Dennis J. Murphy
Vice President
& Chief Operating Officer

PPL Holtwood, LLC
Two North Ninth Street
Allentown, PA 18101-1179
Tel. 610.774.4316
djmurphy@pplweb.com

March 9, 2012

Andrew D. Dehoff, P.E., Manager - Project Review
Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, PA 17102-2391

PPL HOLTWOOD, LLC
HOLTWOOD HYDROELECTRIC STATION
APPLICATION TO PROVIDE CONSUMPTIVE WATER USE MITIGATION

Dear Mr. Dehoff:

PPL Holtwood, LLC, is owner and operator of the Holtwood Hydroelectric Station ("Holtwood"). Holtwood is a 108-megawatt (MW) plant located on the Susquehanna River in Lancaster and York counties, PA, and is licensed by the Federal Energy Regulatory Commission (FERC) as Project PA-1881. PPL Holtwood is filing this application with the Commission to seek approval under Commission regulation §806.22(b)(1)(ii) to amend the existing Holtwood docket to permit PPL to operate Holtwood to mitigate for consumptive water use by PPL facilities in the basin. Subject to Commission approval, it is PPL's intent to use water from the Holtwood project as a component of a corporate storage asset pool to satisfy Commission consumptive use mitigation requirements for PPL existing and proposed projects. PPL intends to separately file an application to request the formation of the Corporate Storage Asset Pool.

PPL Holtwood is currently expanding Holtwood to 195.5 MW by addition of a second powerhouse and other structural and operational enhancements. The Commission approved the expansion on June 18, 2009 (Docket No. 20090623). The expanded project is expected to be fully in service by 2013. However, the proposed operation for consumptive water use mitigation for which this application is submitted to the Commission does not depend upon completion of the expansion.

Background

Holtwood's reservoir, Lake Aldred, contains approximately 54,770 acre-feet of storage and has a surface area of approximately 2,649 acres at the normal maximum operating level, El. 169.75 ft. During the summer recreation season (May 15 to September 15), Holtwood is required by its FERC license to maintain Lake Aldred at a pool level not lower than El. 167.50 ft. The amount of usable storage between El. 167.50 ft and El. 169.75 ft is approximately 5,830 acre-ft.

Other than during the recreation season, Holtwood maintains Lake Aldred at a pool level not lower than El. 163.50 ft. The amount of usable storage between El. 163.50 ft and El. 169.75 ft is approximately 15,170 acre-ft.

The hydraulic capacity of the existing plant is approximately 31,500 cfs. When the expansion is completed, the plant hydraulic capacity will be approximately 61,460 cfs.

Proposed Operation for Consumptive Water Use Mitigation

PPL Holtwood proposes to provide consumptive water use mitigation from Holtwood by preserving storage above minimum required pool elevations and releasing water from storage during Commission flow augmentation periods.

During the recreation season (through September 15), PPL is proposing to provide up to 3,370 acre-feet of storage in the Holtwood pond (Lake Aldred) above the FERC-required recreational pool minimum elevation of 167.5 feet to provide consumptive use make-up water in the basin. After September 15 PPL is proposing to provide up to 6,090 acre feet of Lake Aldred storage for consumptive use make-up.

The proposed consumptive use mitigation operation will complement the daily and continuous minimum flow operations required by PPL's current FERC license. As has been recognized in the procedure for implementing the daily flow release requirement now in effect under the FERC license, a procedure for correction for inadvertent departure from precise end-of-day (3:00 a.m.) lake level target and releases will be necessary. PPL proposes to develop an operations plan in consultation with the Commission subsequent to Commission action on the proposed corporate storage asset pool.

PPL Holtwood believes that approval of the Commission is the sole approval required for the proposed consumptive use mitigation operation at Holtwood, insofar as the required minimum recreation lake level and all other FERC license requirements would be maintained.

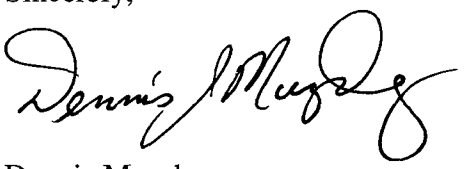
Attachments

An application fee in the amount of $4,750 is enclosed. Attachment 1 contains the Project Information Form. Attachment 2 is a report summarizing the results of analysis using the Commission's OASIS model to simulate operation of the Holtwood project as proposed to

mitigate existing and potential future PPL consumptive use projects in the basin. This analysis presumes implementation of the Bell Bend Nuclear Power Project, and use of PPL's Rushton Mine as a component of the PPL proposed Corporate Storage Asset Pool. Applications for those two projects have been separately filed with the Commission. Attachment 3 is a disc containing OASIS input and output files of model runs referenced in the Attachment 2 report.

Please contact Mr. Gary Petrewski at (610) 774-5996 or e-mail him at gpetrewski@pplweb.com should you have any questions regarding this application.

Sincerely,



Dennis Murphy

Enclosures:

Attachment 1 - Project Information Form
Attachment 2 - Modification And Use Of The Oasis Model To Evaluate Sources Of Flow Augmentation For PPL Consumptive Water Use Mitigation In The Susquehanna River Basin; Document JCP-BB-1, Rev. 0, March 7, 2012
Attachment 3 – Disc of OASIS Input and Output files – March 1, 2012 Report Runs

cc: (w/ attachment 1&2)

Mr. John Fringer
Project Manager
U.S. Nuclear Regulatory Commission
11545 Rockville Pike Mailstop: T-6 C32
Rockville, MD 20852

Ms. Kelly Heffner
Deputy Secretary – Water Management
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

Ms. Jamie Davis
Office of Environmental Programs (3EA30)
U.S. Environmental Protection Agency
1650 Arch Street
Philadelphia, PA 19103-2029

Mr. Gene Trowbridge
Pennsylvania Department of Environmental Protection
Northeast Regional Office
2 Public Square
Wilkes-Barre, PA 18711

Ms. Amy Elliott
U.S. Army Corps of Engineers
State College Field Office
1631 South Atherton Street, Suite 102
State College, PA 16801

Ms. Jennifer Kagel
United States Fish & Wildlife Service
Pennsylvania Field Office
315 S. Allen St. #322
State College, PA 16801

Mr. Mark Hartle
Pa Fish & Boat Commission
450 Robinson Lane
Bellefonte, PA 16823

ATTACHMENT 1

Project Information Form

Form #72
Revised 11/09

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

PROJECT INFORMATION

1. Project Owner's Name, Registered Fictitious Name or Trade Name* PPL Holtwood, LLC

Address 2 North Ninth Street

City Allentown State PA Zip 18101

Type of Organization (Owner):

- ☐ Sole Proprietorship
- ☐ Corporation
- ☐ General Partnership
- ☐ Limited Partnership
- ☒ Limited Liability Company
- ☐ Limited Liability Partnership
- ☐ Government Agency
- ☐ Other

Authorized Contact Person Gary Petrewski Title Environmental Manager

Address (if different) 2 North Ninth Street

GENPL4

City Allentown State PA Zip 18101

Telephone (610)774-5996 Fax (610)774-2618 E-Mail gpetrewski@pplweb.com

2. Project Operator's Name or Registered Fictitious or Trade Name* (if different from No. 1) Same as No. 1

Address

City State Zip

Type of Organization (Operator):

- ☐ Sole Proprietorship
- ☐ Corporation
- ☐ General Partnership
- ☐ Limited Partnership
- ☐ Limited Liability Company
- ☐ Limited Liability Partnership
- ☐ Government Agency
- ☐ Other

3. Authorized Contact Person Same as No. 1 Title

Address (if different)

City State Zip

Telephone ( ) Fax ( ) E-Mail

4. Parent Corporation Name, and Registered Fictitious or Trade Name* (if different from No. 1): (Use additional sheets, if necessary, to describe the corporate hierarchy.) PPL Generation, LLC

Corporate Registration: Entity No. 2916799 State PA

Address (if different) 2 North Ninth Street

City Allentown State PA Zip 18101

* Please attach a copy of your Department of State, Division of Corporations, State Records and UCC (New York), Division of Corporations (Pennsylvania), or Department of Assessments and Taxation (Maryland) **approved** name registration or trade name registration.

5. All Proprietors, Corporate Officers and Directors, or Partners: (add as many lines as needed)

Name	Title	Address	Telephone	Fax	E-mail
David G. DeCampli	President/ Manager	2 North Ninth Street Allentown, PA 18101	(610) 774-4247	(610) 774-6092	dgdecampli@pplweb.com
Victor N. Lopiano	Senior Vice President	Same	(610) 774-3913	610-774-6092	vnlopiano@pplweb.com
Dennis J. Murphy	Vice President and Chief Operating Officer/ Manager	Same	(610) 774-4316	(610) 774-4121	djmurphy@pplweb.com
Paul A. Farr	Treasurer/ Manager	Same	(610) 774-2426	(610) 774-7016	pfarr@pplweb.com
Elizabeth Stevens Duane	Secretary	Same	(610) 774-4107	(610) 774-5019	esduane@pplweb.com

6. Corporate Contact:

Name Gary Petrewski

Title Environmental Manager

Address 2 North Ninth Street

GENPL4

City Allentown State PA Zip 18101

Telephone (610)774-5996 Fax (610)774-2618 E-Mail gpetrewski@pplweb.com

7. Project Hydrogeologist:

Name Not Applicable Title

Company

Address

Telephone ( ) Fax ( ) E-Mail

P.G. License No. State Expiration Date

8. Project Engineer:

Name Jan C. Phillips, P.E. Title NA

Company Jan C. Phillips, P.E.

Address 2611 Walnut Street

Allentown, PA 18104-6230

Telephone (610)821-0160 Fax (610)821-0160 E-Mail jcphllps@enter.net

P.E. License No. PE017909E State PA Expiration Date 9/20/2013

9. Representing Attorney, if applicable:

Name _____

Firm _____

Address _____

_____

_____

Telephone (____) _____ Fax (____) _____ E-Mail _____

10. Name(s) and Signature(s) of Preparer and Project Owner:

The undersigned representatives of the project sponsor certify, under penalty of law (or perjury), as provided by 18 Pa. C.S.A. §4904; Section 210.45, of the New York Penal Law; Section 9-101 Maryland Crimes Code and 28 U.S.C. §1746, attest that the information for all parts contained herein and all information accompanying this application(s) is true and correct, and that they are authorized to act as representatives on behalf of their respective corporate entities.

Preparer Name Jan C. Phillips, P.E. Date 3/09/12

Signature _____

Title NA

Company Jan C. Phillips, P.E.

