97	0.15	28.50	0.15	43.05
260	0.14	33.57	0.14	27.36	0.14	41.33
265	0.13	32.25	0.13	26.29	0.13	39.71
270	0.12	31.01	0.12	25.28	0.12	38.18
275	0.12	29.85	0.12	24.33	0.12	36.74
280	0.11	28.74	0.11	23.43	0.11	35.38
285	0.11	27.70	0.11	22.58	0.11	34.10
290	0.10	26.71	0.10	21.77	0.10	32.88
295	0.09	25.77	0.09	21.01	0.09	31.73
300	0.09	24.89	0.09	20.29	0.09	30.64