Koontz Lake Dam & S.R. 23 Reconstruction

Presented By:

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Dan G. Delgado, P.E.

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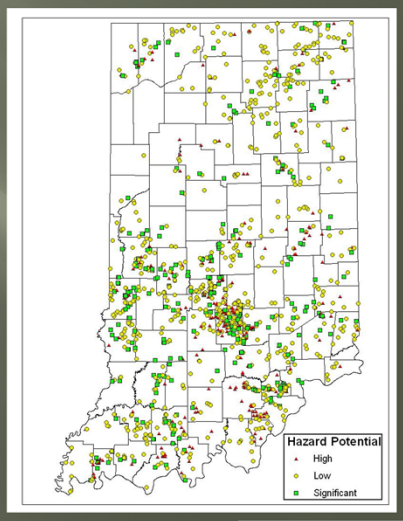
Indiana Dam Safety Laws & Regulations

The Indiana Department of Natural Resource (IDNR) currently regulates over 1,000 dams throughout the State

49 of the 50 States currently regulate dams (Alabama currently has no dam safety legislation or formal dam safety program)

Regulations vary from State to State



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Indiana Dam Safety Laws & Regulations

Dams meeting ***ANY ONE*** of the following criteria are regulated by the IDNR:

- The Drainage Area above the Dam is greater than one (1) square mile;
- The dam embankment is greater than 20-feet high; or
- The dam impounds more than 100 acre-feet of water.

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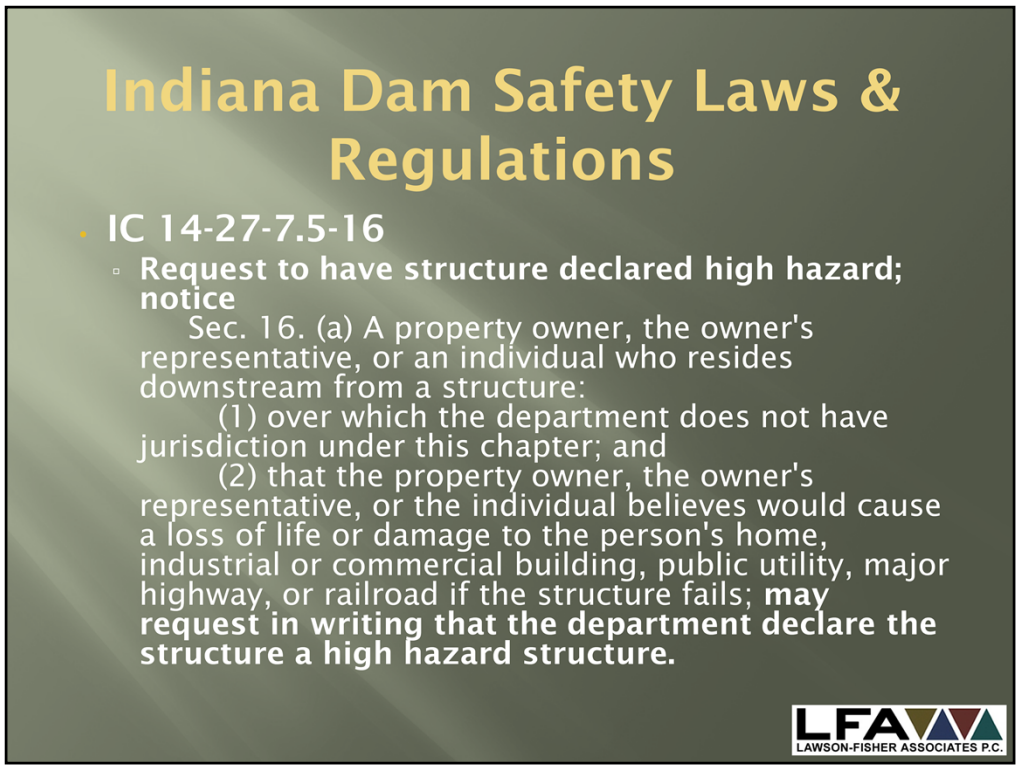

IC 14-27-7.5-16
Request to have structure declared high hazard; notice

Sec. 16. (a) A property owner, the owner's representative, or an individual who resides downstream from a structure:

(1) over which the department does not have jurisdiction under this chapter; and

(2) that the property owner, the owner's representative, or the individual believes would cause a loss of life or damage to the person's home, industrial or commercial building, public utility, major highway, or railroad if the structure fails;

may request in writing that the department declare the structure a high hazard structure.

(b) If the department receives a request under subsection (a), the department shall:

(1) investigate the structure and the area downstream from the structure;

(2) notify the owner of the structure that the structure is being investigated;

(3) review written statements and technical documentation from any interested party; and

(4) after considering the available information, determine whether or not the structure is a high hazard structure.

(c) The department shall issue a written notice of the department's determination under subsection (b) to:

(1) the individual who requested the determination; and

(2) the owner of the structure that is the subject of the request.

(d) Either:

(1) the individual who requested a determination; or

(2) the owner of the structure that is the subject of the request;

may request an administrative review under IC 4-21.5-3-6 within thirty (30) days after receipt of the written determination.

(e) If the department determines that a structure is a high hazard structure under subsection (b), the provisions of this chapter concerning high hazard structures apply to the structure

Dam Hazard Classification System

- **Per Indiana Law**, hazard classification refers to a rating assigned to a structure by the IDNR, based on the best *available* information, regarding potential consequences resulting from the uncontrolled release of its contents due to a failure or wrongful operation of the structure.
  - (hazard classification is not a reflection of the condition of the structure)
- Indiana follows national professional practice of using three (3) hazard classifications
  - *High*
  - *Significant*
  - *Low*

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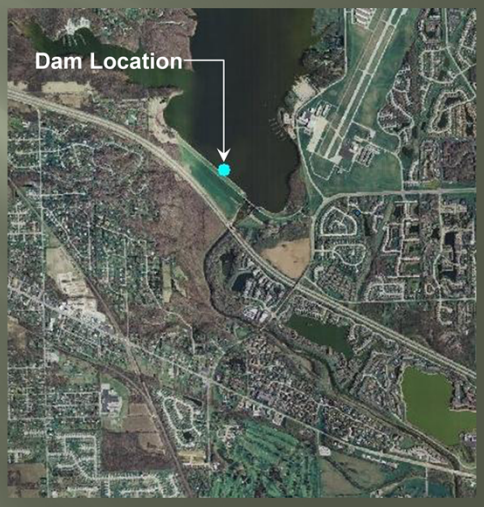
Dam Hazard

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 roads



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Dam Hazard

Significant Hazard

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

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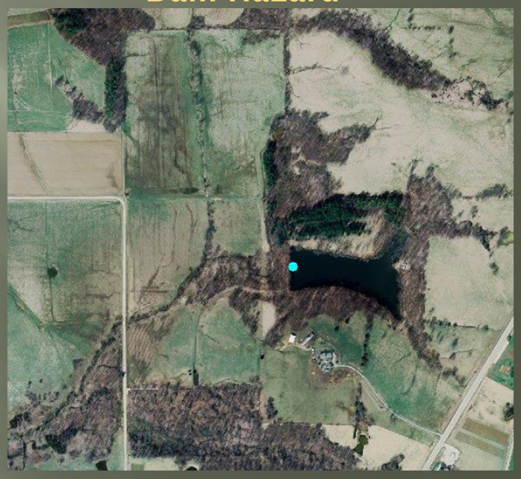
Dam Hazard

Low Hazard

A structure the failure of which may damage farm buildings, agricultural land, or local roads.