Preparer Name _____ Date _____

Signature _____

Title _____

Company _____

Project Owner Name PPL Holtwood, LLC ; Dennis J. Murphy Date 3/09/12

Signature _____

Title Vice President and Chief Operating Officer

Company PPL Holtwood, LLC

Not Applicable

(P.G. Seal) *(P.E. Seal)*

Notes:

1. Mark any information on the application that is considered confidential or proprietary.
2. Items 1 through 6 and 10 are required, and items 7 through 9 are project specific.

PENNSYLVANIA DEPARTMENT OF STATE
CORPORATION BUREAU
ROOM 308 NORTH OFFICE BUILDING
P.O. BOX 8722
HARRISBURG, PA 17105-8722

PPL HOLTWOOD, LLC

THE CORPORATION BUREAU IS HAPPY TO SEND YOU YOUR FILED DOCUMENT. PLEASE NOTE THE FILE DATE AND THE SIGNATURE OF THE SECRETARY OF THE COMMONWEALTH. THE CORPORATION BUREAU IS HERE TO SERVE YOU AND WANTS TO THANK YOU FOR DOING BUSINESS IN PENNSYLVANIA. IF YOU HAVE ANY QUESTIONS PERTAINING TO THE CORPORATION BUREAU, CALL (717) 787-1057.

ENTITY NUMBER: 2916798

MICROFILM NUMBER: 2000006

0958-0960

P BISHOP
DECHERT PRICE & RHOADS ESQS
COUNTER

200006 958

#273941

CONSENT TO USE OF SIMILAR NAME

DSCB:17.3 (Rev 90)

Pursuant to 19 Pa. Code § 17.3 (relating to use of a confusingly similar name) the undersigned association, desiring to consent to the use by another association of a name which is confusingly similar to its name, hereby certifies that:

1. The name of the association executing this Consent to Use of Similar Name is: PP&L, Inc.

2. The (a) address of this association's current registered office in this Commonwealth or (b) name of its commercial registered office provider and the county of venue is (the Department is hereby authorized to correct the following information to conform to the records of the Department):

   (a) 2 N. 9th Street, Allentown, PA 18101, Lehigh County
   Number and Street | City | State | Zip | County

   (b) c/o: _____
   Name of Commercial Registered Office Provider | County

   For an association represented by a commercial registered office provider, the county in (b) shall be deemed the county in which the association is located for venue and official publication purposes.

3. The date of its incorporation or other organization is: June 4, 1920

   The statute under which it was incorporated or otherwise organized is: Pennsylvania Business Corporation Law

5. The association(s) entitled to the benefit of this Consent to Use of Similar Name is (are): PPL Holtwood, LLC

6. A check in this box: ____ indicates that the association executing this Consent to Use of Similar Name is the parent or prime affiliate of a group of associations using the same name with geographic or other designations, and that such association is authorized to and does hereby act on behalf of all such affiliated associations, including the following (see 19 Pa. Code § 17.3(c)(6)):

IN TESTIMONY WHEREOF, the undersigned association has caused this consent to be signed by a duly authorized officer thereof this 4th day of January, 2000.

PP&L, INC.
(Name of Association)

BY: Dennis J. Murphy
(Signature)

TITLE: Vice President-Power Production & Engineering

Microfilm Number 200006-959 Filed with the Department of State on JAN 04 2000

Entity Number 2916798

Secretary of the Commonwealth

APPLICATION FOR REGISTRATION AS A FOREIGN LIMITED LIABILITY COMPANY

DSCB:15-8981 (Rev 95)

In compliance with the requirements of 15 Pa.C.S. § 8981 (relating to registration), the undersigned foreign limited liability company, desiring to register to do business in this Commonwealth, hereby states that:

1. The name of the limited liability company is: PPL Holtwood, LLC

2. (If the name set forth in paragraph 1 is not available for use in this Commonwealth, complete the following): The name under which the limited liability company proposes to register and do business in this Commonwealth is:

N/A

3. The name of the jurisdiction under the laws of which the limited liability company was organized and the date of its formation are:

Jurisdiction: Delaware Date of Formation: 11/29/99

4. The (a) address of this limited liability company's initial registered office in this Commonwealth or (b) name of its commercial registered office provider and the county of venue is:

(a) 2 North Ninth Street, Allentown, PA 18101-1179, Lehigh County
Number and Street City State Zip County

(b) c/o:
Name of Commercial Registered Office Provider County

For a limited liability company represented by a commercial registered office provider, the county in (b) shall be deemed the county in which the limited liability company is located for venue and official publication purposes.

5. (Check and complete one of the following):

___ The address of the office required to be maintained by it in the jurisdiction of its organization by the laws of that jurisdiction is:

Number and Street City State Zip

X It is not required by the laws of its jurisdiction of organization to maintain an office therein and the address of its principal office is:

2 North Ninth Street, Allentown, PA 18101-1179
Number and Street City State Zip

6. ~~(Strike out if inapplicable): The company is a restricted professional company organized to render the following restricted~~ professional service(s):

PA. DEPT. OF STATE
2000 JAN 24 AM 8:32
PA DEPT. OF STATE

DSCB:15-8981 (Rev 95)-2

200006 - 960

IN TESTIMONY WHEREOF, the undersigned limited liability company has caused this Application for Registration as a Foreign Limited Liability Company to be signed by a duly authorized member or manager thereof this 30th day of December, 1999.

PPL HOLTWOOD, LLC

(Name of Limited Liability Company)

BY: James E. Abel

James E. Abel (Signature)

TITLE: Treasurer

PENNSYLVANIA DEPARTMENT OF STATE
CORPORATION BUREAU
ROOM 308 NORTH OFFICE BUILDING
P.O. BOX 8722
HARRISBURG, PA 17105-8722

PPL GENERATION, LLC

THE CORPORATION BUREAU IS HAPPY TO SEND YOU YOUR FILED DOCUMENT. PLEASE NOTE THE FILE DATE AND THE SIGNATURE OF THE SECRETARY OF THE COMMONWEALTH. THE CORPORATION BUREAU IS HERE TO SERVE YOU AND WANTS TO THANK YOU FOR DOING BUSINESS IN PENNSYLVANIA. IF YOU HAVE ANY QUESTIONS PERTAINING TO THE CORPORATION BUREAU, CALL (717) 787-1057.

ENTITY NUMBER: 2916799

MICROFILM NUMBER: 0200002

0874-0875

P BISHOP
DECHERT PRICE & RHOADS ESQS
COUNTER

Microfilm Number 200002 · 874 Filed with the Department of State on JAN - 4 2000

Entity Number 2916799

Secretary of the Commonwealth

APPLICATION FOR REGISTRATION AS A FOREIGN LIMITED LIABILITY COMPANY

DSCB:15-8981 (Rev 95)

In compliance with the requirements of 15 Pa.C.S. § 8981 (relating to registration), the undersigned foreign limited liability company, desiring to register to do business in this Commonwealth, hereby states that:

1. The name of the limited liability company is: PPL Generation, LLC

2. (If the name set forth in paragraph 1 is not available for use in this Commonwealth, complete the following): The name under which the limited liability company proposes to register and do business in this Commonwealth is:

N/A

3. The name of the jurisdiction under the laws of which the limited liability company was organized and the date of its formation are:

Jurisdiction: Delaware Date of Formation: 11/29/99

4. The (a) address of this limited liability company's initial registered office in this Commonwealth or (b) name of its commercial registered office provider and the county of venue is:

(a) 2 North Ninth Street, Allentown, PA 18101-1179, Lehigh County
Number and Street City State Zip County

(b) c/o:
Name of Commercial Registered Office Provider County

For a limited liability company represented by a commercial registered office provider, the county in (b) shall be deemed the county in which the limited liability company is located for venue and official publication purposes.

5. (Check and complete one of the following):

___ The address of the office required to be maintained by it in the jurisdiction of its organization by the laws of that jurisdiction is:

Number and Street City State Zip

_X_ It is not required by the laws of its jurisdiction of organization to maintain an office therein and the address of its principal office is:

2 North Ninth Street, Allentown, PA 18101-1179
Number and Street City State Zip

~~6. (Strike out if inapplicable): The company is a restricted professional company organized to render the following restricted~~ professional service(s):

PA. DEPT. OF STATE
2000 JAN -7 AM 11:40

00 JAN -4 AM 11:32
OF STATE

DSCB:15-8981 (Rev 95)-2

200002 - 875

IN TESTIMONY WHEREOF, the undersigned limited liability company has caused this Application for Registration as a Foreign Limited Liability Company to be signed by a duly authorized member or manager thereof this 30th day of ~~December~~ November, 19 99.

PPL GENERATION, LLC
(Name of Limited Liability Company)

BY: James E. Abel
James E. Abel (Signature)

TITLE: Treasurer

ATTACHMENT 2

Modification And Use Of The Oasis Model To Evaluate Sources of Flow Augmentation For PPL Consumptive Water Use Mitigation In The Susquehanna River Basin; Document JCP-BB-1, Rev. 0, March 7, 2012

MODIFICATION AND USE OF THE OASIS MODEL TO EVALUATE SOURCES OF FLOW AUGMENTATION FOR PPL CONSUMPTIVE WATER USE MITIGATION IN THE SUSQUEHANNA RIVER BASIN

