

## INSPECTION PHOTOGRAPHS



**Photograph No. 9**

Looking southwest at vegetation enroaching the downstream embankment toe where potential seepage is located.



**Photograph No. 10**

Ponding located at the original stream channel location north of the downstream toe.



**LAKE LEMON DAM  
UNIONSVILLE, INDIANA**

Date Photographs Taken: 10/14/2014  
Inspector: Martin Brungard, P.E., D.WRE  
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**Photograph No. 11**

Slight turbidity of channelized water located downstream of the ponding located near the downstream toe.



**Photograph No. 12**

Looking northeast at the downstream embankment slope.



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**Photograph No. 13**

Looking northwest at the vegetation encroaching the left abutment at the downstream embankment.



**Photograph No. 14**

Looking downstream at the stilling basin.



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**Photograph No. 15**

Scoured area immediately downstream of the stilling basin concrete pad.



**Photograph No. 16**

Crack found in the left stilling basin wall.



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## INSPECTION PHOTOGRAPHS



**Photograph No. 17**

Looking at outlet channel downstream of stilling basin.



**Photograph No. 18**

Looking upstream at stilling basin.



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# INSPECTION PHOTOGRAPHS



**Photograph No. 19**

Looking northeast at the ogee spillway.



**Photograph No. 20**

Looking northwest at the vegetation encroaching the left ogee spillway wall.



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UNIONSVILLE, INDIANA**

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# INSPECTION PHOTOGRAPHS



**Photograph No. 21**

Looking southeast at the vegetation encroaching the left ogee spillway wall.



**Photograph No. 22**

Looking southwest at the ogee spillway.



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## APPENDIX III

### COMPLETED IDNR DAM INSPECTION FORM



# SUGGESTED DAM INSPECTION REPORT (Refer to pages 5 and 6 for instructions.)

FD-100 (11-10)

Name of Professional Conducting Inspection Martin Brungard, P.E., D.WRE		Professional License No. (Indiana) PE10910458
Business Address 157 East Maryland St., Indianapolis, IN 46237		Phone: (day) 317 - 633 - 4120 (evening) 317 - 532 - 8215

Company Name

INSPECTION PREPARATION: Reviewed all pertinent technical documentation related to this dam and site in the State's and the Owner's files:  
Yes ☒ No ☐ Comment Last inspection report was reviewed prior to inspection. IDNR's file on the project was also reviewed, including the original construction documents.

MULTIDISCIPLINARY: I am experienced in the technical disciplines or I am working with other professionals experienced in the technical disciplines to properly inspect this dam and appurtenant works. Technical disciplines, in addition to the general civil engineering, may include geotechnical, geological, hydrologic, structural, and mechanical. Yes ☒ No ☐ Comment

Dam Name Lake Lemon Dam		Quad. Hindustan	Date of Inspection 10 / 14 / 2014
State Dam ID 58-1	Permit (if unapproved see pg. 6) State Approved on Construction Completed in 1952	County Monroe	Last Inspection 09 / 26 / 2012

Owners Name  
City of Bloomington Utilities

Owner's Phone  
( )

Address/Zip Code  
P.O. Box 1216, Bloomington, IN 47401

Contact's Name Bob Madden, Manager	Contact's Phone (day) 812 - 334 - 0233 (evening) 812 - 320 - 2841	Spillway Width Top Bot. ~330 ~16	Ft. FBD. ~16
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Hazard High	Drainage Area ~71 MI <sup>2</sup>	Surface Area ~1700 AC	Height ~50 FT	Crest Length ~660 FT	Crest Width ~13 FT	Inlet Below Crest ~16 FT	Slope: Up 3 1/2: 1 Down 3 1/2: 1
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**FIELD CONDITIONS OBSERVED**  
Water Level - Below Dam Crest ~17 Ft.  
Ground Moisture Condition: Dry ☐ Wet ☒ Snowcover ☐ Other Rainy

**DRAWDOWN STRUCTURE**  
☒ Yes ☐ None  
Comment A 42-in. diameter R.C. pipe with a gatewell and stilling basin.

**MONITORING** ☐ Yes ☒ None ☐ Gage Rod ☐ Piezometers ☐ Seepage Weirs ☐ Survey Monuments ☐ Other

Comments

**A UPSTREAM SLOPE**

**GOOD** ☒  
**ACCEPTABLE** ☐  
**DEFICIENT** ☐  
**POOR** ☐

**PROBLEMS NOTED:** ☐ (A-1) None ☐ (A-2) Riprap - Missing, Sparse, Displaced, Weathered ☐ (A-3) Wave Erosion-with Scarps ☐ (A-4) Cracks-with Displacement ☐ (A-5) Sinkhole ☐ (A-6) Appears Too Steep ☐ (A-7) Depressions or Bulges ☐ (A-8) Slides ☐ (A-9) Animal Burrows ☒ (A-10) Trees, Brush, Briars ☐ (A-11) Other

Comments:  
Vegetation observed near the left abutment area on the upstream slope.