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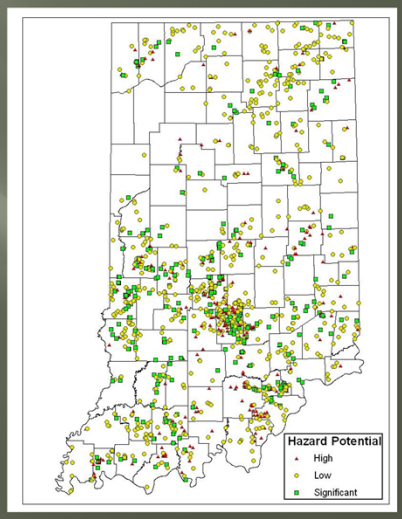
Indiana Dam Hazard Classification Breakdowns

24% High Hazard

28% Significant Hazard

48% Low Hazard



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Koontz Lake Dam

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Koontz Lake Dam

LFA selected in 2007 to design repair for lake level control structure at a small dam.

Estimated Budget for planning, design, and construction - $350,000

LFA asked to attend Dam Safety inspection that was to be conducted by the IDNR

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Koontz Lake Dam

Constructed in 1849 by Samuel Koontz

High Hazard Classification

Drainage Area = 6.27 mi^2 (4,014 Acres)

Lake at Normal Pool = 330 Acres

S.R. 23 Runs along the crest of the dam

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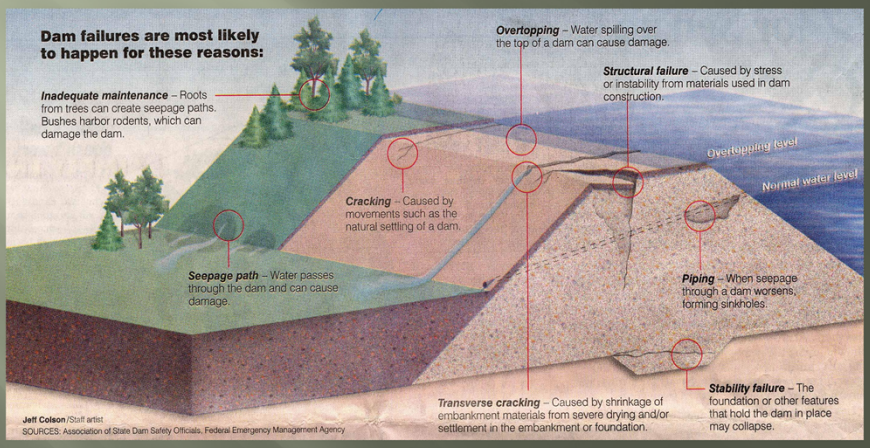
Anatomy of a Dam Failure
The most common causes of dam failures:



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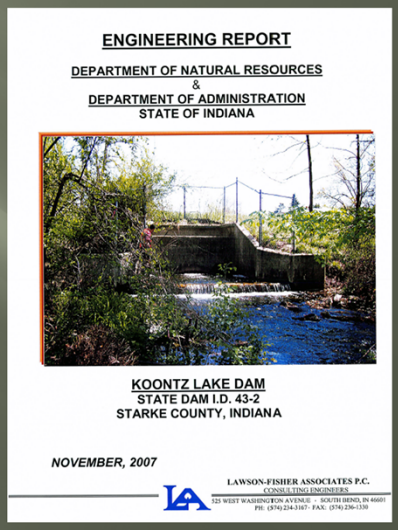
What do we do now?

Conduct a Field Survey to gather topographic information

Conduct a hydrologic/hydraulic (h/h) analysis of the existing spillway system

Perform a geotechnical (soils) investigation and analysis

Perform an alternative analysis to determine design approach



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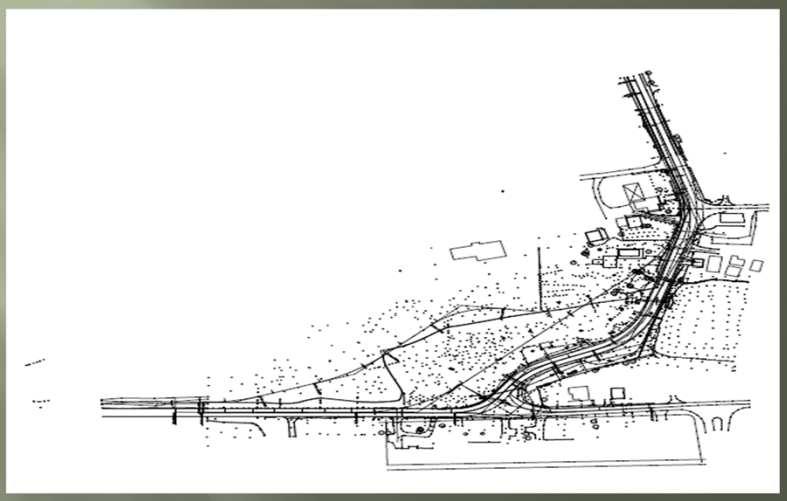
Topographic Survey



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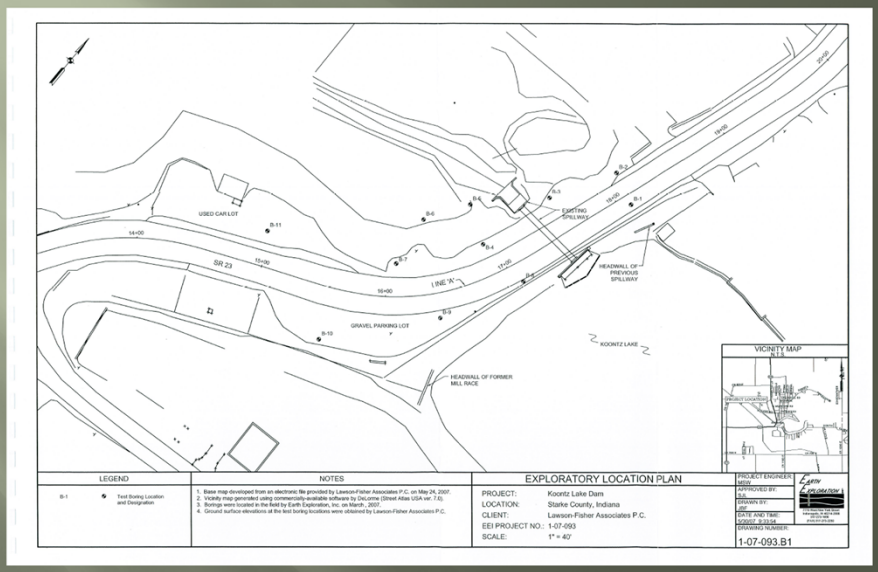
Geotechnical Analysis



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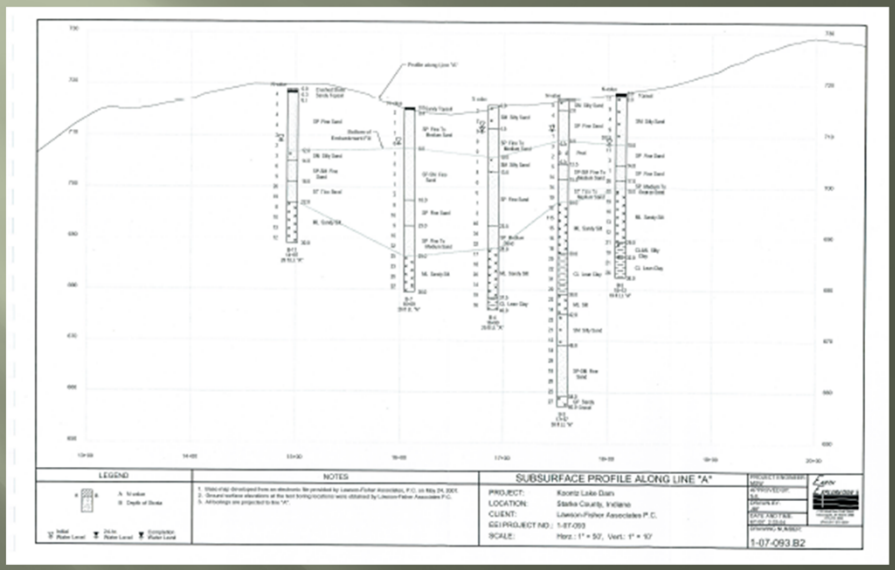

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Hydrologic / Hydraulic Analysis

What is the inflow (cubic feet per second) coming into the Lake?