Document JCP-BB-1

Rev. 0

March 7, 2012

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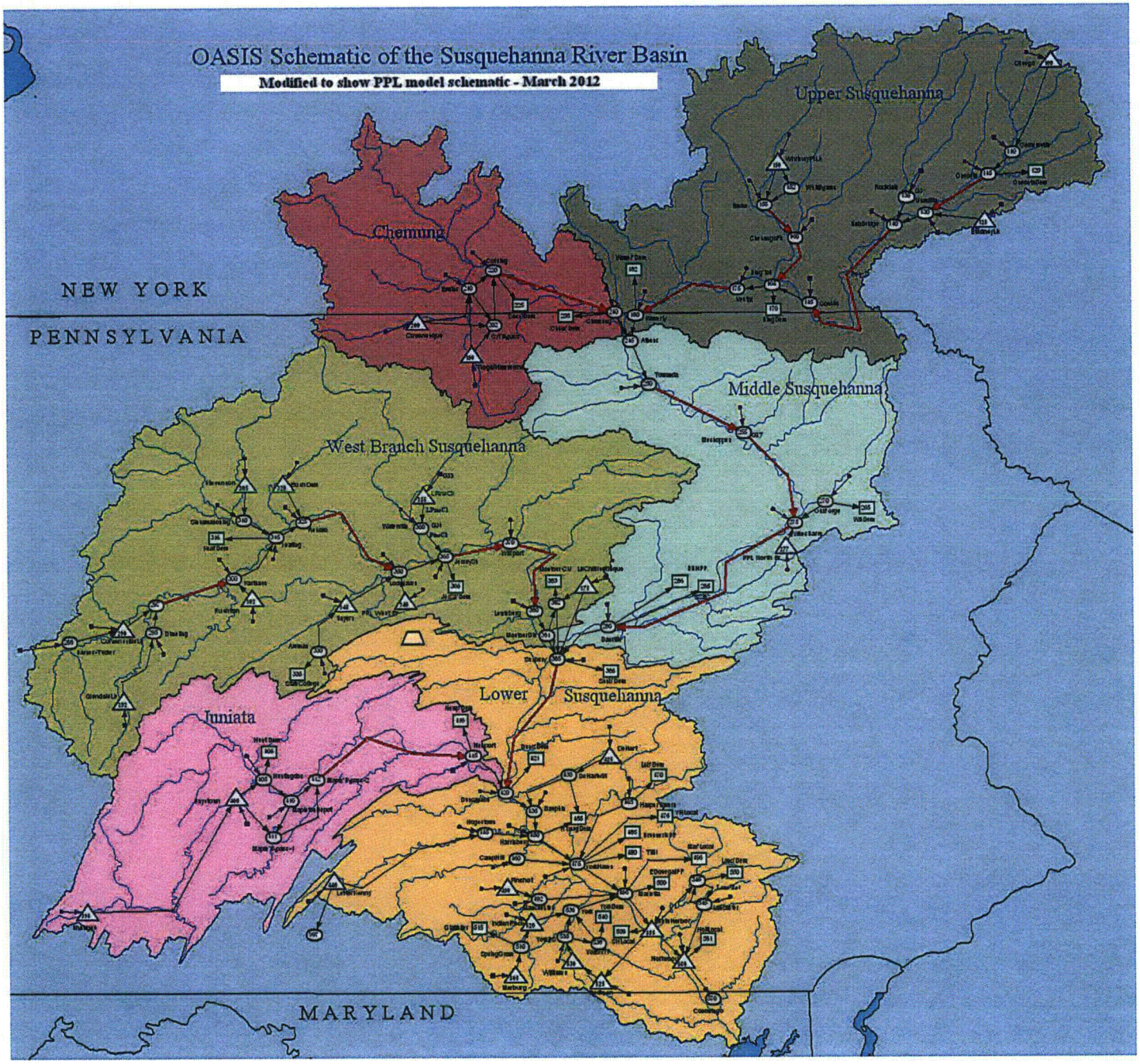
OASIS Schematic of the Susquehanna River Basin
Modified to show PPL model schematic - March 2012
Upper Susquehanna
Chemung
NEW YORK
PENNSYLVANIA
Middle Susquehanna
West Branch Susquehanna
Lower
Susquehanna
Juniata
MARYLAND

MODIFICATION AND USE OF THE OASIS MODEL
TO EVALUATE SOURCES OF FLOW AUGMENTATION
FOR PPL CONSUMPTIVE WATER USE MITIGATION IN THE
SUSQUEHANNA RIVER BASIN

1. PURPOSE

PPL has been evaluating basin storage resources from which releases can be made during drought periods to mitigate consumptive water use at existing and proposed PPL-owned facilities in the Susquehanna River Basin. On June 23, 2011 PPL presented to the Susquehanna River Basin Commission (SRBC) a conceptual proposal to form a Corporate Storage Asset Pool consisting of PPL-owned storage assets that could be collectively used in concert with SRBC-controlled storage assets to satisfy SRBC's consumptive use regulations for all PPL-owned consumptive use projects in the basin. This report summarizes an evaluation of using PPL's existing Rushton Mine and Holtwood Hydroelectric projects as components of the Corporate Storage Asset Pool to satisfy SRBC's consumptive use mitigation requirements. The use of an additional, unspecified storage asset in the West Branch Subbasin as a potential future addition to the Corporate Storage Asset Pool is also examined; this asset is called "West Branch" in this report.

This evaluation was undertaken using the Susquehanna River Basin "OASIS" daily flow model.[1] PPL acquired from SRBC the right to use and modify the model for purposes relating to basin water management. In the course of this evaluation, PPL modified and updated the OASIS model as acquired from SRBC.[2]

The general purposes of this report are:

- To describe the modifications to the OASIS model (Section 3);
- To discuss PPL's evaluation (Section 4); and
- To present key results and conclusions (Section 5)

Tables follow the text of this report.

[1] The Susquehanna River Basin OASIS model was developed for SRBC by HydroLogics, Inc.

[2] In this report, "OASIS" or "the model" or "the SRB OASIS model" will refer to the OASIS model of the Susquehanna River Basin developed by HydroLogics, Inc., including the model's basic "physical" structure of stream reaches, junctions, reservoirs, inflows and withdrawals. "SRBC's model run" will refer to the specific model run with input files provided to PPL by SRBC (as was programmed either by SRBC or by HydroLogics, Inc. for SRBC).

2. SUMMARY

PPL has made extensive use of the Susquehanna River Basin OASIS model to evaluate sources of storage ("resources" or "assets") as proposed or potential components of a PPL Corporate Storage Asset Pool ("Asset Pool"). PPL envisions that the Asset Pool would be operated to mitigate consumptive water use ("CU") at existing and planned PPL CU facilities, in accordance with an "Asset Pool Operations Plan" to be developed cooperatively with the SRBC.
The results of PPL's evaluation using OASIS, as described in this report, suggest that an Asset Pool consisting of Holtwood (as the primary resource), Rushton Mine, and one other resource, can satisfy SRBC's requirement for mitigation of the CU at PPL's existing and planned facilities in the basin.

In the course of its evaluation, PPL has modified the SRBC OASIS model. The principal reasons to modify the model were to:

- Simulate the operation of the proposed Asset Pool to mitigate consumptive water use at PPL consumptive use projects
- Simulate the operation of Rushton Mine, Holtwood and "West Branch" as potential components of the Asset Pool
- Simulate the operation of Whitney Point Lake for low flow augmentation
- Simulate the existing in-basin diversion at the Barnes & Tucker mine
- Remove negative inflows in order to eliminate zero or unrealistically low river flows
- Include BBNPP as a consumptive water use
- Program Holtwood to reflect the daily flow requirement of the amended license
- Remove the portion of the model simulating the basin below Holtwood in order to (a) prevent potential influences of operations of downstream facilities (e.g., Conowingo, Muddy Run and the City of Baltimore) on upstream river flows and reservoir operations and (b) reduce the size of output files
- Simulate the operation of Montour and Lake Chillisquaque in accordance with the Montour Drought Operations Manual
- Include consumptive use mitigation for Montour in releases from of Cowanesque Lake

The principal focus of PPL's evaluation has been to determine how river flows would be affected by the operation of various combinations of CU mitigation resources in the Asset Pool. PPL has also evaluated the relative effect of the CU of the proposed Bell Bend Nuclear Power Plant ("BBNPP") on river flows; BBNPP will be located in the Middle Susquehanna Subbasin. This report does not address the economic benefits and costs of CU mitigation.

Individual CU mitigation resources in the Asset Pool would not be assigned to specific CU facilities but would be operated in a coordinated fashion to serve PPL's combined need, and to better optimize Basin resources. Factors to be considered in determining "optimum" operation would include: operating cost, status of contents and outlook for refill; ambient downstream river flows and flow needs; maintenance requirements; and perhaps others.

As envisioned, the Asset Pool Operations Plan would (a) prescribe the operation of the Asset Pool, including specific operational requirements for individual CU mitigation resources and (b) accommodate changes or additions to both the CU mitigation resources and the facilities for which CU mitigation is provided.

PPL existing CU facilities are: [3]

- Susquehanna Steam Electric Station ("SSES") – Middle Susquehanna Subbasin
- Montour Steam Electric Station ("Montour SES") – West Branch Subbasin
- Brunner Island Steam Electric Station ("BISES") – Lower Susquehanna Subbasin
- Phoenix Links Golf Course ("Phoenix GC") – Lower Susquehanna Subbasin

PPL existing CUs for which additional mitigation is not required are:

- SSES CU up to 40 million gallons per day (mgd) as a 30-day average, mitigated by PPL's sponsorship of storage in Cowanesque Reservoir
- Montour SES CU up to 17.0 mgd, mitigated by a combination of PPL's sponsorship of storage in Cowanesque Reservoir and drought operation of Lake Chillisquaque
- BISES CU up to 8.1 mgd (grandfathered under SRBC regulations)

PPL CUs potentially to be mitigated by new CU mitigation resources and included in OASIS modeling to date are:

- SSES CU exceeding 40 mgd as a 30-day average
- Montour SES CU exceeding 17.0 mgd
- BISES CU exceeding 8.1 mgd
- Phoenix GC CU (combined with BISES CU in OASIS)
- BBNPP CU

For purposes of OASIS modeling, PPL CU values are assumed to be constant during each month of the year. The monthly CU values (mgd) are presented in TABLE 1. The CUs for existing PPL facilities represent average values, on a monthly basis. The BBNPP CU value for each month is the maximum average full-load CU for that month indicated by simulation of BBNPP operation over the period 1949 through 2009. The principal component of BBNPP's CU is cooling tower evaporation. Allowance was made for other plant losses and in-river evaporation.

The "net mgd" values shown in TABLE 1, both with and without BBNPP, represent the PPL CU proposed to be mitigated by the Asset Pool.

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[3] During the second quarter of 2012, PPL expects to acquire the power plant currently known as "AES Ironwood" that is located in the Delaware River Basin but deriving water supply from the Susquehanna River Basin. SRBC has approved the plant's consumptive use of up to 4.500 mgd of basin waters as an out-of-basin diversion. (Ref. Docket No. 19980502-1) PPL has not included the consumptive use in OASIS modeling to date.

Prospective CU mitigation resources evaluated as components of the Asset Pool to date are:

- Holtwood – proposed as an initial component of the Asset Pool
- Rushton Mine – proposed as an initial component of the Asset Pool
- "West Branch" - representing an unspecified source in the West Branch Subbasin that could be potentially developed in the future as a component of the Asset Pool.

A "North Branch" CU mitigation resource (representing an unspecified source upstream from Danville that could be potentially developed in the future as a component of the Asset Pool) has been included in OASIS for possible future evaluation but has not been evaluated to date.

For convenience, the suite of various model runs for which results are presented in this report is referred to as the "February 2012 runs." PPL made numerous other preliminary modeling runs prior to February 2012; those runs are neither discussed nor their results presented herein. PPL considers the results of the February 2012 runs to represent the important results of the evaluation.

The effect and adequacy of CU mitigation resources is quite dependent upon the assumed "trigger flows," i.e., the ambient river flow or flows that indicate when CU mitigation releases are required. Four alternative trigger flow cases were evaluated, all based on flow in the Susquehanna River at Harrisburg:

- "P95": the flows exceeded 95 percent of the time during the individual months July through November, in effect during each of those respective months
- "Adjusted P95":
    - the flow exceeded 95 percent of the time during August, in effect during the months July and August
    - the flow exceeded 95 percent of the time during September, in effect during the month of September
    - the flow exceeded 95 percent of the time during October, in effect during the months October and November
- "Q7-10": the seven-day average annual low flow exceeded once every ten years on average, in effect during the months July through November
- "August-October P95": the flows exceeded 95 percent of the time during the individual months August, September and October, in effect during each of those respective months, with no trigger flow in effect in July or November.