**B CREST**

**GOOD** ☒  
**ACCEPTABLE** ☐  
**DEFICIENT** ☐  
**POOR** ☐

**PROBLEMS NOTED:** ☒ (B-1) None ☐ (B-2) Ruts or Puddles ☐ (B-3) Erosion ☐ (B-4) Cracks with Displacement ☐ (B-5) Sinkholes ☐ (B-6) Not Wide Enough ☐ (B-7) Low Area ☐ (B-8) Misalignment ☐ (B-9) Inadequate Surface Drainage ☐ (B-10) Trees, Brush, Briars ☐ (B-11) Other

Comments:  
None.

Spillway Width refers to the open channel (typically the emergency or auxiliary spillway) at the control section.  
Ft. FBD. refers to the vertical distance from the emergency (auxiliary) spillway control section to the lowest point of the crest of the dam.  
Inlet Below Crest refers to the vertical distance from the inlet of the principal spillway to the crest of the dam.

**C DOWNSTREAM SLOPE**

GOOD	<input type="checkbox"/>
ACCEPTABLE	<input checked="" type="checkbox"/>
DEFICIENT	<input type="checkbox"/>
POOR	<input type="checkbox"/>

PROBLEMS NOTED: ☐ (C-1) None ☐ (C-2) Livestock Damage ☐ (C-3) Erosion or Gullies ☐ (C-4) Cracks with Displacement ☐ (C-5) Sinkholes ☐ (C-6) Appears too Steep ☐ (C-7) Depression or Bulges ☐ (C-8) Slide ☐ (C-9) Soft Areas ☒ (C-10) Trees, Brush, Briars ☐ (C-11) Animal Burrows ☐ (C-12) Other \_\_\_\_\_

Comments:

Vegetation was observed at the left and right abutment areas and at the toe of the downstream slope.

**D SEEPAGE**

GOOD (NONE)	<input type="checkbox"/>
ACCEPTABLE	<input checked="" type="checkbox"/>
DEFICIENT	<input type="checkbox"/>
POOR	<input type="checkbox"/>

PROBLEMS NOTED: ☐ (D-1) None ☐ (D-2) Saturated Embankment Area ☐ (D-3) Seepage Exits on Embankment ☐ (D-4) Seepage Exits at Point Source ☒ (D-5) Seepage Area at Toe ☐ (D-6) Flow Adjacent to Outlet ☐ (D-7) Seepage Clear/Muddy

☐ (D-7) Seepage Clear/Muddy[DRAIN OUTFALLS SEEN ☒ No ☐ Yes ☐ (D-8) Flow Clear/Muddy ☐ (D-9) Dry/Obstructed]☐ (D-10) Other \_\_\_\_\_ Describe location of drains and indicate amount and quality of discharge.

Comments:

Clear water noted at downstream slope toe area. Due to the rainy conditions and vegetation at the downstream slope at the time of inspection the water source could not be verified.

**E PRINCIPAL SPILLWAY**

GOOD	<input type="checkbox"/>
ACCEPTABLE	<input checked="" type="checkbox"/>
DEFICIENT	<input type="checkbox"/>
POOR	<input type="checkbox"/>

DESCRIPTION: A 30" to 40" diameter pipe controlled by a slide gated located within the gate well. The pipe discharges into a stilling basin near the downstream toe of the dam.

PROBLEMS NOTED: ☐ (E-1) None ☐ (E-2) Deterioration ☐ (E-3) Separation ☒ (E-4) Cracking ☐ (E-5) Inlet, Outlet Deficiency ☐ (E-6) Stilling Basin Inadequacies ☐ (E-7) Trash Rack ☒ (E-8) Other Scour/Erosion

Comments:

A large crack was observed in the left wall near the end of the stilling basin. The channel immediately downstream of the stilling basin appears to be scoured. The footings downstream of the stilling basin also appear to be undermined.

