

PUCO EXHIBIT FILING

Date of Hearing: November 15, 2019

Case No. 17-2295-EL-BGN

PUCO Case Caption: In the Matter of the Application
of Republic Wind, LLC for a Certificate of
Environmental Compatibility and Public Need
for a Wind-Powered Electric Generating
Facility in Seneca and Sandusky Counties; Ohio

Volume VI

List of exhibits being filed:

Applicant Exhibit 39

Local Resident Exhibit 13, pgs 1; 2, 166

Reporter's Signature: Carolyn M. Burke

Date Submitted: 12/4/2019

2019 DEC -5 PM 11:10

This is to certify that the images appearing are an accurate and complete reproduction of a case file document delivered in the regular course of business.

technician DR date processed 12.5.19

BEFORE THE OHIO POWER SITING BOARD

- - -

In the Matter of the :
Application of Republic :
Wind, LLC for a Certificate :
of Environmental :
Compatibility and Public : Case No. 17-2295-EL-BGN
Need for a Wind-Powered :
Electric Generating :
Facility in Seneca and :
Sandusky Counties, Ohio. :

- - -

PROCEEDINGS

before Mr. Jay S. Agranoff and Ms. Anna Sanyal,
Administrative Law Judges, at the Ohio Power Siting
Board, 180 East Broad Street, Room 11-B, Columbus,
Ohio, called at 9:00 a.m. on Friday, November 15,
2019.

- - -

VOLUME VI

- - -

ARMSTRONG & OKEY, INC.
222 East Town Street, Second Floor
Columbus, Ohio 43215-5201
(614) 224-9481 - (800) 223-9481

- - -



Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

App Ex 39
Aeronautical Study No.
2017-WTE-8955-OE

Issued Date: 07/11/2018

EDP Renewables NA LLC
Sarah Distelrath
129 E. Market St. #600
Indianapolis, IN 46204

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted 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:

Structure: Wind Turbine TRIV-07-LC416-12
Location: Payne, OH
Latitude: 41-07-49.93N NAD 83
Longitude: 84-40-48.17W
Heights: 739 feet site elevation (SE)
599 feet above ground level (AGL)
1338 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. Therefore, pursuant to the authority delegated to me, it is hereby determined that the structure would not be a hazard to air navigation provided the following condition(s) is(are) met:

As a condition to this Determination, the structure is to be marked/lighted in accordance with FAA Advisory circular 70/7460-1 L Change 1, Obstruction Marking and Lighting, white paint/synchronized red lights - Chapters 4, 12 & 13 (Turbines).

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

- ☒ At least 10 days prior to start of construction (7460-2, Part 1)
☒ Within 5 days after the construction reaches its greatest height (7460-2, Part 2)

See attachment for additional condition(s) or information.

This determination expires on 01/11/2020 unless:



- (a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
- (b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is subject to review if an interested party files a petition that is received by the FAA on or before August 10, 2018. In the event a petition for review is filed, it must contain a full statement of the basis upon which it is made and be submitted to the Manager of the Airspace Policy Group. Petitions can be submitted via mail to Federal Aviation Administration, 800 Independence Ave, SW, Room 423, Washington, DC 20591, via email at OEPetitions@faa.gov, or via facsimile (202) 267-9328.

This determination becomes final on August 20, 2018 unless a petition is timely filed. In which case, this determination will not become final pending disposition of the petition. Interested parties will be notified of the grant of any review. For any questions regarding your petition, please contact Airspace Policy Group via telephone – 202-267-8783.

This determination is based, in part, on the foregoing description which includes specific coordinates and heights. This determination is valid for coordinates within one (1) second latitude/longitude and up to the approved AMSL height listed above. If a certified 1A or 2C accuracy survey was required to mitigate an adverse effect, any change in coordinates or increase in height will require a new certified accuracy survey and may require a new aeronautical study.

If construction or alteration is dismantled or destroyed, you must submit notice to the FAA within 5 days after the construction or alteration is dismantled or destroyed.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. All information from submission of Supplemental Notice (7460-2 Part 2) will be considered the final data (including heights) for this structure. Any future construction or alteration, including but not limited to changes in heights, requires separate notice to the FAA.