The values for the various trigger flows, in cubic feet per second (cfs), were provided by SRBC and are presented in TABLE 2.

Other important assumptions adopted for the February 2012 runs are listed below. These are discussed in Sections 3 and 4.

- The model is "cut off" below Holtwood
- Safe Harbor operates on a daily run-of-river basis
- Holtwood operates on a daily run-of-river basis except when providing CU releases or refilling following a period of CU releases

- River flow indicators are Danville, Sunbury, Marietta, Harrisburg and Holtwood; the Holtwood flow represents total outflow from the Holtwood project
- The operating procedures of the Montour Drought Operations Manual are in effect
- CU mitigation resources collectively serve PPL's combined CU mitigation need; i.e., releases from resource "X" are not specifically allocated to CU facilities "Y" or "Z."
- The increases in Holtwood outflow indicate the potential beneficial effects of the Asset Pool with respect to maintaining flow to the Chesapeake Bay, in accordance with SRBC policy. The effects of facilities and withdrawals downstream from Holtwood on flow to the Chesapeake Bay are not evaluated herein.

The key results of the February 2012 runs are:

- The future designation by SRBC of a "trigger flow" for PPL CU mitigation will be very important and will affect the amount of PPL CU mitigation resources required and the operation of those resources.
- Releases (a) from Cowanesque Reservoir for Montour SES and Three-Mile Island ("TMI") according to the present plan[4] and (b) from Whitney Point Lake for low flow augmentation[5] combine to offset the potential flow effects of BBNPP CU, as indicated by low flow statistics at Danville.
- Releases (a) from Cowanesque Reservoir for TMI according to the present plan[6] and (b) from Whitney Point Lake for low flow augmentation[7] combine to offset the potential flow effects of BBNPP CU, as indicated by low flow statistics at Sunbury and Harrisburg.
- BBNPP CU appears to reduce low flows at Marietta (downstream from TMI and BISES) by less than 2 percent. However, PPL understands that low flow augmentation from Raystown Lake improves conditions compared to unregulated low flows in this area of the river.
- Flows at Holtwood (outflow) appear to indicate potential flow improvements to the Chesapeake Bay.
- An Asset Pool consisting of Rushton and Holtwood appears to provide sufficient water to meet PPL's existing CU mitigation need, subject to Commission review.
- If BBNPP is built, potential CU mitigation from Rushton and Holtwood appears to meet the need for CU mitigation at BBNPP, while meeting most or all of the mitigation needs for existing PPL CU facilities. Inclusion of the "West Branch" or other significant resource in the Asset Pool appears to be needed to meet PPL's total need if the trigger flow is based on the P95 flow at Harrisburg.

Determining flow improvements depends upon the selection of appropriate "base flow" scenarios modeled by representative OASIS runs. The "base flow" runs differ at the different flow points (Danville, Sunbury, Harrisburg, Marietta and Holtwood). PPL proposes that the appropriate "base flow" runs are those which exclude the benefits of Whitney Point low flow

[4] Ref. "Cowanesque Operations Manual," SRBC Publication 157, January 1994.
[5] As implemented by the SRBC-Corps Whitney Point "Section 1135 Modification."
[6] Ref. "Cowanesque Operations Manual," SRBC Publication 157, January 1994.
[7] As implemented by the SRBC-Corps Whitney Point "Section 1135 Modification."

augmentation and the benefits of releases from Cowanesque for designated uses downstream. The specific values selected for comparison in this study are the low flows exceeded 95%, 96%, 97%, 98%, 99% and 100% of the time during the period July through November.

Prior runs (not included among the February 2012 runs) suggest that storage capacity in Lake Chillisquaque might suffice to provide additional CU mitigation beyond that provided by operation according to the Montour Drought Operations Manual. PPL would like to explore this possibility with SRBC staff.

3. MODIFICATIONS TO OASIS MODEL

The SRBC model operates on a daily basis, simulating the period February 1930 through March 2008. PPL understands that inflows at the various inflow nodes were developed based on actual gaging station records for the model period. The starting point for PPL's modifications was SRBC's model run ("reference run") "_Automatic_QFERC+1000_updated_20110216."

PPL's modifications may be considered in three categories:

- Structural: changes to the basin stream-reservoir-demand network.
- Programming: changes to routines or water management rules implemented by the several operator control language ("OCL") files.
- Data: changes to data in either the OCL files or in the "statdata.mdb" files.

Some modifications fall into more than one of the three categories.

The significant PPL modifications are summarized, below. Model nodes are represented by the node number in brackets, e.g. "[300]," and model arcs by upstream/downstream nodes separated by a period, e.g. "385.420." Demands simulated in the model are entirely consumptive.

3.1 Structural Modifications

Model cutoff

The SRBC model extends downstream from Holtwood to the Chesapeake Bay and includes Conowingo, Muddy Run, the Baltimore water supply system, and several demands downstream from Conowingo. The PPL model is "cut off" downstream from Holtwood [560]. Holtwood discharge is simulated as the flow in 560.570; node [570] represents Conowingo Reservoir but is a non-operating terminal node in the cut-off model. The primary purpose of the "cutoff" is to evaluate only the part of the basin system that PPL operations (either demands or storage releases) could affect, without requiring assumptions about Conowingo or Baltimore operations. A secondary purpose is to reduce model run times and the amount of output data.

The model has been tested with and without cutoff to determine suitability for purposes of PPL's evaluation. (See subsection 3.4 "Model Cutoff and Hydro Peaking," below.)

Proposed Bell Bend Nuclear Power Plant (BBNPP)

BBNPP is added as a demand node [286], removing water from the river system at Danville [280] via 280.286.

Barnes & Tucker

The Barnes & Tucker in-basin transfer is added to the model as node [288]. Inflow to [288] and outflow to Curwensville Lake [290] via 288.290 is 10.0 mgd when the Harrisburg flow is below the assumed SRBC Q7-10 trigger flow and 7.5 mgd at all other times.

Rushton Mine

PPL's Rushton Mine is proposed as a component of the Asset Pool (SRBC Pending No. 2011-146) and is added as reservoir node [302]. Model outflow from Rushton enters the river system at Karthaus [300]. Modeled inflow to Rushton for each month of the year is based on estimates of inflow derived from estimated net pumping and observed mine pool level fluctuations; inflow ranges from 2.9 mgd to 5.2 mgd. To retain the model overall water balance, inflow to [302] is subtracted from inflow to [300]. The available CU mitigation from Rushton is modeled as 2.0 mgd. The 2.0 mgd represents the potential available mitigation from the existing project, i.e., maximum drawdown to approximately El. 1380 ft from the nominal maximum operating level of El. 1420 ft. The estimated mine void in this interval is 565 acre-ft. To represent depletion of storage, the amount of flow augmentation and the inflow to the mine are combined in the Rushton release as flow in 302.300.

"West Branch" resource

Additional PPL storage in the West Branch subbasin potentially to be included in the Asset Pool is added as "West Branch" reservoir node [340]. Model outflow from "West Branch" enters the river system at Lock Haven [350]. Inflow to "West Branch" is modeled as a constant 5.0 mgd. To retain the model overall water balance, inflow to [340] is subtracted from inflow to [350]. The potential available storage and the maximum potential CU release are initially considered to be essentially unlimited, but were limited in the February 2012 runs to the amounts necessary to provide for the total PPL CU mitigation need under the P95 trigger flow.[8] To represent depletion of storage, the amount of flow augmentation and the inflow are combined in the "West Branch" release as flow in 340.350.

"North Branch" resource

Additional PPL storage upstream from Wilkes-Barre [275] potentially to be included in the Asset Pool is added as "North Branch" reservoir node [277]. Model outflow from "North Branch" enters the river system at Wilkes-Barre. Inflow to "North Branch" is modeled as a constant 5.0

[8] The estimated need for a "West Branch" resource under a P95 trigger flow is 9.3 mgd maximum CU mitigation release rate and a total storage of 1,383 acre-ft. This was determined by a run not reported herein.

mgd. To retain the model overall water balance, inflow to [277] is subtracted from inflow to [275]. No runs were made utilizing "North Branch"; in effect, [277] remains "full" and all inflow passed to [275] via 277.275.

Montour – Lake Chillisquaque

The SRBC model shows Montour SES as a demand [382] receiving supply both by (gravity) flow from Lake Chillisquaque [375] and (pumped) flow from the West Branch at the "Montour Diversion" [381], located just above Sunbury [385]. Lake Chillisquaque discharges to Sunbury via 375.385.

The "Montour – Lake Chillisquaque" system was modified in the PPL model to better reflect actual operation of the Montour complex, including drought operations. In the modified model, Montour SES [382] again receives supply from both Lake Chillisquaque [375] and "Montour Diversion" [381], but the Montour SES CU is represented by a new node [383], which receives flow via 382.383. Non-consumptive Montour SES use demand is discharged to Sunbury via 382.385. Also, water can be pumped from the river to the lake via 381.375. Conservation flow (0.81 cfs) and excess inflow to the lake are released via 375.381 as in the SRBC model. The flow in Chillisquaque Creek downstream from the Montour SES is not modeled per se but would be represented by the sum of the flows in 375.385 and 382.385.

Letterkenney diversion

The SRBC model has an out-of-basin diversion [997] from Letterkenny Reservoir [440]. The relationship of daily Letterkenny diversion and outflow was irregular, apparently influenced by in-basin river flows. As a result, varying amounts of flow would bypass the Lower Susquehanna. PPL replaced the diversion with a constant in-basin demand [441] of 1.4 mgd to alleviate variability. Letterkenny operates as an uncontrolled reservoir meeting the 1.4 mgd demand and a constant minimum release of 3.2 mgd to Conodoguinet Creek via 440.445. The Letterkenney demand and minimum release rates were suggested by SRBC staff.

3.2 Programming Modifications

In addition to programming necessary to implement the "Structural Modifications" discussed above, significant program modifications to the model are discussed in this section.

TABLE 3 lists the OCL files included in the reference SRBC model run and the PPL model. TABLE 3 indicates PPL's implementation of each file. PPL's additions and modifications to the OCL files are discussed in this section.

Elimination of negative inflows

In the SRBC model, inflows at several nodes are adjusted in the adjust_inflows OCL file to eliminate negative inflows. In order to maintain overall water balance, the adjustment routine

zeroes each negative inflow as it occurs and applies the negative amount to succeeding positive inflows by zeroing those positive inflows until all negativity has been distributed. However, several other nodes had negative inflows. Of particular significance were negative inflows at Wilkes-Barre [275] that sometimes reduced the river flow in 275.280 to zero. In the PPL model, all inflows were included in the adjust_inflows OCL file in order to be certain to eliminate negative inflows throughout the model system.