**F AUXILIARY SPILLWAY**

GOOD	<input type="checkbox"/>
ACCEPTABLE	<input checked="" type="checkbox"/>
DEFICIENT	<input type="checkbox"/>
POOR	<input type="checkbox"/>

DESCRIPTION: A 329-foot long concrete ogee-type (curved crest) structure located in a valley northeast of the dam.

PROBLEMS NOTED: ☐ (F-1) None ☐ (F-2) No Auxiliary Spillway Found ☐ (F-3) Erosion-with Backcutting☒ (F-4) Crack with Displacement ☐ (F-5) Appears to be Structurally Inadequate ☐ (F-6) Appears too Small☐ (F-7) Inadequate Freeboard ☐ (F-8) Flow Obstructed ☐ (F-9) Concrete Deteriorated/Undermined☒ (F-10) Other Vegetation at Walls

Comments:

The concrete ogee section and training walls appeared unchanged since the 2012 inspection. Some joints offset 1/2" to 3/4" and joint filler was squeezed out. These conditions were old and the spillway appeared to be in satisfactory condition. Vegetation was observed at the left walls of the spillway.

**G MAINTENANCE AND REPAIRS**

GOOD	<input type="checkbox"/>
ACCEPTABLE	<input checked="" type="checkbox"/>
DEFICIENT	<input type="checkbox"/>
POOR	<input type="checkbox"/>

PROBLEMS NOTED: ☐ (G-1) None ☐ (G-2) Access Road Needs Maintenance ☐ (G-3) Cattle Damage☐ (G-4) Spillway Obstruction ☒ (G-5) Brush, Weeds, Tall Grass, on Upstream Slope, Crest, Downstream Slope, Toe☐ (G-6) Trees on Upstream Slope, Crest, Downstream Slope ☐ (G-7) Rodent Activity on Upstream Slope, Crest, Down-stream Slope, Toe ☐ (G-8) Deteriorated Concrete-Facing, Outlet, Spillway ☐ (G-9) Gate and/or Drawdown Need Repair☐ (G-10) Other \_\_\_\_\_

Comments:

Refer to page 3 of 6.

**H OVERALL CONDITIONS**Based on this inspection and recent file review, the overall surficial condition is determined to be: ☒ (H-1) Satisfactory ☐ (H-2) Fair☐ (H-3) Conditionally Poor ☐ (H-4) Poor ☐ (H-5) Unsatisfactory

IMPORTANT: IF THIS RATING IS DIFFERENT THAN PREVIOUS IDNR RATING, PLEASE ATTACH EXPLANATION AND REASONS FOR CHANGE ON PAGE 4.



RECOMMENDATIONS AND ITEMS REQUIRING ACTION BY OWNER  
TO IMPROVE THE SAFETY OF THE DAM

## MAINTENANCE-MINOR REPAIR-MONITORING

- ☒ (1) Provide Additional Erosion Protection: Fill the channel bottom immediately downstream of the stilling basin using concrete or riprap.
- ☐ (2) Mow: \_\_\_\_\_ ☐ Remove vegetation along downstream toe near midpoint of the embankment, left abutment at both the
- ☒ (3) Clear Trees and/or Brush From: upstream and downstream sides, and at the left ogee spillway wall at the upstream and downstream sides.
- ☒ (4) Initiate Rodent Control Program and Properly Backfill Existing Holes: Properly backfill existing holes at upstream embankment.
- ☐ (5) Repair: \_\_\_\_\_
- ☐ (6) Provide Surface Drainage For: \_\_\_\_\_
- ☒ (7) Monitor: Monitor possible seepage along the downstream toe of embankment including channel erosion and ponding at old channel location.
- ☒ (8) Other: Monitor the gully located at the left abutment area for additional erosion and potential seepage.
- ☒ (9) Other: Monitor animal activities on the embankment, erosion conditions downstream of the stilling basin and any movement of the spillway.

## ENGINEERING-EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO:

(Plans &amp; Specifications must be approved by State prior to construction.)