Obstruction marking and lighting recommendations for wind turbine farms are based on the scheme for the entire project. ANY change to the height, location or number of turbines within this project will require a reanalysis of the marking and lighting recommendation for the entire project. In particular, the removal of previously planned or built turbines/turbine locations from the project will often result in a change in the marking/lighting recommendation for other turbines within the project. It is the proponent's responsibility to contact the FAA to discuss the process for developing a revised obstruction marking and lighting plan should this occur.

In order to ensure proper conspicuity of turbines at night during construction, all turbines should be lit with temporary lighting once they reach a height of 200 feet or greater until such time the permanent lighting configuration is turned on. As the height of the structure continues to increase, the temporary lighting should be relocated to the uppermost part of the structure. The temporary lighting may be turned off for periods when they would interfere with construction personnel. If practical, permanent obstruction lights should be installed and operated at each level as construction progresses. An FAA Type L-810 steady red light fixture shall be

used to light the structure during the construction phase. If power is not available, turbines shall be lit with self-contained, solar powered LED steady red light fixture that meets the photometric requirements of an FAA Type L-810 lighting system. The lights should be positioned to ensure that a pilot has an unobstructed view of at least one light at each level. The use of a NOTAM (D) to not light turbines within a project until the entire project has been completed is prohibited.

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.

This aeronautical study considered and analyzed the impact on existing and proposed arrival, departure, and en route procedures for aircraft operating under both visual flight rules and instrument flight rules; the impact on all existing and planned public-use airports, military airports and aeronautical facilities; and the cumulative impact resulting from the studied structure when combined with the impact of other existing or proposed structures. The study disclosed that the described structure would have no substantial adverse effect on air navigation.

An account of the study findings, aeronautical objections received by the FAA during the study (if any), and the basis for the FAA's decision in this matter can be found on the following page(s).

If we can be of further assistance, please contact Paul Holmquist, at (206) 231-2990, or paul.holmquist@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2017-WTE-8955-OE.

Signature Control No: 348973288-370009527

(DNH -WT)

Mike Helvey

Manager, Obstruction Evaluation Group

Attachment(s)

Additional Information

Map(s)

Additional information for ASN 2017-WTE-8955-OE

Abbreviations

AGL - above ground level	AMSL - above mean sea level	RWY - runway
VFR - visual flight rules	IFR - instrument flight rules	NM - nautical mile
ASN- Aeronautical Study Number altitude	CAT - category aircraft	MVA - minimum vectoring
MDA - minimum descent altitude	DA - decision altitude	
Part 77 - Title 14 Code of Federal Regulations (CFR) Part 77, Safe, Efficient Use and Preservation of the Navigable Airspace		

The proposed Timber Road IV wind turbine project near Payne, OH consists of 46 wind turbines at 599 feet AGL and are assigned FAA aeronautical study numbers (ASNs) as listed below.

1. LOCATION OF PROPOSED CONSTRUCTION

The proposed wind turbine project lies approximately between 9.2 NM to 18.7 NM north northwest of the Airport Reference Point (ARP) for the Van Wert County Airport (VNW), Van Wert, OH. The VNW elevation is 787 AMSL.

The wind turbines' described locations are expressed in AGL/AMSL and latitude/longitude. All the wind turbines are 599 feet AGL.