Does the existing spillway system have the capability to safely pass the design inflow (I = O + S)

What are the discharge characteristics of the existing spillway

If the spillway is inadequate – what do we need to do.

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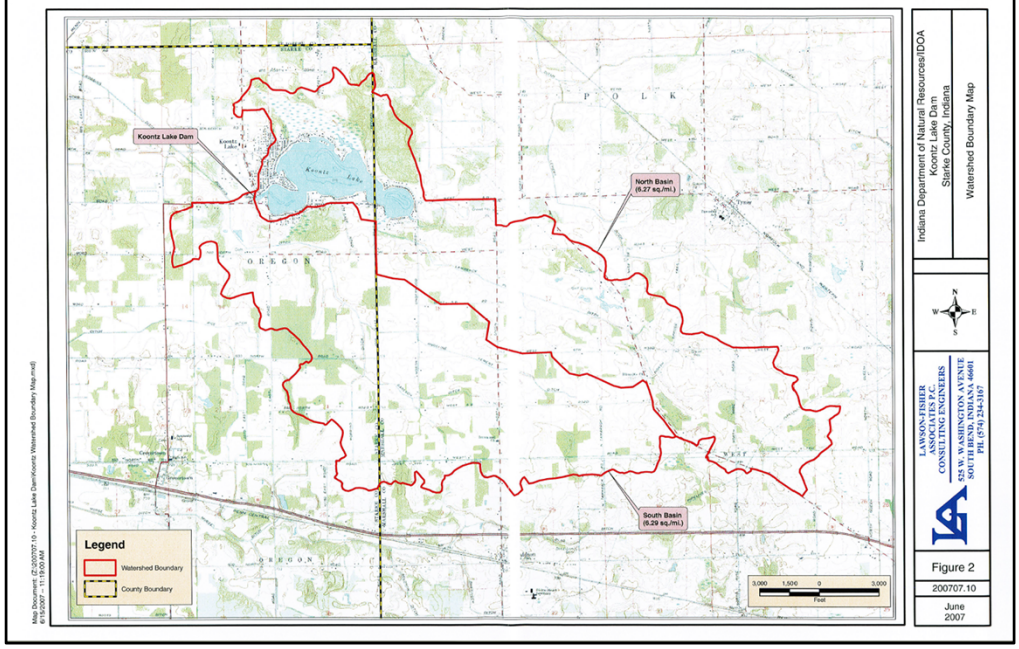
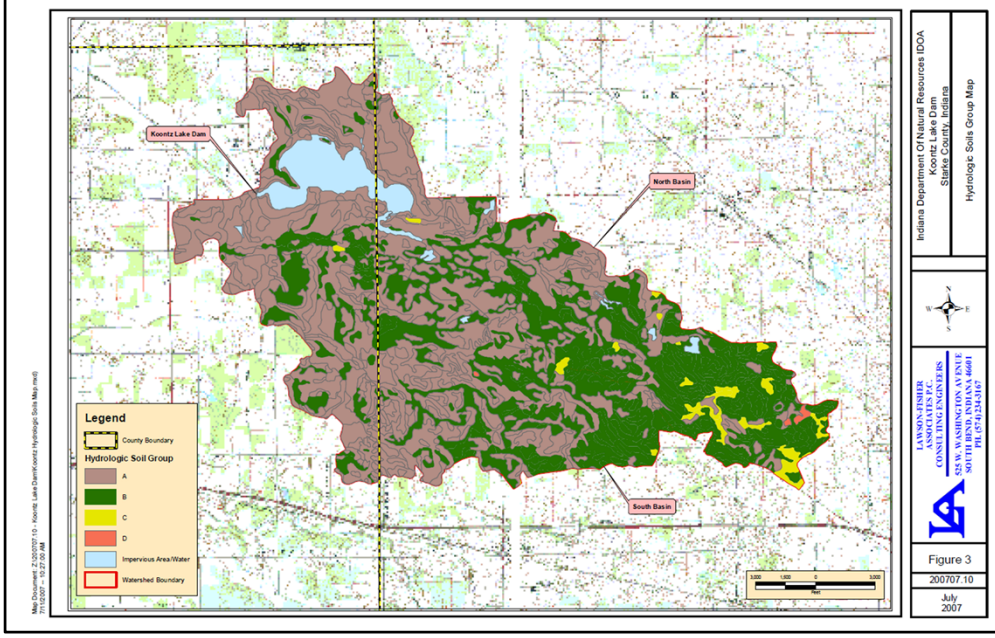
Hydrology


Koontz Lake Dam
North Basin
(6.27 sq./mi.)
South Basin
(5.29 sq./mi.)
Legend
Watershed Boundary
County Boundary
POLK
OREGON
3,000 1,500 0 3,000
Feet
Indiana Department of Natural Resources/IDOA
Koontz Lake Dam
Starke County, Indiana
Watershed Boundary Map
LAWSON-FISHER ASSOCIATES P.C.
CONSULTING ENGINEERS
525 W. WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH. (574) 234-5167
Figure 2
200707.10
June 2007