- ☐ (10) Prepare Plans and Specifications for the Rehabilitation of the Dam: \_\_\_\_\_
- ☐ (11) Prepare As-Built Drawings of: \_\_\_\_\_
- ☐ (12) Perform a Geotechnical Investigation to Evaluate the Stability of the Dam: \_\_\_\_\_
- ☐ (13) Perform a Hydrologic Study to Determine Required Spillway Size: \_\_\_\_\_
- ☐ (14) Prepare Plans and Specifications for an Adequate Spillway: \_\_\_\_\_
- ☐ (15) Set up a Monitoring Program: \_\_\_\_\_
- ☐ (16) Refer to Unapproved Status of Dam: \_\_\_\_\_
- ☐ (17) Develop an Emergency Action Plan: \_\_\_\_\_
- ☐ (18) Other: \_\_\_\_\_
- ☐ (19) Other: \_\_\_\_\_

Recommended schedule for upgrades/comments (Please prioritize and note importance of each item.)

Photographs ☒ Attachments ☐ENGINEER'S INSTRUCTION Instructed owner on the safety concerns with the structure and how to monitor and inspect the dam and appurtenant works in the interim period between the regulatory two-year inspections. Yes ☒ No ☐

Comment

It is recommended the Lake Manager and Lake Staff continue to visually monitor possible seepage and erosion on a regular basis and after significant rainfall events. Contact a qualified engineering firm if any changes are noted.

Professional Engineer's Signature \_\_\_\_\_

Date

11/11/14

Reviewed By

Robert E. Madden

Owner/Owner's Representative

Date

11/17/14

**EXPLANATION FOR CHANGE IN RATINGS** ( Describe all repairs, upgrades or improvements made if dam conditions and rating have improved since the last inspection. Describe deteriorating conditions if ratings have worsened.)

REASONS FOR RATING CHANGE:

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

HAVE THEY BEEN PERFORMED ☒ YES ☐ NO (If no, please explain:)

\* An emergency action plan for the Lake Lemon Dam is under preparation and is expected to be completed in the first quarter of 2015.

Supporting Documentation

Photographs ☒ Attachments ☐ Calculations ☐ Drawings ☐ Other ☐

Comments:



## INSTRUCTIONS FOR COMPLETING DAM VISUAL INSPECTION REPORT

1. Complete all items that are applicable; if not applicable, write in "N/A". For concrete dams, complete all applicable items and use "comments" section to cover items not included in the check boxes. Also indicate that the dam is concrete in the comments section.
2. Use page 6 to determine ratings of each dam component (items A through G) and for Overall Conditions (Item H).
3. Please write legibly and concisely.
4. Inspector must be knowledgeable with the type of dam, materials, and components being inspected. If not, qualified assistance shall be engaged.
5. The inspector shall review the dam owner's and IDNR project files prior to the inspection. Previous inspection reports shall be closely reviewed for previous problems and deficiencies.
6. If the ratings of the components (items A through G) or the Overall Conditions (item H) of the dam have changed since the last inspection, please complete page 4. If a rating has improved, dam repairs, improvements, analyses, or maintenance must have been performed and documented on page 4.
7. For a dam to have a satisfactory "Overall Conditions" rating, it must have no existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including infrequent hydrologic events (PMP for high hazard dams) and seismic events. The dam owner's project files must contain hydrologic and hydraulic analyses of the dam and its spillways to verify performance. The files must also contain slope stability analyses to verify embankment stability under full reservoir conditions and rapid-draw down conditions. The dam and all of its components must meet current IDNR and design standards. "Normal" deficiencies such as minor erosion, minor seepage, or normal concrete aging may not make a dam unsatisfactory or unacceptable. For a satisfactory "Overall Conditions" rating to be assigned, items A through G generally should all have a "good" rating; however, in some cases an "acceptable" rating may be satisfactory if the "Problems Noted" are minor, or "normal" conditions, such as minor erosion rills, small puddles on crest, or if grass needs mowed, but is in good condition.
8. An inspection report form must be submitted to IDNR along with a formal technical inspection report as described in Chapter 4.0 of Part 3 of the Indiana Dam Safety Inspection Manual.
9. Please sign and date this page in the space below to verify that you have read and understand these instructions.

Inspector's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

11/11/14

## GUIDELINES FOR DETERMINING CONDITIONS

### CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, PRINCIPAL SPILLWAY, AUXILIARY SPILLWAY

GOOD	ACCEPTABLE	DEFICIENT	POOR
In general, this part of the structure has a good appearance, and conditions observed in this area do not appear to threaten the safety of the dam.	Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.	Continued deterioration and/or unusual loading may threaten the safety of the dam.	Conditions observed in this area appear to threaten the safety of the dam. Conditions observed in this area are unacceptable.