ASN	Structure Name	AGL/AMSL	LAT/LONG
2017-WTE-8954-OE	TRIV-04-LC416-12	599/1332	41-09-19.04N/84-42-03.94W
2017-WTE-8955-OE	TRIV-07-LC416-12	599/1338	41-07-49.93N/84-40-48.17W
2017-WTE-8956-OE	TRIV-08-LC416-09	599/1336	41-07-30.07N/84-40-30.60W
2017-WTE-8958-OE	TRIV-10-LC416-12	599/1334	41-07-01.93N/84-40-27.81W
2017-WTE-8962-OE	TRIV-17-LC416-12	599/1332	41-08-23.35N/84-39-24.17W
2017-WTE-8967-OE	TRIV-44-LC416-12	599/1341	41-06-07.79N/84-41-44.20W
2017-WTE-8971-OE	TRIV-48-LC416-12	599/1339	41-08-33.59N/84-41-51.80W
2017-WTE-8972-OE	TRIV-49-LC416-12	599/1336	41-04-25.51N/84-37-26.78W
2017-WTE-8973-OE	TRIV-50-LC416-12	599/1336	41-04-10.39N/84-37-09.76W
2017-WTE-8982-OE	TRIV-59-LC416-12	599/1349	41-02-09.29N/84-41-29.86W
2017-WTE-8986-OE	TRIV-63-LC416-12	599/1345	41-03-04.08N/84-40-35.83W
2017-WTE-8989-OE	TRIV-66-LC416-12	599/1338	41-05-05.65N/84-40-51.00W
2017-WTE-8990-OE	TRIV-67-LC416-12	599/1336	41-05-19.97N/84-39-50.15W
2017-WTE-8993-OE	TRIV-70-LC416-12	599/1336	41-04-46.22N/84-37-33.10W
2017-WTE-8997-OE	TRIV-74-LC416-12	599/1351	41-02-33.32N/84-40-58.49W
2017-WTE-9001-OE	TRIV-78-LC416-13	599/1357	41-00-52.81N/84-42-01.86W
2018-WTE-1978-OE	TRIV-09-LC416-18	599/1336	41-06-42.99N/84-41-41.58W
2018-WTE-1980-OE	TRIV-14-LC416-18	599/1332	41-09-12.33N/84-40-30.11W
2018-WTE-1981-OE	TRIV-15-LC416-18	599/1332	41-08-53.36N/84-39-52.05W
2018-WTE-1982-OE	TRIV-16-LC416-18	599/1331	41-08-39.50N/84-39-39.86W
2018-WTE-1984-OE	TRIV-19-LC416-18	599/1334	41-06-58.20N/84-39-31.38W
2018-WTE-1985-OE	TRIV-27-LC416-18	599/1329	41-10-00.29N/84-39-47.83W
2018-WTE-1986-OE	TRIV-41-LC416-18	599/1335	41-07-49.78N/84-42-08.86W
2018-WTE-1987-OE	TRIV-42-LC416-18	599/1336	41-07-32.68N/84-41-37.79W

2018-WTE-1989-OE	TRIV-45-LC416-18	599/1329	41-10-07.59N/84-40-22.53W
2018-WTE-1990-OE	TRIV-46-LC416-18	599/1329	41-10-16.48N/84-40-46.35W
2018-WTE-1991-OE	TRIV-47-LC416-18	599/1336	41-08-25.86N/84-41-00.32W
2018-WTE-1993-OE	TRIV-49-LC416-18	599/1347	41-02-59.89N/84-41-28.57W
2018-WTE-1994-OE	TRIV-50-LC416-18	599/1352	41-02-12.10N/84-42-11.06W
2018-WTE-1996-OE	TRIV-52-LC416-18	599/1349	41-01-37.53N/84-41-07.32W
2018-WTE-1997-OE	TRIV-53-LC416-18	599/1349	41-01-14.64N/84-40-52.68W
2018-WTE-1999-OE	TRIV-55-LC416-18	599/1350	41-00-45.67N/84-41-05.01W
2018-WTE-2000-OE	TRIV-56-LC416-18	599/1351	41-00-02.64N/84-41-54.22W
2018-WTE-2001-OE	TRIV-57-LC416-18	599/1345	41-03-26.76N/84-40-55.61W
2018-WTE-2004-OE	TRIV-60-LC416-18	599/1343	41-02-45.64N/84-40-28.61W
2018-WTE-2005-OE	TRIV-61-LC416-18	599/1347	41-02-13.73N/84-40-27.48W
2018-WTE-2006-OE	TRIV-62-LC416-18	599/1344	41-01-45.87N/84-39-52.44W
2018-WTE-2007-OE	TRIV-63-LC416-18	599/1347	41-01-24.42N/84-39-49.36W
2018-WTE-2010-OE	TRIV-66-LC416-18	599/1337	41-04-51.64N/84-39-05.13W
2018-WTE-2011-OE	TRIV-71-LC416-18	599/1337	41-04-53.49N/84-38-14.06W
2018-WTE-2015-OE	TRIV-76-LC416-18	599/1344	41-04-25.94N/84-41-45.76W
2018-WTE-2016-OE	TRIV-77-LC416-18	599/1343	41-04-23.94N/84-40-59.96W
2018-WTE-2017-OE	TRIV-78-LC416-18	599/1347	41-03-34.00N/84-41-26.03W
2018-WTE-2018-OE	TRIV-80-LC416-18	599/1354	41-01-25.06N/84-41-56.92W
2018-WTE-2019-OE	TRIV-82-LC416-18	599/1357	41-00-30.29N/84-41-58.56W
2018-WTE-2020-OE	TRIV-84-LC416-18	599/1337	41-04-24.56N/84-38-10.30W

2. OBSTRUCTION STANDARDS EXCEEDED

The following proposed turbines would exceed Part 77 standards as described below.