Hydrology


Koontz Lake Dam
North Basin
South Basin
Legend
County Boundary
Hydrologic Soil Group
A
B
C
D
Impervious Area/Water
Watershed Boundary
Indiana Department Of Natural Resources IDOA
Koontz Lake Dam
Starke County, Indiana
Hydrologic Soils Group Map
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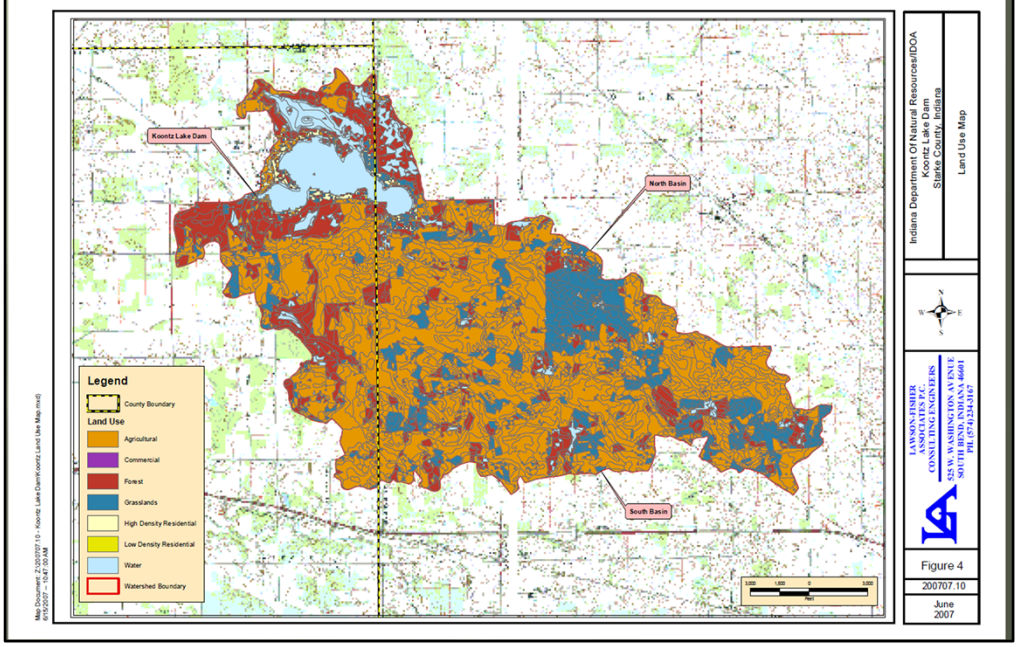
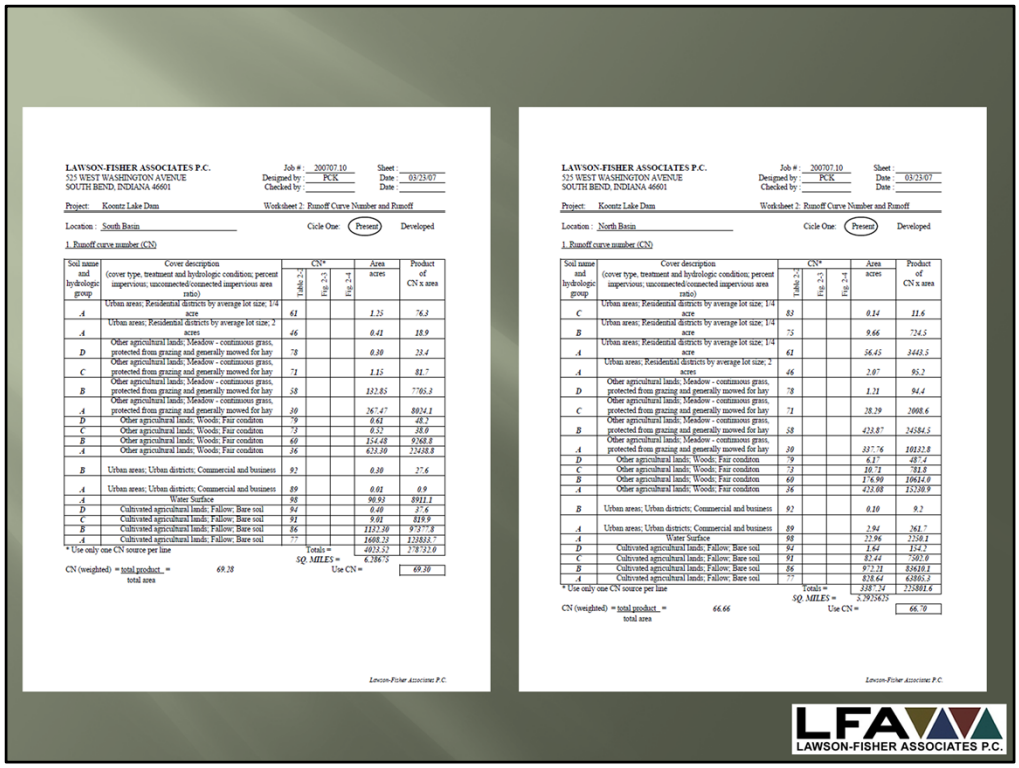
CONSULTING ENGINEERS
525 W. WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH: (574) 234-4149
Figure 3
20707.10
July 2007

Hydrology


Koontz Lake Dam
North Basin
South Basin
Legend
County Boundary
Land Use
Agricultural
Commercial
Forest
Grasslands
High Density Residential
Low Density Residential
Water
Watershed Boundary
Indiana Department Of Natural Resources/DOA
Koontz Lake Dam
Starke County, Indiana
Land Use Map
LAWSON-FISHER ASSOCIATES P.C.
CONSULTING ENGINEERS
525 W. WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH. (574)234-3167
Figure 4
200707.10
June 2007



LAWSON-FISHER ASSOCIATES P.C.
525 WEST WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601

Job # : 200707.10
Designed by : PCK
Checked by :
Sheet :
Date : 03/23/07
Date :

Project: Koontz Lake Dam
Worksheet 2: Runoff Curve Number and Runoff

Location : South Basin
Cicle One: (Present) Developed

1. Runoff curve number (CN)

Soil name and hydrologic group	Cover description (cover type, treatment and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	Fig. 2-3	Fig. 2-4	Area acres	Product of CN x area
A	Urban areas; Residential districts by average lot size; 1/4 acre	61			1.25	76.3
A	Urban areas; Residential districts by average lot size; 2 acres	46			0.41	18.9
D	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	78			0.30	23.4
C	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	71			1.15	81.7
B	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	58			132.85	7705.3
A	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	30			267.47	8024.1
D	Other agricultural lands; Woods; Fair condition	79			0.61	48.2
C	Other agricultural lands; Woods; Fair condition	73			0.52	38.0
B	Other agricultural lands; Woods; Fair condition	60			154.48	9268.8
A	Other agricultural lands; Woods; Fair condition	36			623.30	22438.8
B	Urban areas; Urban districts; Commercial and business	92			0.30	27.6
A	Urban areas; Urban districts; Commercial and business	89			0.01	0.9
A	Water Surface	98			90.93	8911.1
D	Cultivated agricultural lands; Fallow; Bare soil	94			0.40	37.6
C	Cultivated agricultural lands; Fallow; Bare soil	91			9.01	819.9
B	Cultivated agricultural lands; Fallow; Bare soil	86			1122.30	9652.8
A	Cultivated agricultural lands; Fallow; Bare soil	77			1608.23	123833.7
			Totals =		4923.53	278732.0

* Use only one CN source per line

SQ. MILES = 6.286675

CN (weighted) = total product / total area = 69.28

Use CN = 69.30

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525 WEST WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601

Job # : 200707.10
Designed by : PCK
Checked by :
Sheet :
Date : 03/23/07
Date :

Project: Koontz Lake Dam
Worksheet 2: Runoff Curve Number and Runoff

Location : North Basin
Cicle One: (Present) Developed

1. Runoff curve number (CN)

Soil name and hydrologic group	Cover description (cover type, treatment and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	Fig. 2-3	Fig. 2-4	Area acres	Product of CN x area
C	Urban areas; Residential districts by average lot size; 1/4 acre	83			0.14	11.6
B	Urban areas; Residential districts by average lot size; 1/4 acre	75			9.66	724.5
A	Urban areas; Residential districts by average lot size; 1/4 acre	61			56.45	3443.5
A	Urban areas; Residential districts by average lot size; 2 acres	46			2.07	95.2
D	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	78			1.21	94.4
C	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	71			28.29	2008.6
B	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	58			423.87	24584.5
A	Other agricultural lands; Meadow - continuous grass, protected from grazing and generally mowed for hay	30			337.76	10132.8
D	Other agricultural lands; Woods; Fair condition	79			6.17	487.4
C	Other agricultural lands; Woods; Fair condition	73			10.73	783.8
B	Other agricultural lands; Woods; Fair condition	60			176.90	10614.0
A	Other agricultural lands; Woods; Fair condition	36			423.08	15230.9
B	Urban areas; Urban districts; Commercial and business	92			0.10	9.2
A	Urban areas; Urban districts; Commercial and business	89			2.94	261.7
A	Water Surface	98			22.96	2250.1
D	Cultivated agricultural lands; Fallow; Bare soil	94			1.64	154.2
C	Cultivated agricultural lands; Fallow; Bare soil	91			82.44	7502.0
B	Cultivated agricultural lands; Fallow; Bare soil	86			972.21	83619.1
A	Cultivated agricultural lands; Fallow; Bare soil	77			838.64	64586.3
			Totals =		3387.24	225893.6