### CONDITIONS OBSERVED - APPLIES TO SEEPAGE

GOOD (NONE)	ACCEPTABLE	DEFICIENT	POOR
No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.	Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.	Excessive seepage exists at areas other than drain outfalls and other designed drains. Seepage needs to be evaluated. Increased flow and/or continued deterioration in seepage conditions may threaten the safety of the dam.	Excessive seepage conditions observed appear to threaten the safety of the dam and is unacceptable. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment, i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage or ponding appears to threaten the safety of the dam.

### CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

GOOD	ACCEPTABLE	DEFICIENT	POOR
Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.	Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.	Level of maintenance of the dam needs significant improvement. Major repairs may be required. Continued neglect of maintenance may threaten the safety of the dam.	Dam does not receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam. Level of maintenance is unacceptable.

### OVERALL CONDITIONS

**SATISFACTORY** - No existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including such events as infrequent hydrologic and/or seismic events. Project Files contain necessary hydrologic, and other engineering calculations to verify dam safety and performance.

**FAIR** - No existing dam safety deficiencies are recognized for normal loading conditions. Infrequent hydrologic and/or

seismic events would probably result in a dam safety deficiency.

**CONDITIONALLY POOR** - A potential safety deficiency is recognized for unusual loading conditions which may realistically occur during the expected life of the structure. **CONDITIONALLY POOR** may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency; further investigations and studies are necessary.

**POOR** - A potential dam safety deficiency is clearly recognized for normal loading conditions. Immediate actions to resolve the deficiency are recommended; reservoir restrictions may be necessary until problem resolution.

**UNSATISFACTORY** - A dam safety deficiency exists for normal conditions. Immediate remedial action is required for problem resolution.

### HAZARD CLASSIFICATIONS OF DAMS (STRUCTURE)

**LOW HAZARD** - A structure the failure of which may damage farm buildings, agricultural land, or local roads

**SIGNIFICANT HAZARD** - A structure the failure of which may damage isolated homes and highways, or cause the temporary interruption of public utility services.

**HIGH HAZARD** - A structure the failure of which may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.

## UNAPPROVED STATUS OF DAM

A dam that has been given an unapproved status (see entry for permit) means that plans, construction specifications, hydraulic analyses, and/or a geotechnical investigation on your dam, proving the safety of the structure, have not been received and approved by the Indiana Department of Natural Resources (IDNR). IDNR records indicate that no progress has been made to secure this approval. The fact that the dam is inspected under the Regulation of Dams Act (IC 14-27-7.5) in no way alters the illegal status of the structures.

If your dam is indicated to be unapproved; it is requested that your engineer contact the Indiana Department of Natural Resources,