- a. Section 77.17(a)(1): The surface above 499 feet AGL, in which an object would be an obstruction to aircraft operating under VFR conditions in the en route phase of flight established under 77.17, 77.19, or 77.23.

All of the turbines listed in Section 1 of this narrative exceed the surface by 100 feet.

- b. Section 77.17.(a)(3): A height within a terminal obstacle clearance area, including an initial approach segment, a departure area, and a circling approach area, which would result in the vertical distance between any point on the object and an established minimum instrument flight altitude within that area or segment to be less than the required obstacle clearance.

The following proposed structures would increase the Minimum Obstruction Clearance Altitude (MOCA) for airway V96 segment from Fort Wayne (FWA) VORTAC to ILLIE intersection from 2300 AMSL to 2400 AMSL.

2017-WTE-8997-OE
 2017-WTE-9001-OE
 2018-WTE-1978-OE
 2018-WTE-1980-OE
 2018-WTE-1981-OE
 2018-WTE-1982-OE
 2018-WTE-1984-OE
 2018-WTE-1985-OE

2018-WTE-1986-OE
2018-WTE-1987-OE
2018-WTE-1989-OE
2018-WTE-1990-OE
2018-WTE-1991-OE
2018-WTE-1993-OE
2018-WTE-1994-OE
2018-WTE-2001-OE
2018-WTE-2004-OE
2018-WTE-2005-OE
2018-WTE-2006-OE
2018-WTE-2007-OE
2018-WTE-2010-OE
2018-WTE-2011-OE
2018-WTE-2015-OE
2018-WTE-2016-OE
2018-WTE-2017-OE
2018-WTE-2018-OE
2018-WTE-2019-OE
2018-WTE-2020-OE

The following proposed structures would increase the MOCA for airway V8 Goshen (GSH) VORTAC from GAREN intersection to TWERP intersection from 2200 AMSL to 2400 AMSL.

2017-WTE-8997-OE
2017-WTE-9001-OE
2018-WTE-1978-OE
2018-WTE-1980-OE
2018-WTE-1981-OE
2018-WTE-1982-OE
2018-WTE-1984-OE
2018-WTE-1985-OE
2018-WTE-1986-OE
2018-WTE-1987-OE
2018-WTE-1989-OE
2018-WTE-1990-OE
2018-WTE-1991-OE
2018-WTE-2011-OE

The following proposed structures would increase the Detroit Metropolitan Wayne County (DTW) (Plan on File) STAR HANBL ONE ARRIVAL (RNAV) Minimum Obstruction Clearance Altitude (MOCA) from JOEBU to VDUUB from 2300 AMSL to 2400 AMSL.

2018-WTE-1989-OE
2018-WTE-1990-OE

The following proposed structures would increase the Detroit Metropolitan Wayne County (DTW) (Plan on File) STAR LECTR ONE ARRIVAL (RNAV) Minimum Obstruction Clearance Altitude (MOCA) from JOEBU to VDUUB from 2300 AMSL to 2400 AMSL.

2018-WTE-1989-OE
2018-WTE-1990-OE

The following proposed structures would increase the Akron-Canton Regional (CAK) (Plan on File) HUUVR ONE ARRIVAL (RNAV) Increase Minimum Obstruction Clearance Altitude (MOCA) from MSKTS to JJUST from 2300 AMSL to 2400 AMSL.

2018-WTE-1994-OE
2018-WTE-1996-OE
2018-WTE-1997-OE
2018-WTE-1999-OE
2018-WTE-2000-OE
2018-WTE-2001-OE
2018-WTE-2004-OE
2018-WTE-2005-OE
2018-WTE-2006-OE
2018-WTE-2007-OE
2018-WTE-2010-OE
2018-WTE-2011-OE
2018-WTE-2015-OE
2018-WTE-2016-OE
2018-WTE-2017-OE
2018-WTE-2018-OE
2018-WTE-2019-OE

The following proposed structures would increase the Akron Fulton International (AKR) (Plan on File) HUUVR ONE ARRIVAL (RNAV) Minimum Obstruction Clearance Altitude (MOCA) from MSKTS to JJUST from 2300 AMSL to 2400 AMSL.