* Use only one CN source per line

SQ. MILES = 5.2925625

CN (weighted) = total product / total area = 66.66

Use CN = 66.70

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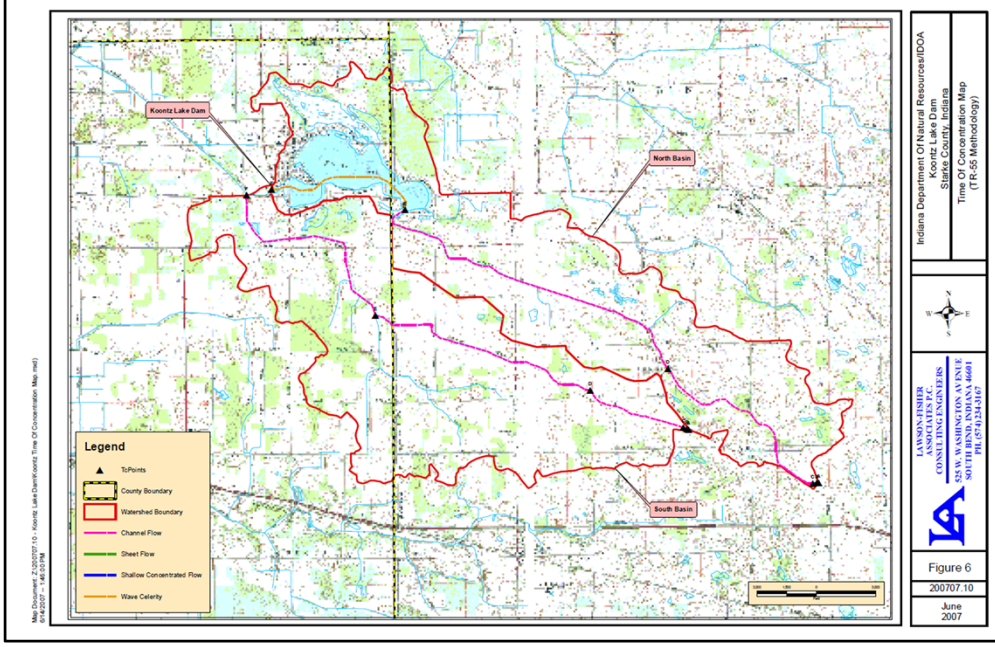
Hydrology


Koontz Lake Dam
North Basin
South Basin
Legend
TcPoints
County Boundary
Watershed Boundary
Channel Flow
Sheet Flow
Shallow Concentrated Flow
Wave Celerity
Indiana Department Of Natural Resources/DOA
Koontz Lake Dam
Starke County, Indiana
Time Of Concentration Map
(TR-55 Methodology)
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CONSULTING ENGINEERS
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SOUTH BEND, INDIANA 46601
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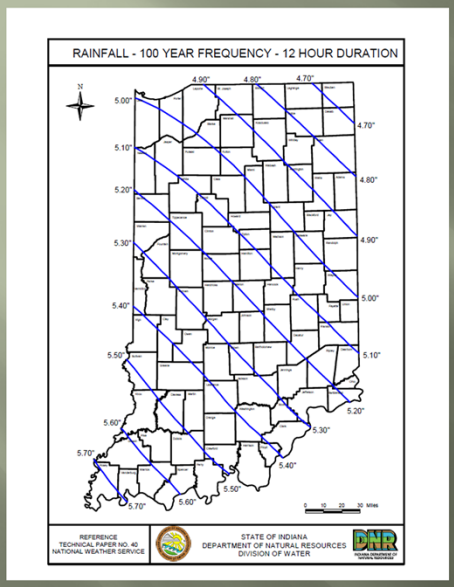
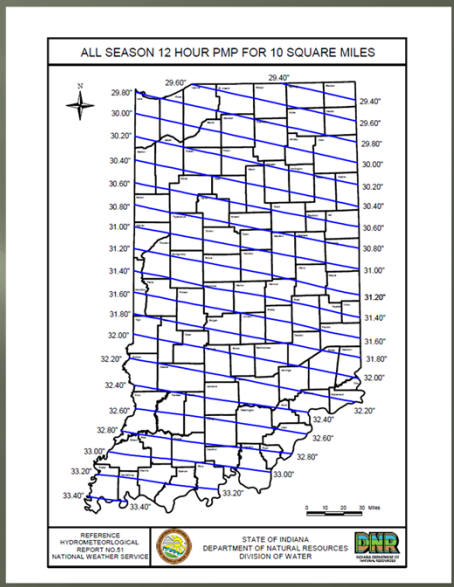
Figure 6
20070710
June 2007





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Hydraulics – Stage-Discharge

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531 WEST WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601

Job # 200707.10 Sheet 2
By RCE Date 7/24/07
Ck'd SEM Date 7/26/07

Project: Koontz Lake Dam Subject: Stage-Discharge Relationship

Determine Rating of Sheet Pile Weir Entrance

Weir Length 1 =	29.42 ft
Weir Length 2 =	3.0 ft
Weir Length 3 =	3.0 ft
Total Weir Length =	35.42 ft
Weir Coef., C_w =	3.33
Invert Elevation =	714.55 ft NGVD 29
Gravity Constant, g =	32.2 ft/s²
Flow Area, A =	88.25 ft²
Orifice Coef., C_d =	0.6

Weir Equation: $Q = C_w L H^{1.5}$

Orifice Equation: $Q = C_d A \sqrt{2gh}$

Weir		
Q (ft³)	H (ft)	WSE (ft)
2	0.07	714.62
10	0.19	714.74
20	0.31	714.86
30	0.40	714.95
40	0.49	715.04
50	0.56	715.11
100	0.90	715.45
150	1.17	715.72
190	1.37	715.92
400	2.26	716.81
896	3.87	718.42
992	4.14	718.69
1079	4.37	718.92
1160	4.59	719.14
1235	4.79	719.34
1306	4.97	719.52
1374	5.14	719.69

Orifice		
Q (ft³)	h (ft)	WSE (ft)
2	0.00	714.55
10	0.00	714.55
20	0.00	714.55
30	0.00	714.55
40	0.01	714.56
50	0.01	714.56
100	0.06	714.61
150	0.12	714.67
190	0.20	714.75
400	0.89	715.44
896	4.45	719.00
992	5.45	720.00
1079	6.45	721.00
1160	7.45	722.00
1235	8.45	723.00
1306	9.45	724.00
1374	10.45	725.00

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Hydraulics


Legend
Cross Sections
County Boundary
SR 23
Outlet Channel
Crest of Koontz Lake Dam
Indiana Department Of Natural Resources/IDOA
Koontz Lake Dam
Starke County, Indiana
Cross Section Location Map
LAWSON-FISHER ASSOCIATES, INC
CONSULTING ENGINEERS
5630 WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH. (574) 234-3167
Figure 7
200707.10
June 2007