Whitney Point flow augmentation

In the SRBC model reference run, operation of Whitney Point Lake [150] does not replicate the SRBC-Corps Section 1135 Project Modification. Minimum reservoir outflow to the river 150.155 is 10 cfs. Reservoir outflow to the river 150.155 is intended to be constrained to a maximum 2,000 cfs May-September and 3,500 cfs in other months.

PPL added a Whitney Point OCL file to simulate the Section 1135 reservoir operation for flow augmentation. The flow augmentation replicates as closely as possible the rules provided by SRBC staff.[9] The modified operation triggers releases from Whitney Point to meet flow targets in the Otselic River below the lake, at Chenango Forks [160], and at Waverly [180].

Hydro peaking operations

In the SRBC model reference run, Safe Harbor and Holtwood operate strictly as a run-of-river reservoirs (outflow = inflow less losses). PPL developed routines to simulate maximum Safe Harbor and Holtwood weekly peaking, i.e. to maximize weekday generation and minimize weekend day generation as limited by inflow, available storage, plant hydraulic capacity and, for Holtwood, the required minimum daily flow release (see below).

PPL tested the model both with Safe Harbor/Holtwood run-of-river and peaking, both with and without model cutoff. Safe Harbor/Holtwood peaking operation was assumed in some comparative preliminary runs to evaluate PPL CU mitigation. However, as discussed in Section 3, it was determined that that run-of-river hydro operation will be assumed in the model runs to evaluate PPL CU mitigation as reported herein. (See subsection 3.4 "Model Cutoff and Hydro Peaking")

Holtwood daily minimum flow operation

In addition to the maximum weekly peaking routine discussed above, PPL also modified the holtwood_ops OCL file to reflect the daily minimum release requirement of the amended license. Holtwood is required each day to release either net inflow or 98.7 percent of the prevailing Conowingo minimum flow, whichever is less. The Conowingo minimum flow is the

[9] "Whitney Point Lake – Determining Release Rates for Flow Augmentation" dated 2/4/2011. PPL understands that the document was developed by the Corps.

lesser of the "QFERC" flow[10] or the prior-day flow at Marietta. With the redeveloped project, there will be a required minimum flow of 200 cfs to the Piney Channel. However, since run-of-river operation was assumed for both Safe Harbor and Holtwood, these requirements did not affect outcomes of the various runs evaluated for this report.

Holtwood operation for PPL consumptive use mitigation

Holtwood will be proposed to be included in the Asset Pool and is modeled in selected PPL runs as the primary source of CU mitigation. PPL proposes to provide CU mitigation releases from Holtwood by maintaining the lake levels above the current minimum levels by an amount sufficient to provide the corresponding amount of CU mitigation releases. During CU mitigation operation, the lake would be drawn down daily by an amount equivalent to the amount of CU mitigation provided. Daily (but not weekly) peaking could continue during CU mitigation operation as constrained by the pool limits necessary to assure adequate water for CU mitigation.

PPL proposes to provide CU releases during the recreation season (ends September 15) from storage between El. 168.80 ft and El. 167.50 ft. (El 167.50 ft is the minimum lake level allowed during the recreation season.) This storage is estimated as 3,370 acre-ft.

PPL proposes to provide CU releases during the post-recreation season (beginning September 16) from storage between El. 167.50 ft and El. 165.00 ft. (The minimum operating level is El. 163.50 ft.) This storage is estimated as 6,090 acre-ft.

Holtwood was evaluated to determine the maximum amount of CU mitigation both during the recreation season and the post-recreation season, as discussed in Section 4.

In the February 2012 runs, the daily Holtwood lake levels in OASIS represent the elevation of the remaining CU mitigation storage during the months July through November and the full operating lake level (El. 169.75 ft) during the months December through June.

Montour SES drought operations

The SRBC model reference run excludes CU makeup for Montour SES. PPL modified the model (with the modified Montour-Lake Chillisquaque structural changes discussed above) to simulate drought operations in accordance with the Montour SES Drought Operations Manual. To implement drought operations, PPL (1) added the montour_ops OCL file to simulate operation of the Montour system including Lake Chillisquaque and (2) modified the SRBCstorage_ops OCL file to simulate releases from Cowanesque Lake for Montour SES.

[10] During the July-November PPL CU release period, "QFERC" is 5,000 cfs through September 14 and 3,500 cfs thereafter.

Curwensville pass-through of Barnes & Tucker

Curwensville Lake operation is modified in the SRBCstorage_ops OCL file so that the Barnes & Tucker flow augmentation 288.290 entering Curwensville is always added to the reservoir release and not retained in the reservoir.

Potential new PPL consumptive use mitigation

The operation of potential new sources for additional PPL CU mitigation is programmed in the PPL_CU_mitigation OCL file. This includes the maximum CU release and the priority of use of each source.

3.3 Data Modifications

Demand weights

In the SRBC model reference run, demand weights[11] are relatively low (200 or 210) so that demand withdrawals are automatically curtailed during low river flows. In the PPL model, in order to accurately compare the effects of different basin operations on river flows without the effect of variations in consumptive demands, all demand weights are set at 2000, with the result that demands are constant under all conditions with one exception; there are times when flow in the Lackawanna River at Old Forge [270] is not adequate to meet the Wilkes-Barre demand [265].

PPL consumptive water use (demand)

The modeled demand (representing CU) at existing PPL facilities is modified to represent average full-load values, on a monthly basis. BBNPP demand (representing CU) has been added to represent the maximum simulated full-load demand for each month. All February 2012 runs include the CUs of all existing PPL facilities. The BBNPP CU was included in selective runs.

Safe Harbor and Holtwood SAE values

The Safe Harbor and Holtwood storage-area-elevation (SAE) values are modified to: (1) show absolute storages; (2) increase the Safe Harbor maximum operating level to EL. 228.0 ft; and (3) to correct the values to correspond to known values.

[11] OASIS uses numerical "weights" (selected by the user) to prioritize choices among river flows, water in storage, and water withdrawn (demands). In this case, the weight for each demand was set at 2,000, a value higher than the weights of river flows and water in storage so that demands would not be curtailed as river flows decreased during drought.

Curwensville dead storage

The elevation of the top of "dead" (unusable) storage in Curwensville is revised to El. 1135 ft from El. 1150 ft, as recommended by SRBC staff.

Trigger flows

Trigger flows for flow augmentation for PPL CU mitigation are set in the PPL_CU_mitigation OCL file. Trigger flows for SRBC storage releases (from Cowanesque and Curwensville) are set in the SRBCstorage_ops OCL file. (PPL developed and initially tested the CU_trigger OCL file to facilitate testing varying CU mitigation trigger flows; however, for the purpose of the February 2012 runs, it was found to be more convenient to insert and adjust trigger flows in the PPL_CU_mitigation OCL file.)

The trigger flows for SRBC releases from Cowanesque and Curwensville, respectively, are the Wilkes-Barre and Harrisburg Q7-10 flows as simulated in the SRBC model reference run.

3.4 Model Cutoff and Hydro Peaking

Two important alternative attributes of the model for purposes of PPL's evaluation are whether or not to (a) cut off the model downstream from Holtwood ("model cutoff") and (b) assume weekly peaking at Safe Harbor and Holtwood ("hydro peaking"). Four preliminary runs were made for the purpose of testing the effects of model cutoff:

- Run 1: no model cutoff, no hydro peaking
- Run 1C: model cutoff, no hydro peaking
- Run 1P: no model cutoff, hydro peaking
- Run 1PC: model cutoff and hydro peaking

These runs are not included among the February 2012 runs.

Results of the four preliminary runs are presented in TABLE 4. The results indicate:

- Model cutoff does not affect flows upstream from Holtwood
- Model cutoff affects Holtwood outflows only when hydro peaking is assumed
- Hydro peaking does not affect flows upstream from Holtwood

It is important to recognize the overwhelming potential effect of peaking at Safe Harbor on outflow at Holtwood. There are three reasons for this:

- Safe Harbor has no flow (release) requirement;
- Safe Harbor's usable reservoir capacity greatly exceeds Holtwood's, both during the recreation season and at other times; and
- Safe Harbor's hydraulic capacity significantly exceeds Holtwood's even with Holtwood redeveloped.

Accordingly, Holtwood operation, to a large degree, depends on Safe Harbor operation. If Safe Harbor is regulating its storage for peaking operation, Holtwood can effectively peak in parallel

with Safe Harbor without using any of its own storage (i.e., by keeping a steady pond level). In addition, during relatively low flow periods, it is sometimes possible for Holtwood to use its reservoir storage to intensify its own peaking.

Nevertheless, because of the degree of control of Safe Harbor on Holtwood daily operations, PPL considers it more representative to assume daily run-of-river operation at both Safe Harbor and Holtwood for purposes of evaluating the effects of CU mitigation resources using OASIS. Accordingly, the February 2012 runs as reported in this report assume daily run-of-river operation at Safe Harbor and Holtwood (i.e., no hydro peaking) except when Holtwood is making CU releases or refilling after drawdown for CU releases.

Since model cutoff is shown not to affect flows upstream from Holtwood, the cutoff model was used for all February 2012 runs.

4. EVALUATION OF POTENTIAL CONSUMPTIVE USE MITIGATION ASSETS

PPL has made dozens of OASIS runs to test various combinations of different CU facilities, different CU mitigation resources and alternative possible trigger flows. Reported herein are the results of the "February 2012 runs" – a selected group of runs made or reviewed in February 2012. The February 2012 runs include combinations of the following options:

- Whether Cowanesque operates for SSES only, or for SSES and Montour, or for SSES, Montour and Three-Mile Island ("TMI")
- Whether Whitney Point Lake operates for low flow augmentation
- Whether BBNPP is operational
- Alternative PPL CU mitigation trigger flows (TABLE 2)
- Whether PPL CU mitigation is provided; when it is, Rushton Mine and Holtwood are always assumed to provide mitigation.
    - Rushton provides 2.0 mgd.
    - Holtwood provides between 27.0 mgd and 36.3 mgd during the recreation season and 31.5 mgd during the post-recreation season; the basis for these values is discussed below.
- Whether the "West Branch" CU mitigation resource is operational in addition to Rushton and Holtwood; if so, the maximum CU mitigation release is 9.3 mgd; the basis for this value is discussed below.
- Alternative priorities of the sources of CU mitigation; Rushton is always first priority.

TABLE 5 is a "menu" of the February 2012 runs and the assumed options of each.