2018-WTE-1996-OE
2018-WTE-1997-OE
2018-WTE-1999-OE
2018-WTE-2000-OE
2018-WTE-2001-OE
2018-WTE-2004-OE
2018-WTE-2005-OE
2018-WTE-2006-OE
2018-WTE-2007-OE
2018-WTE-2010-OE
2018-WTE-2011-OE
2018-WTE-2015-OE
2018-WTE-2016-OE
2018-WTE-2017-OE
2018-WTE-2018-OE
2018-WTE-2019-OE

The following proposed structures would increase the Kent State University (1G3) (Plan on File) HUUVR ONE ARRIVAL (RNAV) Minimum Obstruction Clearance Altitude (MOCA) from MSKTS to JJUST from 2300 AMSL to 2400 AMSL.

2018-WTE-1994-OE
2018-WTE-1996-OE
2018-WTE-1997-OE
2018-WTE-1999-OE
2018-WTE-2000-OE
2018-WTE-2001-OE
2018-WTE-2004-OE
2018-WTE-2005-OE
2018-WTE-2006-OE
2018-WTE-2007-OE
2018-WTE-2010-OE
2018-WTE-2011-OE
2018-WTE-2015-OE
2018-WTE-2016-OE
2018-WTE-2017-OE
2018-WTE-2018-OE
2018-WTE-2019-OE

The following proposed structures would increase the Akron Fulton International (AKR) (Plan on File) HUUVR Minimum Vectoring Altitude (MVA) Sector B MVA from 2300 AMSL to 2400 AMSL.

2018-WTE-1994-OE

The following proposed structures would increase the minimum vectoring altitude for Fort Wayne ATCT/ TRACON Chart 2017 Area: B altitude from 2300 AMSL to 2400 AMSL.

2018-WTE-2000-OE
2018-WTE-2018-OE
2018-WTE-2019-OE

3. EFFECT ON AERONAUTICAL OPERATIONS

- a. The impact on arrival, departure, and en route procedures for aircraft operating under VFR: No substantial adverse effect and no issues were raised during the public comment period.

There are no effects on any public use or military airport VFR traffic pattern.

The effects on any existing or proposed arrival, departure, or en route IFR/VFR minimum flight altitudes: All of the turbines listed in in this proposed project exceed the Part 77 Section 77.17(a)(1) surface by 100 feet, however, no substantial adverse effect was found and no issues were raised during the public comment period.

There are no effects on any airspace and routes used by the military.

- b. The impact on arrival, departure, and en route procedures for aircraft operating under IFR: See section 2 - minimum flight altitudes will be raised upon notification of the start of construction of the project. Air Traffic has determined this would not create a substantial adverse impact on their operations at this time.
- c. The impact on all planned public-use airports and aeronautical facilities: None.

d. The cumulative impact resulting from the proposed construction or alteration of a structure when combined with the impact of other existing or proposed structures: None.

RADAR

Analysis indicates that all of the proposed turbines in this project would be in the line of sight for the Fort Wayne, Indiana Airport Surveillance Radar-9 (ASR-9); however, Air Traffic has determined this would not create a substantial adverse impact on their operations at this time.

4. CIRCULATION AND COMMENTS RECEIVED

The proposal was circulated for public comment based on 3 May 2018 and the public comment period closed on 9 June 2018. No comments were received by 9 June 2018.

This does not affect the public's right to petition for review determinations regarding structures, which exceed the subject obstruction standards.

5. DETERMINATION - NO HAZARD TO AIR NAVIGATION

It is determined that the proposed construction would not have a substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on any air navigation facility and would not be a hazard to air navigation provided the conditions set forth in this determination are met.

6. BASIS FOR DECISION

Study for possible VFR effect disclosed that the proposed structures would have no effect on any existing or proposed arrival or departure VFR operations or procedures. At 599 feet above ground level the proposed structures would not have a substantial adverse effect on VFR en route flight operations as no issues were raised during the public comment period. There are no IFR effects as the affected airspace will be adjusted to mitigate the height of the structures.

The proposed structures must be appropriately obstruction marked and/or lighted to make them more conspicuous to airmen.

7. CONDITIONS

For the following studies as identified by their ASN, at least 56 days before the start of construction the proponent is required to file a FAA form 7460-2, Part 1, Actual Construction notification, at the OE/AAA website (<http://oeaaa.faa.gov>). This actual construction notification will be used to update published instrument flight procedures.