Model Results

SUMMARY OF HYDROLOGIC PARAMETERS

BASIN	Area (sq. mi.)	Tc (hr)	SCS Lag (hr)	RCN	Calibrated RCN	Percent Impervious
North	5.293	2.647	1.59	66.7	55	0
Lake	0.98	0	0	98	98	100
South	6.287	2.867	1.72	69.3	55	0

SUMMARY OF RESULTS

Duration	Frequency	Rainfall (in)	Distribution	Peak Stage (ft)	Outflow (cfs)	Inflow (cfs)
12 Hr	All Season PMP for 10 Square Miles	29.90	SCS Type II	722.41	6577	17780
12 Hr	100 Year	4.95	SCS Type II	715.53	114	2690

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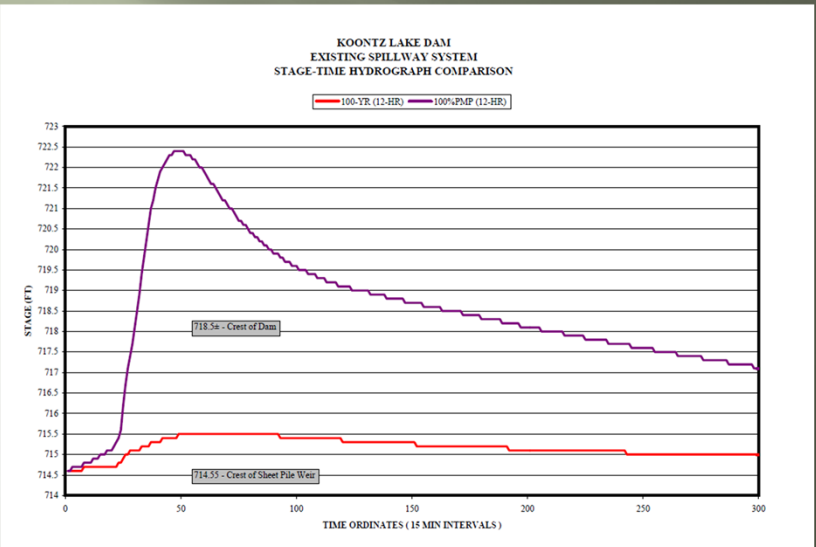
Model Results



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Alternative Analysis

How do we increase our spillway capacity (I = O + S)

Address our geotechnical issues

State Highway

Environmental aspects

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Labyrinth Weir

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Labyrinth Weir

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Koontz Lake Dam & S.R. 23 Reconstruction

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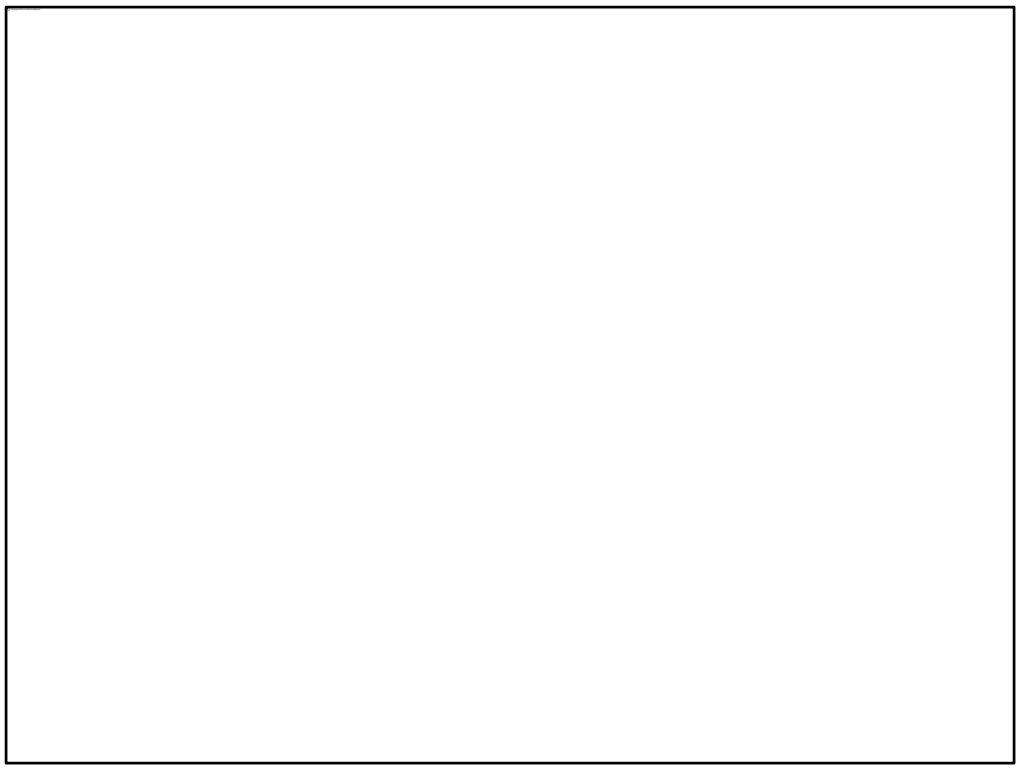