The assumed maximum amount of usable storage (mine void space) available at Rushton Mine is 565 acre-feet; this is the estimated volume between El. 1420 ft and El. 1380 ft. The assumed maximum CU "release" rate of 2.0 mgd is the rate of withdrawal that can be sustained for a period of 92 days.

The storage in Holtwood proposed to be dedicated to CU mitigation, in both the recreation and post-recreation seasons, is described in "Holtwood operation for PPL consumptive use mitigation" in Section 3.2. The maximum values of CU releases available from Holtwood CU mitigation storage depend upon the assumed PPL CU mitigation trigger flow.
Initial determination of the maximum possible available CU release values was made by working in Excel for selected drought years (1930 and 1961-1966) using as a basis the data from an OASIS run. In the Excel work, as in the OASIS modeling, it was assumed that the Holtwood CU storage can refill, to the extent possible according to flows, when (a) the Harrisburg flow exceeds the PPL trigger flow and (b) the inflow to Holtwood exceeds the Holtwood daily flow release requirement (98.7% of the lesser of the QFERC flow and the prior day flow at Marietta).

The Excel work indicated the following maximum possible Holtwood CU release rates:

PPL CU Trigger Flow	Maximum possible CU release during recreation season [year]	Maximum possible CU release during post-recreation season [year]
P95	28.1 mgd [1962]	35.4 mgd [1964]
Adjusted P95	38.6 mgd [1964]	35.4 mgd [1964]
Q7-10	109.7 mgd [1964]	82.6 mgd [1964]
August-October P95	38.6 mgd [1964]	55.0 mgd [1964]

Based on the Excel work and the PPL CU values, the initial maximum possible Holtwood CU releases selected for the alternative trigger flows were:

	Recreation season (mgd)	Post-recreation season (mgd)
July-November P95	27.0 [1]	31.5 = max need (September) with Rushton providing 2.0
Adjusted July-November P95	36.3 = max need (July) with Rushton providing 2.0	same as above
Q7-10	same as above	same as above
August-October P95	same as above	same as above

[1] Increased to 31.5 mgd in Run F-7A to provide 100 percent of CU mitigation need

However, in runs F-4B and F-4D, as discussed in Section 5, the 36.3 mgd recreation season maximum proved to result in excessive drawdown at Holtwood during the recreation season and was reduced to 29.6 mgd in those runs to constrain the drawdown to El. 167.50 ft.

The need for PPL storage in a "West Branch" resource was evaluated in the following manner. Run F-5A modeled operation of Rushton, Holtwood and West Branch, assuming a July-November P95 trigger flow (Harrisburg) and unlimited storage in West Branch. Holtwood was assumed to provide up to 27.0 mgd during the recreation season and up to 31.5 mgd during the post-recreation season. The priority of CU releases in Run F-5A was first Rushton, then Holtwood, and finally West Branch if and as needed. The maximum storage used in West Branch in Run F-5A was 1,383 acre-ft and the maximum CU release required was 9.3 mgd. These values were then accepted as the West Branch capability in Runs F-6A and F-7A, with

West Branch given priority over Holtwood in those runs to improve flows in the main stem of the river. In Run F-6A, some PPL CU remained un-mitigated. In Run F-7A, the maximum recreation season CU release from Holtwood was increased to 31.5 mgd, the maximum needed in September, and the total PPL need was met.
The results of the February 2012 runs are discussed in Section 5 and presented quantitatively in the referenced tables.

5. RESULTS AND CONCLUSIONS

In addition to the secondary result that use of a cutoff OASIS model is appropriate for evaluating the potential benefits of the PPL Asset Pool, the primary results of this study are presented to show:

- The effectiveness of PPL CU resources to meet PPL CU mitigation needs
- The effect of BBNPP CU on local river flows (at Danville) in the absence of upstream CU assets serving BBNPP
- The effect of PPL CU assets on main stem river flows

The key results are presented in TABLE 6 (a and b) through TABLE 12.

5.1 Effectiveness of PPL CU Mitigation Resources

For the runs simulating PPL CU mitigation releases, TABLES 6a and 6b present results in terms of the total annual CU (in million gallons) for which CU releases would be required and the respective amounts of this CU either mitigated or unmitigated during an average year and drought years 1930, 1962 and 1964. (The data for an "average" year are the average annual values for the entire model period.) These values are intended solely to suggest the relative effectiveness or adequacy of the Asset Pool resources represented by each run. When unmitigated CU is indicated, this value does not distinguish between insufficiency of CU releases on the days when (a) the combined rate of maximum allowable CU mitigation releases was less than the total net CU and (b) the available CU mitigation releases were limited due to depletion of storage in the CU mitigation resources.

It was assumed for purposes of the modeling that, when BBNPP is in service, CU releases (without regard to the source) would be applied to BBNPP CU first and to the CUs of the other PPL facilities second. As indicated in TABLE 6a and TABLE 6b, for a July-November P95 trigger flow, Rushton and Holtwood together suffice to satisfy the BBNPP CU need in all years for all runs. For runs F-4A, -4B and -4D, the CU of the existing facilities is only partially satisfied. The greatest deficiencies in runs F-4A, -4B and -4D occurred in 1962; this is because the drought in 1962 was most severe during the Holtwood recreation season, when Holtwood CU mitigation was relatively limited. To satisfy all PPL CU mitigation need in all years under a July-November P95 trigger flow, an adjusted July-November P95 trigger flow, or an August-October P95 trigger flow in all years, CU mitigation resources additional to Rushton and Holtwood would be needed, as is simulated in Run F-7A.

TABLE 7 presents the maximum and average Rushton and "West Branch" drawdown and minimum Holtwood lake levels in an average year and in selected drought years 1930, 1962 and 1964. Drawdown at Holtwood is maintained above the minimum recreation and post-recreation season levels respectively in all runs. In the July-November P95 runs (F-4A and F-7A), lake level is drawn down very close to the minimum recreation season level (El. 167.50 ft) in 1962. As explained below, there were violations of the minimum recreation season lake level in the initial runs F-4B and F-4D, which were subsequently revised to maintain the lake level above the minimum.

The fundamental reason for excessive Holtwood drawdowns in the initial runs F-4B and F-4D is that the initial maximum CU releases were determined by an Excel spreadsheet. Excel can manipulate data in a way that OASIS cannot. Specifically as pertains to this work, Excel can use "today's" flow at Harrisburg and "today's" inflow at Holtwood for comparison, respectively, with the PPL trigger flow and the required daily Holtwood release in order to determine whether a CU release is required or whether there is excess inflow that can be stored for refill. But OASIS determines "today's" Harrisburg flow and "today's" inflow at the same time (end of day) it determines the Holtwood outflow. Thus, for example, when "yesterday's" Harrisburg flow is lower than the PPL CU trigger flow but "today's" Harrisburg flow exceeds the trigger flow, OASIS will nevertheless call for a CU release "today." Further, if "today's" inflow is greater than the required daily flow but the perceived (programmed) inflow based on "yesterday's" Safe Harbor release is less than the required daily flow, OASIS will not allow "today's" excess flow to be used to refill the CU storage. On most days the OASIS and Excel analyses agree, but there can be differences during low flow periods on days when flows change significantly from one day to the next.

Consequently, Runs F-4B and F-4D were revised by reducing the maximum CU release to the largest release that would maintain the recreation season lake level above El. 167.50 ft at all times. The reduction was to 29.6 mgd from 36.3 mgd, and this left a small amount of non-BBNPP CU unmitigated.

5.2 Local Effect of BBNPP CU

TABLE 8, which compares low flow statistics at Danville from Runs F-3 and F-1, indicates that CU mitigation releases from Cowanesque Reservoir for Montour, SSES and TMI combined with low flow augmentation releases from Whitney Point Lake more than offset flow reductions due to potential BBNPP CU at very low flows. The flow improvements diminish at flows greater than P97 flows because the trigger flow for Cowanesque Reservoir releases is the Q7-10 flow at Wilkes-Barre for Montour SES and at Harrisburg for TMI. This suggests that Asset Pool resources to mitigate BBNPP CU need not be located upstream from BBNPP.

5.3 Main Stem River Flow Effects

The purpose of addressing "main stem" river flow effects (at Sunbury, Marietta and Harrisburg) is to indicate whether providing some or most new PPL CU mitigation at a downstream site

(Holtwood) might be detrimental to the river. The OASIS modeling provides gallon-for-gallon releases for PPL's CU on days required by the respective alternative trigger flows, so that the replacement of the CU is assured from a basin perspective and is not at issue.

The runs representing the several PPL CU mitigation resource scenarios are Runs F-4A, -4B, -4C, -4D and -7A. In TABLES 9 through 12 (for Sunbury, Harrisburg, Marietta and Holtwood outflow, respectively) the low flows exceeded 95% to 100% of the time during July through November in the CU mitigation runs are compared with the corresponding flows of a "base run." The selected "base run" for Sunbury and Harrisburg excludes the effects of CU makeup from Cowanesque Reservoir dedicated to downstream uses (TMI) and from the operation of Whitney Point Lake for low flow augmentation. The selected "base run" for Marietta and Holtwood excludes the effects from the operation of Whitney Point Lake for low flow augmentation.

In comparing flows among runs on the basis of low flow exceedances, it is recognized that comparisons of flows at a particular exceedance do not represent flow improvements or deficiencies on specific days (except where absolute minimum flows occur on the same day among different runs). Since the OASIS model period extends for 79 years, the number of low flow days is sufficient to give statistical meaning to the exceedances.

The effects on river flows at Danville were addressed in Section 5.2, above, with reference to TABLE 8, indicating that BBNPP CU flow impacts are more than offset at extreme low flows by flow improvements derived from the operation of Whitney Point and Cowanesque. Insofar as there is no currently proposed PPL CU mitigation resource upstream from Danville, further comparison of flows at Danville would not be meaningful.

Sunbury

Refer to TABLE 9 – July-November low flow exceedances at Sunbury for Runs F-2b, -4A, -4B, -4C, -4D and -7A.

The "base run" for comparison of the flow effects of PPL CU mitigation at Sunbury is Run F-2b; this run excludes the Cowanesque release for TMI and the low flow augmentation operation of Whitney Point. All PPL CU mitigation scenarios include BBNPP. In Runs F-4A, -4B, -4C and -4D, Rushton is the only new PPL CU resource providing CU mitigation releases upstream from Sunbury; these runs show July-November low flow improvements up to the 96% exceedance low flow. Run F-7A, which also includes PPL CU mitigation releases from the "West Branch" resource, shows low flow improvement through the 95% exceedance low flow.

Low flow improvements due to Curwensville Reservoir operation and to the in-basin transfer at Barnes & Tucker are effective in the "base run" and in all the PPL CU mitigation runs.

The data in TABLE 9 suggest that low flow augmentation from Whitney Point and from Cowanesque for TMI, plus PPL CU mitigation releases from Rushton, more than offsets the flow effect of BBNPP CU at Sunbury during extreme low flows.