2018-WTE-1994-OE

2018-WTE-2000-OE

2018-WTE-2018-OE

2018-WTE-2019-OE

For all other studies in this project, at least 10 days before the start of construction the proponent is required to file a FAA form 7460-2, Part 1, Actual Construction notification, at the OE/AAA website (<http://>

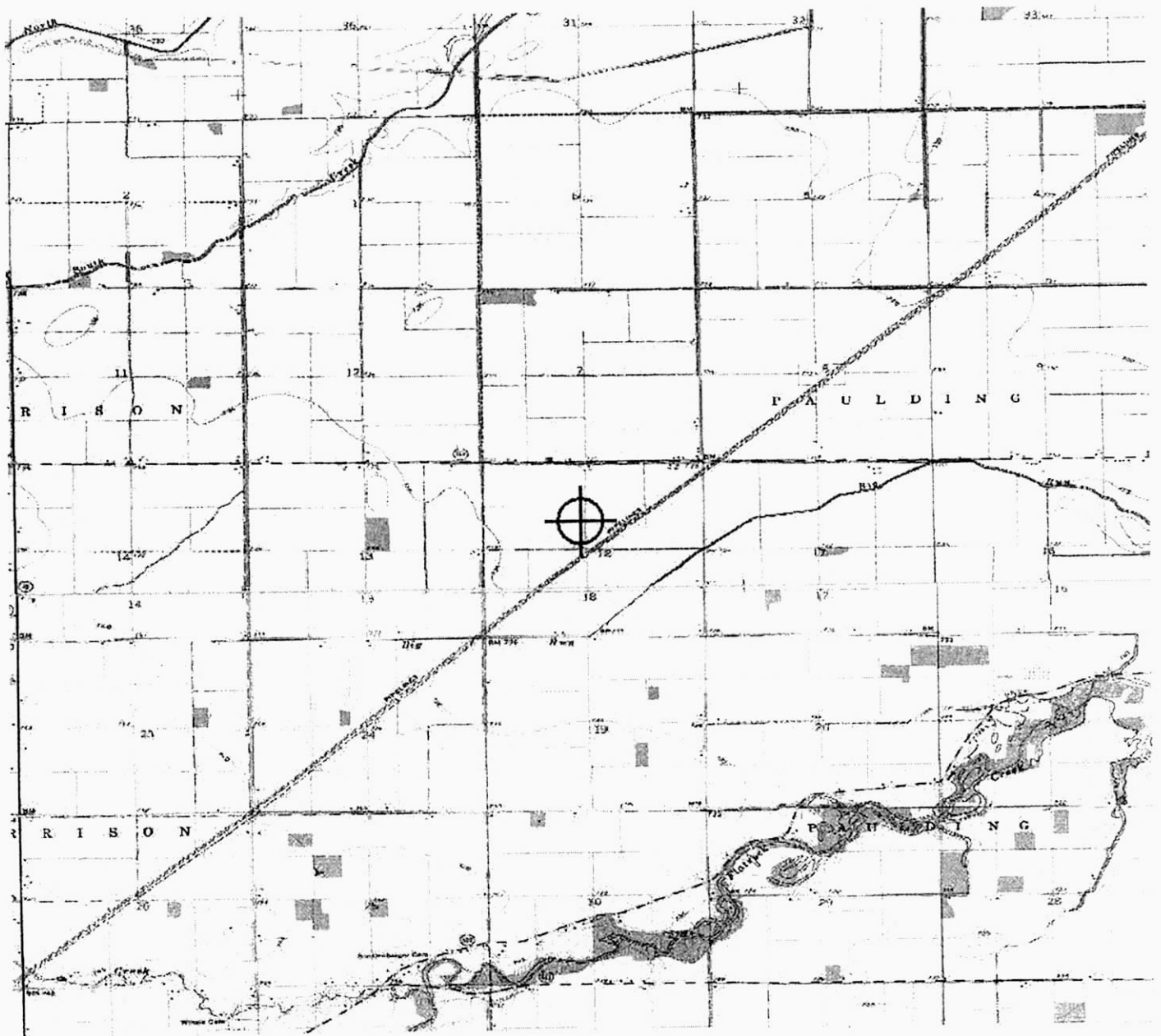
oeaaa.faa.gov). This actual construction notification will be used to update published instrument flight procedures.