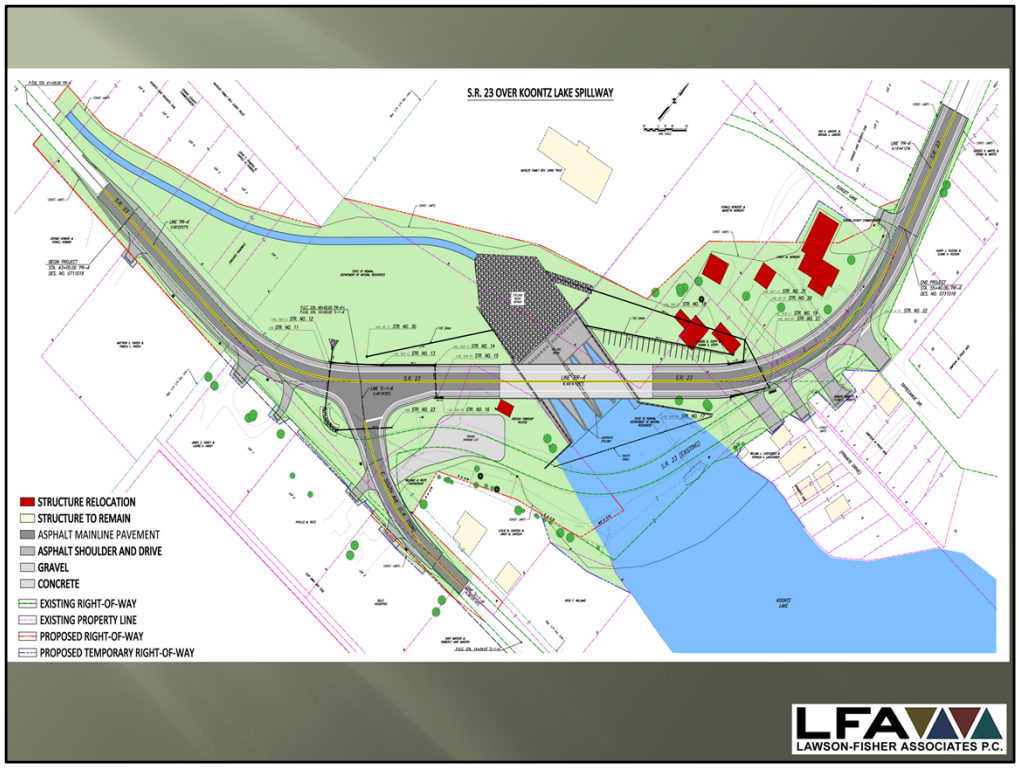
S.R. 23 OVER KOONTZ LAKE SPILLWAY
STRUCTURE RELOCATION
STRUCTURE TO REMAIN
ASPHALT MAINLINE PAVEMENT
ASPHALT SHOULDER AND DRIVE
GRAVEL
CONCRETE
EXISTING RIGHT-OF-WAY
EXISTING PROPERTY LINE
PROPOSED RIGHT-OF-WAY
PROPOSED TEMPORARY RIGHT-OF-WAY
LFA
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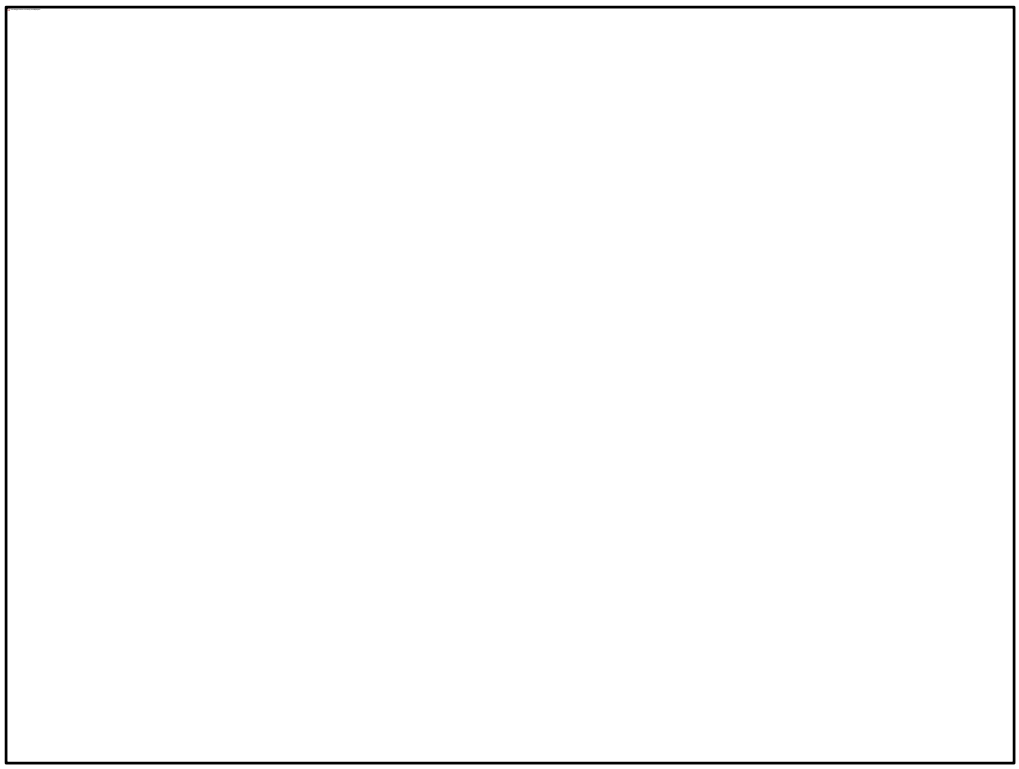

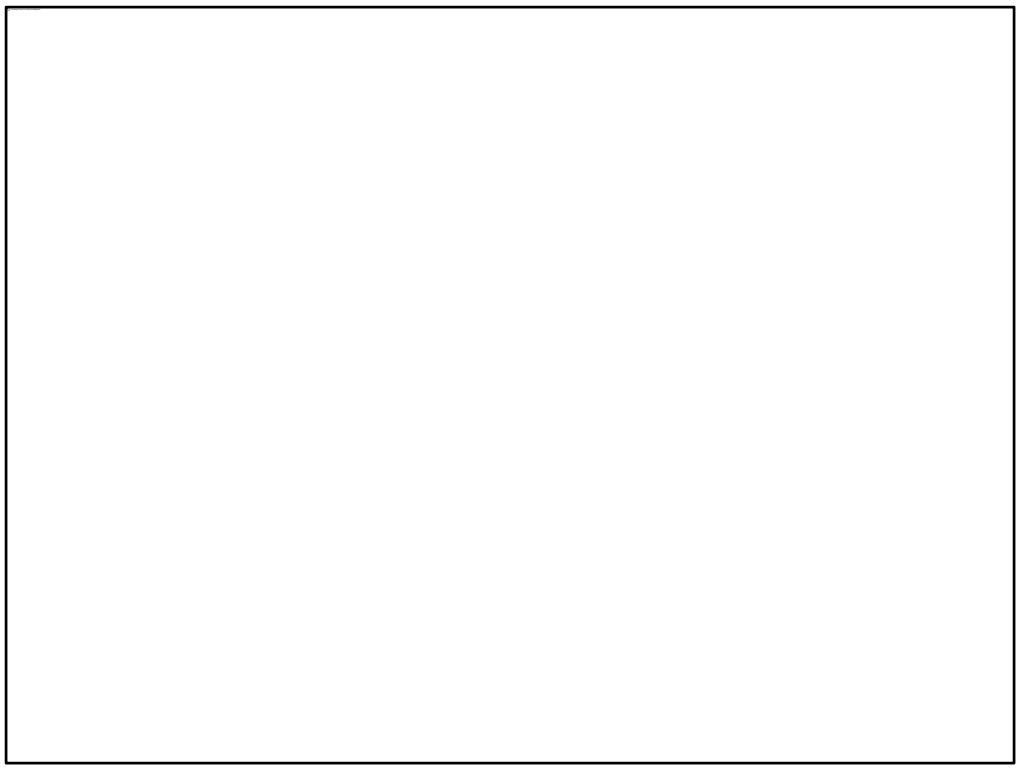

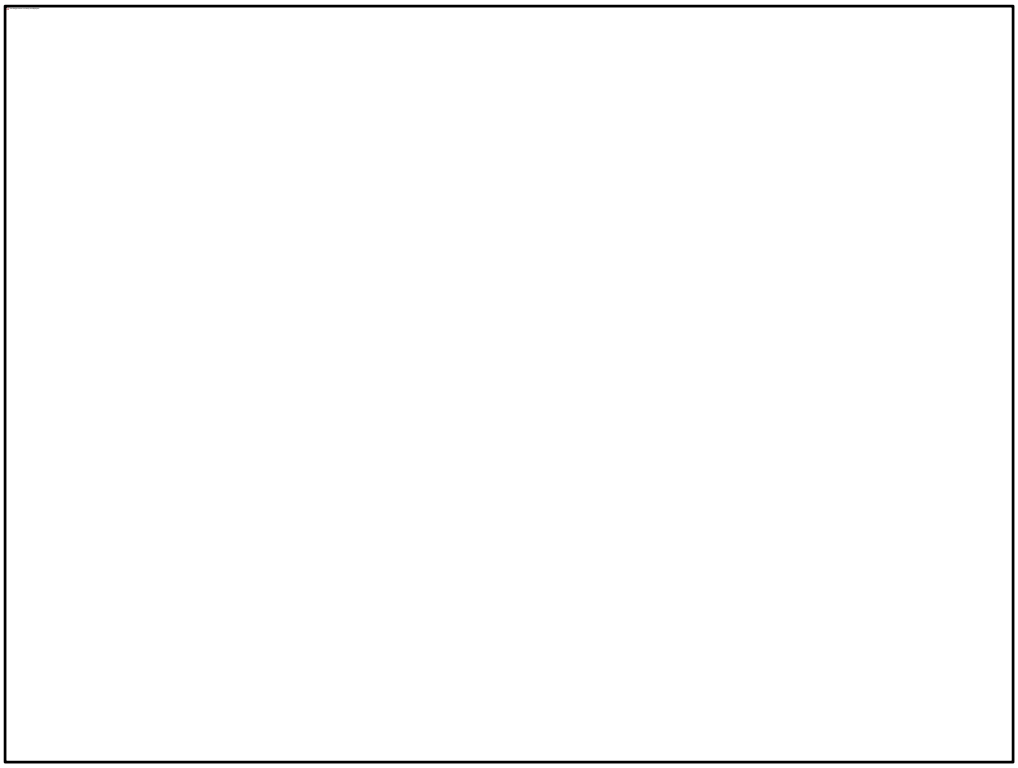

PARTNERING TEAM

- INDOT – Owner
- IDNR – Owner
- Lawson-Fisher Associates P.C. – Engineer
- Northern Indiana Construction Co., Inc. – Contractor
- Various Subcontractors & Suppliers
- Utility Companies
- Starke County