Harrisburg

Refer to TABLE 10 – July-November low flow exceedances at Harrisburg for Runs F-2b, -4A, -4B, -4C, -4D and -7A.

The "base run" for comparison of the flow effects of PPL CU mitigation at Harrisburg is Run F-2b; this run excludes the Cowanesque release for TMI and the low flow augmentation operation of Whitney Point. All PPL CU mitigation scenarios include BBNPP. In Runs F-4A, -4B, -4C and -4D, Rushton is the only new PPL CU resource providing CU mitigation releases upstream from Harrisburg; these runs show July-November low flow improvements up to the 97% exceedance low flow. Run F-7A, which also includes PPL CU mitigation releases from the "West Branch" resource, shows low flow improvement through the 96% exceedance low flow. Low flow improvements due to operation of Raystown Lake and Curwensville Reservoir and to the in-basin transfer at Barnes & Tucker are effective in the "base run" and in all the PPL CU mitigation runs.

The data in TABLE 10 suggest that low flow augmentation from Whitney Point and from Cowanesque for TMI, plus PPL CU mitigation releases from Rushton, more than offsets the flow effect of BBNPP CU at Harrisburg during extreme low flows.

Marietta

Refer to TABLE 11 -- July-November low flow exceedances at Marietta for Runs F-2c, -4A, -4B, -4C, -4D and -7A.

The "base run" for comparison of the flow effects of PPL CU mitigation at Marietta is Run F-2c; this run excludes the low flow augmentation operation of Whitney Point. All PPL CU mitigation scenarios include BBNPP. In Runs F-4A, -4B, -4C and -4D, Rushton is the only new PPL CU resource providing CU mitigation releases upstream from Marietta; these runs indicate July-November low flows are slightly reduced, by approximately 10 cfs to 30 cfs or approximately one percent to two percent in the range of the 95% to 100% exceedance low flows. Only at the 98% exceedance low flow is no reduction evident. For Run F-7A, which also includes PPL CU mitigation releases from the "West Branch" resource, the low flow reductions are smaller, i.e., up to approximately 1.5 percent, with a 0.3 percent improvement at the 98% exceedance low flow. The differences between the results at Marietta and the results at Harrisburg reflect the absence of the TMI release from Cowanesque in the PPL CU mitigation runs.

Low flow improvements due to operation of Raystown Lake and Curwensville Reservoir and to the in-basin transfer at Barnes & Tucker are effective in the "base run" and in all the PPL CU mitigation runs. While not illustrated in runs provided in this report, flow releases from Raystown, Curwensville, and Barnes & Tucker would be expected to offset the flow effects of PPL CU at Marietta.

Any assessment of a potential small flow reduction at Marietta should take into account the local nature of the river.

Holtwood (outflow)

Refer to TABLE 12 -- July-November low flow exceedances at Holtwood for Runs F-2c, -4A, -4B, -4C, -4D and -7A.

The "base run" for comparison of the flow effects of PPL CU mitigation in the Holtwood outflow is Run F-2c; this run excludes the low flow augmentation operation of Whitney Point. All PPL CU mitigation scenarios include BBNPP. In Runs F-4A, -4B, -4C and -4D, Rushton and Holtwood provide CU mitigation releases effective at Holtwood; these runs indicate July-November low flows are generally increased, and the very lowest flows significantly increased (up to 2+ percent). For Run F-7A, which also includes PPL CU mitigation releases from the "West Branch" resource and satisfies all PPL CU mitigation needs, the low flow improvements increase from 16-20 cfs (0.5%-0.7%) at the 95%-96% exceedance low flow to 43-48 cfs (2.0%-2.5%) at the 99%-100% exceedance low flow. These increases represent potential improvements to low inflow to the Chesapeake Bay.

Low flow improvements due to operation of Raystown Lake and Curwensville Reservoir and to the in-basin transfer at Barnes & Tucker are effective in the "base run" and in all the PPL CU mitigation runs.

TABLES

TABLE 1. PPL CU values assumed in February 2012 runs. All values are assumed constant during a given month.

	SSES [285]		Montour [383]		BISES + Phoenix [485]		BBNPP [286]	Combined w/o BBNPP		Combined with BBNPP	
	Total mgd	Net mgd	Total mgd	Net mgd	Total mgd	Net mgd	Total mgd	Total mgd	Net mgd	Total mgd	Net mgd
Jan	32.94	0.00	14.61	0.00	9.27	1.17	17.82	56.82	1.17	74.64	18.99
Feb	33.19	0.00	14.72	0.00	9.33	1.23	17.93	57.24	1.23	75.17	19.16
Mar	35.40	0.00	15.68	0.00	11.62	3.52	19.23	62.70	3.52	81.93	22.75
Apr	38.10	0.00	16.87	0.00	13.26	5.16	20.90	68.23	5.16	89.13	26.06
May	40.98	0.98	18.15	1.15	14.86	6.76	22.46	73.99	8.89	96.45	31.35
Jun	42.39	2.39	18.77	1.77	16.13	8.03	23.29	77.29	12.19	100.58	35.48
Jul	43.41	3.41	19.23	2.23	16.86	8.76	23.86	79.50	14.40	103.36	38.26
Aug	42.93	2.93	19.02	2.02	16.66	8.56	23.57	78.61	13.51	102.18	37.08
Sep	41.61	1.61	18.42	1.42	15.71	7.61	22.79	75.74	10.64	98.53	33.43
Oct	39.26	0.00	17.38	0.38	13.58	5.48	21.41	70.22	5.86	91.63	27.27
Nov	36.64	0.00	16.23	0.00	12.12	4.02	19.95	64.99	4.02	84.94	23.97
Dec	34.12	0.00	15.13	0.00	9.42	1.32	18.48	58.67	1.32	77.15	19.80

The bracketed numbers indicate the respective node designations in the OASIS model.

TABLE 2. Alternative "trigger flows" at Harrisburg for PPL CU mitigation releases assumed in February 2012 runs

Month	P95 (cfs)	Adjusted P95 (cfs)	Q7-10 (cfs)	August-October P95 (cfs)
July	4,360	3,500	2,570	
August	3,500	3,500	2,570	3,500
September	2,980	2,980	2,570	2,980
October	3,120	3,120	2,570	3,120
November	4,100	3,120	2,570	

Values provided by the SRBC

TABLE 3. Listing of OCL files in SRBC and PPL OASIS runs

OCL file	Included in SRBC reference run? [1]	Implementation in PPL February 2012 evaluation runs
Aberdeen_ops	yes	Inactive (below Holtwood)
adjust_inflows	yes	modified – see discussion
baltimore_ops	yes	Inactive (below Holtwood)
channel_routing	yes	Unchanged
chester_ops	yes	Inactive (below Holtwood)
Conowingo_ops	yes	Inactive (below Holtwood)
constants_inc	yes	Unchanged
constants_table	yes	Unchanged
holtwood_ops	yes	modified – see discussion
lancaster_ops	yes	Unchanged
main	yes	modified to accommodate added OCL files
muddy_run	yes	Inactive (below Holtwood)
safe_harbor_ops	yes	Unchanged
SRBCstorage_ops	yes	modified – see discussion
substitutes	yes	Unchanged
udef_list	yes	modified to accommodate new variables
york_ops	yes	Unchanged
barnes_tucker	no	added – see discussion
CU_trigger	no	added – see discussion – but inactive in all evaluation runs; could be dropped
montour_ops	no	added – see discussion
PPL_CU_mitigation	no	added – see discussion
whitney_point	no	added – see discussion

[1] "_Automatic_QFERC+1000_updated_20110216"

TABLE 4. Comparison of PPL "preliminary" runs

	Run 1	Run 1C	Run 1P	Run 1PC
Cutoff below Holtwood?	No	Yes	No	Yes
Peaking at Safe Harbor and Holtwood?	No	No	Yes	Yes
Danville flows				
Mean (cfs)	15,562	15,562	15,562	15,562
90% exceedance (cfs)	1,966	1,966	1,966	1,966
95% exceedance (cfs)	1,445	1,445	1,445	1,445
99% exceedance (cfs)	939	939	939	939
Minimum (cfs)	524	524	524	524
Sunbury flows				
Mean (cfs)	26,781	26,781	26,781	26,781
90% exceedance (cfs)	3,454	3,454	3,454	3,454
95% exceedance (cfs)	2,534	2,534	2,534	2,534
99% exceedance (cfs)	1,687	1,687	1,687	1,687
Minimum (cfs)	1,023	1,023	1,023	1,023
Harrisburg flows				
Mean (cfs)	33,967	33,967	33,967	33,967
90% exceedance (cfs)	4,783	4,783	4,783	4,783
95% exceedance (cfs)	3,609	3,609	3,609	3,609
99% exceedance (cfs)	2,522	2,522	2,522	2,522
Minimum (cfs)	1,585	1,585	1,585	1,585
Holtwood flows (outflows)				
Mean (cfs)	38,110	38,110	38,108	38,108
90% exceedance (cfs)	5,454	5,454	4,309	4,085
95% exceedance (cfs)	4,017	4,017	1,251	1,189
99% exceedance (cfs)	2,663	2,664	495	490
Minimum (cfs)	1,681	1,679	490	490

TABLE 5. "Menu" of PPL February 2012 runs

	Runs [see NOTES, below]										
	F-1	F-2b	F-2c	F-3	F-4A	F-4B	F-4C	F-4D	F-5A	F-6A	F-7A
Cowanesque operates for:											
SSES only	√										
SSES and Montour		√									
SSES, Montour, TMI			√	√	√	√	√	√	√	√	√
Whitney Point flow augmentation				√	√	√	√	√	√	√	√
BBNPP					√	√	√	√	√	√	√
PPL CU Mitigation											
Trigger flow (Harrisburg)					P95	Adjusted P95	Q7-10	Aug-Oct P95	P95	P95	P95
Resources (Asset Pool)											
Rushton Mine											
Available storage (acre-ft)					565	565	565	565	565	565	565
Maximum CU release (mgd)					2.0	2.0	2.0	2.0	2.0	2.0	2.0
Holtwood recreation season											
Available storage (acre-ft)					3,370	3,370	3,370	3,370	3,370	3,370	3,370
Maximum CU release (mgd)					27.0	29.6	36.3	29.6	27.0	27.0	31.5
Holtwood post-recreation season											
Available storage (acre-ft)					6,090	6,090	6,090	6,090	6,090	6,090	6,090
Maximum CU release (mgd)					31.5	31.5	31.5	31.5	31.5	31.5	31.5
West Branch storage											
Available storage (acre-ft)									Note	1,383	1,383
Maximum CU release (mgd)									Note	9.3	9.3
Priority of PPL CU mitigation					R,H	R,H	R,H	R,H	R,H,W	R,W,H	R,W,H