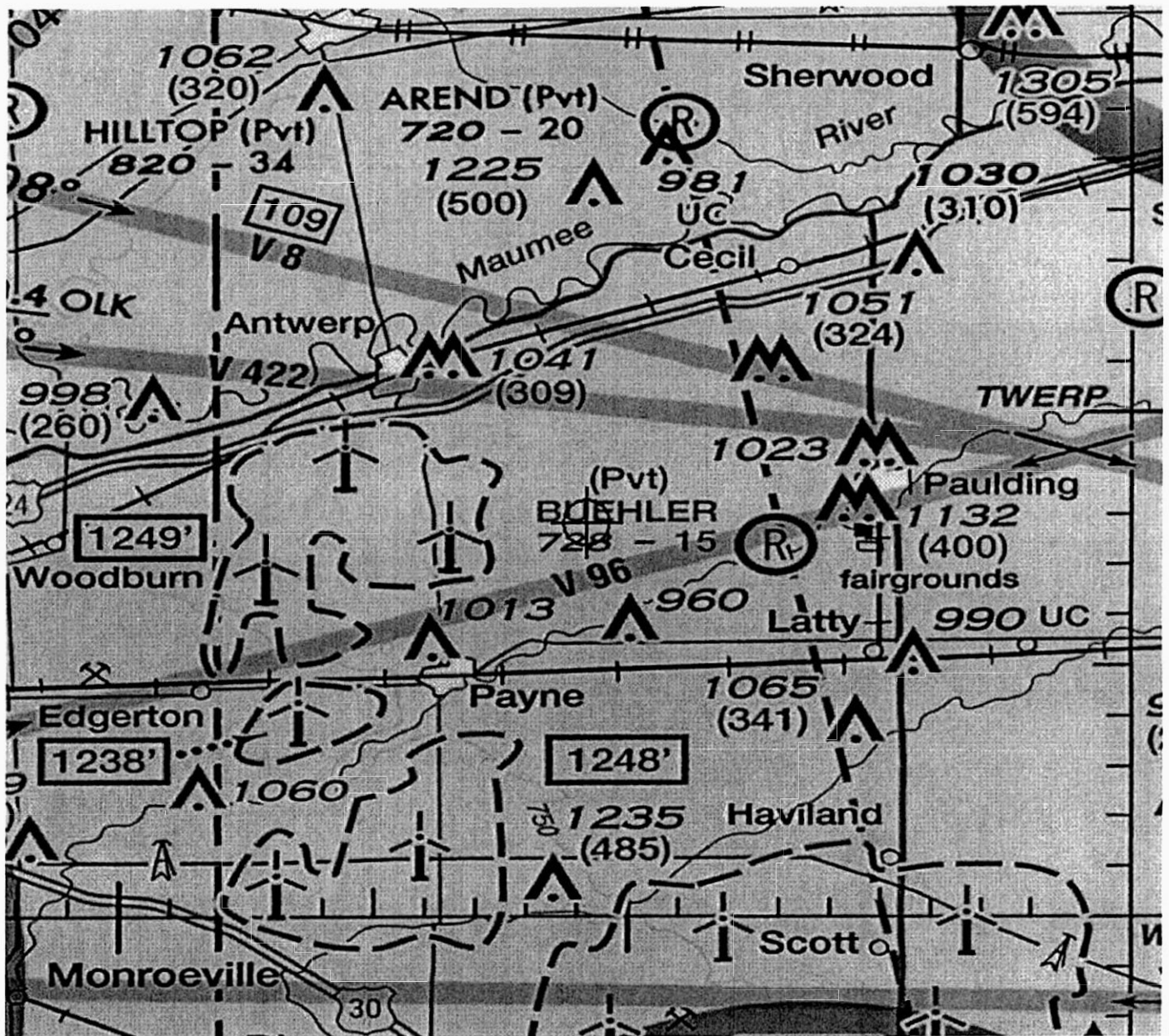
Within five days after the structure reaches its greatest height, proponent is required to file a FAA form 7460-2, Actual Construction notification, at the OE/AAA website (<http://oeaaa.faa.gov>). This actual construction notification will be the source document detailing the site location, site elevation, structure height, and date structure was built for the FAA to map the structure on aeronautical charts and update the national obstruction database.