## **APPENDIX IV**

# **PRECIPITATION RECORDS FOR BLOOMINGTON, INDIANA**

## Weather History for Bloomington, IN

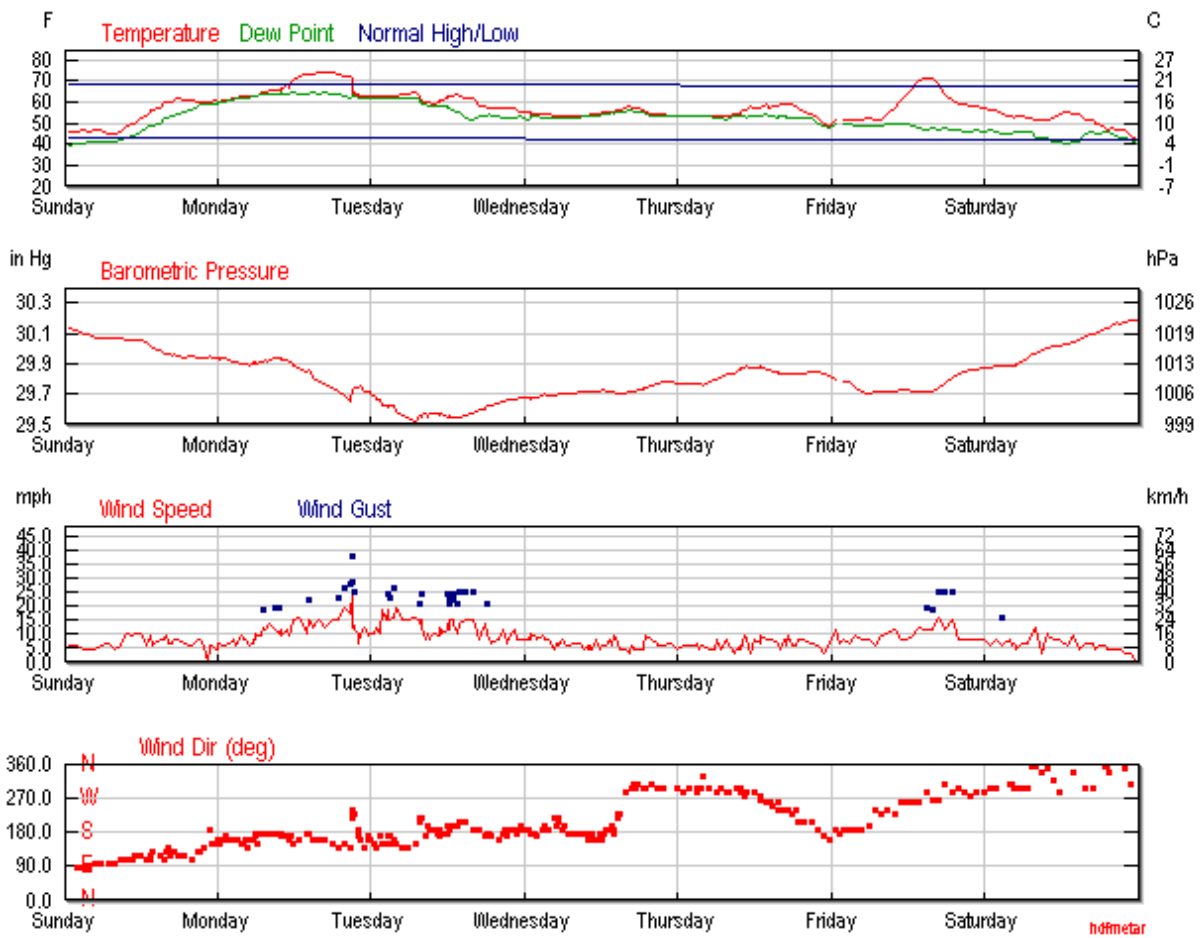
### Week of October 12, 2014 through October 18, 2014

[« Previous Week](#)[Next Week »](#)

	Daily	Weekly	Monthly	Custom
	Max	Avg	Min	Sum
Temperature				
Max Temperature	<b>75 °F</b>	<b>64 °F</b>	<b>56 °F</b>	
Mean Temperature	<b>68 °F</b>	<b>58 °F</b>	<b>49 °F</b>	
Min Temperature	<b>61 °F</b>	<b>51 °F</b>	<b>41 °F</b>	
Degree Days				
Heating Degree Days (base 65)	16	8	0	54
Cooling Degree Days (base 65)	3	0	0	3
Growing Degree Days (base 50)	16	7	0	50
Dew Point				
Dew Point	<b>65 °F</b>	<b>52 °F</b>	<b>39 °F</b>	
Precipitation				
Precipitation	<b>1.26 in</b>	<b>0.34 in</b>	<b>0.00 in</b>	<b>2.41 in</b>
Snowdepth	-	-	-	-
Wind				
Wind	<b>26 mph</b>	<b>9 mph</b>	<b>0 mph</b>	
Gust Wind	<b>38 mph</b>	<b>22 mph</b>	<b>16 mph</b>	
Sea Level Pressure				
Sea Level Pressure	<b>30.19 in</b>	<b>29.82 in</b>	<b>29.52 in</b>	



## Weekly Weather History Graph



## Daily Weather History &amp; Observations

2014	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)	Events
Oct	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum	
12	62	54	45	59	50	39	97	85	72	30.13	30.00	29.94	10	9	2	12	7	16	0.27	Rain
13	75	68	61	65	63	60	100	87	73	29.94	29.85	29.65	10	6	0	26	12	38	1.26	Fog , Rain , Thunderstorm
14	66	61	55	62	57	51	100	84	67	29.69	29.60	29.52	10	9	2	23	12	34	0.52	Rain
15	58	56	53	56	53	52	100	93	86	29.78	29.71	29.67	10	6	2	13	7	17	0.32	Rain
16	61	55	49	54	52	48	100	88	75	29.88	29.83	29.76	10	8	2	12	7	18	0.03	Rain
17	71	61	50	50	48	46	96	69	41	29.87	29.76	29.70	10	10	9	21	9	30	0.00	
18	56	49	41	47	44	40	93	74	55	30.19	30.02	29.87	10	10	6	13	6	19	0.01	Rain