NOTES:

- All runs have model cut off below Holtwood
- All runs assume run-of-river operation at Safe Harbor and run-of-river operation at Holtwood except as required for CU mitigation
- All runs assume existing Curwensville operation plus Barnes & Tucker
- West Branch storage and CU release in Run F-5A were unlimited
- Holtwood recreation season maximum CU release (29.6 mgd) was initially selected to be 36.3 mgd
- R = Rushton; H = Holtwood; and, W = West Branch

TABLE 6a. Effectiveness of PPL CU Assets in meeting PPL CU mitigation needs in an average year and in 1930

	Run [see TABLE 5 for complete run parameters}				
Run [see TABLE 5 for all run parameters}	F-4A	F-4B	F-4C	F-4D	F-7A
PPL CU mitigation:					
Rushton (mgd)	2.0	2.0	2.0	2.0	2.0
West Branch (mgd)					9.3
Holtwood (rec season/post rec season mgd)	27.0/31.5	29.6/31.5	36.3/31.5	29.6/31.5	31.5/31.5
Average year					
CU release days	16.2	13.3	6.9	10.5	16.2
Net PPL CU subject to makeup (mg) [1]	542	447	224	355	542
BBNPP	366	304	158	242	366
Other PPL facilities	172	143	70	114	172
Net PPL CU made up (mg) [1]	462	407	224	326	542
BBNPP	366	304	158	242	366
Other PPL facilities	95	103	70	84	172
Percent net PPL CU made up	85	91	100	92	100
BBNPP	100	100	100	100	100
Other PPL facilities	55	72	100	74	100
1930					
CU release days	86	69	50	57	86
Net PPL CU subject to makeup (mg) [1]	2,593	2,186	1,535	1,898	2,593
BBNPP	1,875	1,536	1,100	1,296	1,875
Other PPL facilities	718	650	434	602	718
Net PPL CU made up (mg) [1]	2,338	2,027	1,535	1,739	2,593
BBNPP	1,875	1,536	1,100	1,296	1,875
Other PPL facilities	463	491	434	443	718
Percent net PPL CU made up	90	93	100	92	100
BBNPP	100	100	100	100	100
Other PPL facilities	64	76	100	74	100

[1] PPL total sometimes differs from sum of BBNPP and other facilities due to rounding of components

TABLE 6b. Effectiveness of PPL CU Assets in meeting PPL CU mitigation needs in 1962 and 1964

	Run [see TABLE 5 for complete run parameters}				
	F-4A	F-4B	F-4C	F-4D	F-7A
PPL CU mitigation:					
Rushton (mgd)	2.0	2.0	2.0	2.0	2.0
West Branch (mgd)					9.3
Holtwood (rec season/post rec season mgd)	27.0/31.5	29.6/31.5	36.3/31.5	29.6/31.5	31.5/31.5
1962					
CU release days	78	72	44	47	78
Net PPL CU subject to makeup (mg) [1]	2,830	2,601	1,552	1,644	2,830
BBNPP	1,826	1,683	1,020	1,087	1,826
Other PPL facilities	1,004	917	532	557	1,004
Net PPL CU made up (mg) [1]	2,320	2,299	1,552	1,509	2,830
BBNPP	1,826	1,683	1,020	1,087	1,826
Other PPL facilities	493	616	532	422	1,004
Percent net PPL CU made up	82	88	100	92	100
BBNPP	100	100	100	100	100
Other PPL facilities	49	67	100	76	100
1964					
CU release days	133	119	83	81	133
Net PPL CU subject to makeup (mg) [1]	4,221	3,686	2,429	2,603	4,221
BBNPP	2,961	2,627	1,796	1,822	2,961
Other PPL facilities	1,261	1,059	634	782	1,261
Net PPL CU made up (mg) [1]	3,741	3,460	2,429	2,457	4,221
BBNPP	2,961	2,627	1,796	1,822	2,961
Other PPL facilities	780	833	634	635	1,261
Percent net PPL CU made up	89	94	100	94	100
BBNPP	100	100	100	100	100
Other PPL facilities	62	79	100	81	100

[1] PPL total sometimes differs from sum of BBNPP and other facilities due to rounding of components

TABLE 7. Use of PPL Asset Pool resources

	Run [see TABLE 5 for complete run parameters]				
	F-4A	F-4B	F-4C	F-4D	F-7A
Rushton					
Average drawdown (ft)	0.5	0.4	0.1	0.2	0.5
Maximum drawdown (ft)	40.0	40.0	25.6	31.4	40.0
Date of maximum drawdown	9-Nov-64	20-Nov-64	26-Nov-64	31-Oct-64	9-Nov-64
Holtwood (Jul 1-Sep 15)					
Average lake level (ft)	168.77	168.77	168.77	168.77	168.77
Minimum lake level (ft)					
1930	167.62	167.50	167.89	167.50	167.72
1962	167.52	167.67	168.40	168.31	167.54
1964	167.81	167.71	167.98	167.71	167.86
Holtwood (Sep 16-Nov 30)					
Average lake level (ft)	167.49	167.49	167.49	167.49	167.49
Minimum lake level (ft)					
1930	166.71	167.00	167.09	167.00	166.82
1962	167.50	167.50	167.50	167.50	167.50
1964	165.80	165.83	166.35	166.56	165.81
West Branch storage					
Average drawdown (ac-ft)					54
Maximum drawdown (ac-ft)					1,383
Date of maximum drawdown					11-Nov-30 5-Sep-62 10-Sep-64

TABLE 8. July-November low flow exceedances at Danville, Run F-3 vs F-1.

Run [see TABLE 5 for complete run parameters]		F-1	F-3	F-3 v F-1
Cowanesque operates for:				
SSES only		√		
SSES, Montour, TMI			√	
Whitney Point flow augmentation			√	
BBNPP			√	
PPL CU Mitigation Sources (Asset Pool)		none	none	
Low flow at Danville (July-November):				
	% time exceeded	**cfs**	**cfs**	**delta cfs**
	95	1,109	1,108	-1
	96	1,051	1,051	0
	97	977	982	5
	98	904	912	8
	99	791	822	31
	100	524	544	20

TABLE 9. July-November low flow exceedances at Sunbury.

	Run [see TABLE 5 for complete run parameters]					
	F-2b	F-4A	F-4B	F-4C	F-4D	F-7A
Cowanesque operates for:						
SSES and Montour only	√					
SSES, Montour, TMI		√	√	√	√	√
Whitney Point flow augmentation		√	√	√	√	√
BBNPP		√	√	√	√	√
PPL CU Mitigation Sources (Asset Pool)	none	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton West Branch Holtwood
Low flow at Sunbury (July-November):						
95% exceedance (cfs)	1,978	1,975	1,974	1,973	1,974	1,979
96% exceedance (cfs)	1,858	1,857	1,857	1,856	1,856	1,868
97% exceedance (cfs)	1,764	1,768	1,768	1,768	1,768	1,771
98% exceedance (cfs)	1,650	1,650	1,650	1,650	1,650	1,659
99% exceedance (cfs)	1,456	1,466	1,466	1,466	1,466	1,477
100% exceedance (minimum, cfs)	1,037	1,078	1,078	1,076	1,078	1,087

TABLE 10. July-November low flow exceedances at Harrisburg.

	Run [see TABLE 5 for complete run parameters]					
	F-2b	F-4A	F-4B	F-4C	F-4D	F-7A
Cowanesque operates for:						
SSES and Montour only	√					
SSES, Montour, TMI		√	√	√	√	√
Whitney Point flow augmentation		√	√	√	√	√
BBNPP		√	√	√	√	√
PPL CU Mitigation Sources (Asset Pool)	None	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton West Branch Holtwood
Low flow at Harrisburg (July-November):						
95% exceedance (cfs)	2,870	2,856	2,856	2,855	2,854	2,863
96% exceedance (cfs)	2,748	2,745	2,745	2,744	2,744	2,753
97% exceedance (cfs)	2,635	2,638	2,638	2,637	2,637	2,649
98% exceedance (cfs)	2,482	2,487	2,487	2,488	2,487	2,497
99% exceedance (cfs)	2,247	2,255	2,256	2,257	2,254	2,268
100% exceedance (minimum, cfs)	1,599	1,603	1,602	1,603	1,596 [see note]	1,604

Note. The minimum flow in run F-4D occurred in November 1963 and reflects the refilling of Rushton following the end of the CU mitigation season in this run.

TABLE 11. July-November low flow exceedances at Marietta.

	Run [see TABLE 5 for complete run parameters]					
	F-2c	F-4A	F-4B	F-4C	F-4D	F-7A
Cowanesque operates for:						
SSES, Montour, TMI	√	√	√	√	√	√
Whitney Point flow augmentation		√	√	√	√	√
BBNPP		√	√	√	√	√
PPL CU Mitigation Sources (Asset Pool)	None	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton West Branch Holtwood
Low flow at Marietta (July-November):						
95% exceedance (cfs)	3,095	3,085	3,085	3,086	3,085	3,089
96% exceedance (cfs)	2,932	2,920	2,919	2,921	2,917	2,929
97% exceedance (cfs)	2,813	2,795	2,795	2,796	2,793	2,805
98% exceedance (cfs)	2,634	2,634	2,635	2,633	2,634	2,643
99% exceedance (cfs)	2,402	2,395	2,395	2,397	2,395	2,400
100% exceedance (minimum, cfs)	1,775	1,744	1,743	1,744	1,737 [see note]	1,757

Note. The minimum flow in run F-4D occurred in November 1963 and reflects the refilling of Rushton following the end of the CU mitigation season in this run.

TABLE 12. July-November low flow exceedances at Holtwood (outflow).

	Run [see TABLE 5 for complete run parameters]					
	F-2c	F-4A	F-4B	F-4C	F-4D	F-7A
Cowanesque operates for:						
SSES, Montour, TMI	√	√	√	√	√	√
Whitney Point flow augmentation		√	√	√	√	√
BBNPP		√	√	√	√	√
PPL CU Mitigation Sources (Asset Pool)	None	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton Holtwood	Rushton West Branch Holtwood
Low flow at Holtwood (July-November):						
95% exceedance (cfs)	3,086	3,103	3,102	3,081	3,091	3,107
96% exceedance (cfs)	2,938	2,955	2,955	2,935	2,943	2,954
97% exceedance (cfs)	2,782	2,810	2,812	2,806	2,805	2,815
98% exceedance (cfs)	2,626	2,654	2,658	2,656	2,639	2,659
99% exceedance (cfs)	2,304	2,350	2,352	2,353	2,347	2,352
100% exceedance (minimum, cfs)	1,717	1,743	1,747	1,749	1,747	1,750

ATTACHMENT 3

Disc of OASIS Input and Output files – March 7, 2012 Report Runs