NOTE:

A recommendation for white paint/synchronized red lights will be made for all turbines until such time as the proponent confirms that the layout is final (no changes, no additions, no removals) and all turbines can and will be built at their determined location and height. At that time, the proponent may contact this office and request a re-evaluation of the marking and lighting recommendations for the turbines within this project and a portion of the turbines may qualify for the removal of the lighting recommendation.

TOPO Map for ASN 2017-WTE-8955-OE





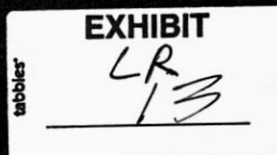
"Highly recommended" —*LIBRARY JOURNAL*

How Birds Migrate

SECOND EDITION



PAUL KERLINGER
Illustrations by Pat Archer



Copyright © 2009 by Stackpole Books

Published by
STACKPOLE BOOKS
5067 Ritter Road
Mechanicsburg, PA 17055
www.stackpolebooks.com

All rights reserved, including the right to reproduce this book or portions thereof in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from the publisher. All inquiries should be addressed to Stackpole Books, 5067 Ritter Road, Mechanicsburg, PA 17055.

Printed in the United States of America

First edition

10 9 8 7 6 5 4 3 2 1

Cover design by Wendy A. Reynolds

Library of Congress Cataloging-in-Publication Data

Kerlinger, Paul.

How birds migrate / Paul Kerlinger ; revisions by Ingrid Johnson ;
illustrated by Pat Archer. — 2nd ed.

p. cm.

Includes index.

ISBN-13: 978-0-8117-3230-7

ISBN-10: 0-8117-3230-4

1. Birds—Migration. I. Title.

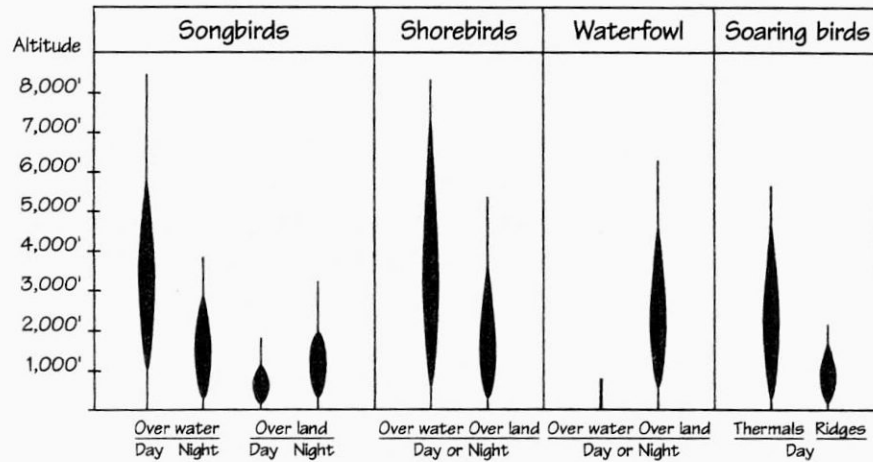
QL698.9.K47 2009

598.156'8—dc22

2008015947

motes the most efficient, safe, and rapid flight—anywhere from one foot to several thousand feet above the ground or water. Different kinds of powered migrants fly at different altitudes. Songbirds fly lower, on average, than most ducks and shorebirds.

Shorebirds and ducks may fly within this layer but frequently fly somewhat higher. A study in Switzerland, for example, revealed that larger radar echoes, presumably from shorebirds, were seen more often than songbird echoes in the atmospheric strata above 3,000 feet (900 meters). Similar results come from studies in North America.



The altitudes at which migrating birds fly depend largely on how and where they are flying. Powered fliers prefer high altitudes, to avoid overheating; raptors generally don't fly over water.

The altitude of migrating waterfowl is probably the most variable of any group of birds. At times they fly at several thousand feet; at other times they fly just above the waves. The migratory flight of ducks and other waterbirds near shore is usually within 100 to 200 feet (30 to 60 meters) of the waves. In studies along the Atlantic coast, Cape May Bird Observatory researchers noted that more than 90 percent of thousands of scoters, mergansers, black ducks, loons, gannets, and other birds flew at less than 200 feet (60 meters) above the waves. Scoters and loons can usually be seen within 20 to 30 feet (6 to 10 meters) of the water.

V
ground
may r
tip an
energ
waves
ily. Lo
winds
as stro
ated b
wind
tions a
ing ov



By f
reduc

THE A
Hawks, j
soaring
much les
own ene
occur on