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PLANNING – Design & Construction

- INDOT Criteria - Road/bridge
- IDNR Criteria - Dam/labyrinth
- Construction Inspection
  - IDNR (1 On-site Inspector)
  - INDOT (2 On-site Inspectors)
- Application for Payment Coordination
- Memorandum of Understanding Between IDNR/INDOT

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KOONTZ LAKE DAM FINAL QUANTITY SUMMARY (Road/Dam Breakout)

PCN : 711018 ROAD CONSTRUCTION

LINE NO.	ITEM NUMBER	ITEM DESCRIPTION	FINAL QUANTITY	ITEM UNIT	UNIT PRICE	AMOUNT	% ROAD/ BRIDGE	% DAM	ROAD/ BRIDGE	DAM
1	105-06845	CONSTRUCTION ENGINEERING	1.00	LUMP	50,309.60	50,309.60	50%	50%	25,154.80	25,154.80
2	105-08520	CELLULAR TELEPHONE/RADIO	0.00	EACH	75.00	0.00	100%	0%	0.00	0.00
3	105-08521	CELLULAR TELEPHONE/RADIO SERVICE	0.00	MOS	45.00	0.00	100%	0%	0.00	0.00
4	105-08524	CELLULAR TELEPHONE/RADIO, ADDITIONAL MINUTES	0.00	DOL	1.00	0.00	100%	0%	0.00	0.00
5	109-08359	LIQUIDATED DAMAGES	0.00	DOL	1.00	0.00	50%	50%	0.00	0.00
6	109-08360	CONTRACT LIENS	0.00	DOL	1.00	0.00	50%	50%	0.00	0.00
7	109-08443	QUALITY ADJUSTMENTS, TEMPORARY TRAFFIC CONTROL DEVICES	0.00	DOL	1.00	0.00	50%	50%	0.00	0.00
8	109-08444	QUALITY ADJUSTMENTS, FAILED MATERIALS	0.00	DOL	1.00	0.00	50%	50%	0.00	0.00
9	109-08463	PROJECT ESTIMATE ADJUSTMENT	0.00	DOL	1.00	0.00	50%	50%	0.00	0.00
10	109-09489	PAYMENT ADJUSTMENT, PG ASPHALT BINDER	8242.00	DOL	1.00	8,242.00	50%	50%	4,121.00	4,121.00
11	110-01001	MOBILIZATION AND DEMOBILIZATION	1.00	LUMP	197,450.00	197,450.00	50%	50%	98,725.00	98,725.00
12	113-01614	PARTNERING OVERHEAD	1.00	LUMP	13,000.00	13,000.00	50%	50%	6,500.00	6,500.00
13	201-52370	CLEARING RIGHT OF WAY	1.00	LUMP	86,390.00	86,390.00	50%	50%	43,195.00	43,195.00
14	202-01000	STRUCTURES AND OBSTRUCTIONS, REMOVE SPILLWAY	1.00	LUMP	50,000.00	50,000.00	50%	50%	25,000.00	25,000.00
15	202-01261	TESTING FOR ASBESTOS, TYPE	10.00	EACH	235.00	2,350.00	50%	50%	1,175.00	1,175.00
16	202-03000	HOUSES AND BUILDINGS, REMOVE, PARCEL NO 13	1.00	LUMP	10,000.00	10,000.00	50%	50%	5,000.00	5,000.00
17	202-03000	HOUSES AND BUILDINGS, REMOVE, PARCEL NO 16	1.00	LUMP	25,000.00	25,000.00	50%	50%	12,500.00	12,500.00
18	202-91385	INLET, REMOVE	1.00	EACH	810.00	810.00	50%	50%	405.00	405.00
19	202-93047	MANHOLE, REMOVE	1.00	EACH	1,575.00	1,575.00	50%	50%	787.50	787.50
20	202-96133	PIPE, REMOVE	303.00	LFT	21.70	6,575.10	50%	50%	3,287.55	3,287.55
21	203-02000	EXCAVATION, COMMON	19128.58	CYS	11.79	225,525.96	50%	50%	112,762.98	112,762.98
22	203-02070	BORROW	22876.91	CYS	14.40	329,427.50	50%	50%	164,713.75	164,713.75
23	203-02100	EXCAVATION, PEAT	4834.00	CYS	16.35	79,035.90	50%	50%	39,517.95	39,517.95
24	203-04523	DEWATERING AND PROTECTION OF EXISTING AND PROPOSED STRUCTURE	1.00	LUMP	387,569.84	387,569.84	50%	50%	193,784.92	193,784.92
25	205-03371	SEDIMENT, REMOVE	0.00	CYS	20.00	0.00	50%	50%	0.00	0.00
26	205-06933	TEMPORARY DITCH INLET PROTECTION	0.00	EACH	89.50	0.00	50%	50%	0.00	0.00
27	205-06934	TEMPORARY MULCHING	0.38	TON	331.00	125.78	50%	50%	62.89	62.89
28	205-06937	TEMPORARY SILT FENCE	3186.00	LFT	1.10	3,504.60	50%	50%	1,752.30	1,752.30
29	205-09543	NO 2 STONE	252.85	TON	7.00	1,769.95	100%	0%	1,769.95	0.00
30	207-08262	SUBGRADE TREATMENT, TYPE I	4587.61	SYS	5.75	26,378.76	100%	0%	26,378.76	0.00
31	207-08267	SUBGRADE TREATMENT, TYPE IIIA	850.33	SYS	8.00	6,802.64	100%	0%	6,802.64	0.00
32	210-09275	PERMANENT CUTOFF WALL	1.00	LUMP	125,000.00	125,000.00	0%	100%	0.00	125,000.00
33	210-09482	GLACIAL STONE	867.64	TON	61.45	53,316.48	0%	100%	0.00	53,316.48
34	210-09620	STILLING BASIN RIPRAP AND GRADED FILTER	1.00	LUMP	205,000.00	205,000.00	0%	100%	0.00	205,000.00
35	210-09621	FLOATING BARRIER SAFETY CABLES	1.00	LUMP	6,834.42	6,834.42	0%	100%	0.00	6,834.42
36	210-09622	TOE DRAIN SYSTEM	1.00	LUMP	145,984.00	145,984.00	0%	100%	0.00	145,984.00
37	211-02050	B BORROW	4328.00	CYS	20.80	89,980.80	20%	80%	17,996.16	71,984.64
38	211-09264	STRUCTURAL BACKFILL, TYPE 1	309.00	CYS	16.25	5,021.25	20%	80%	1,004.25	4,017.00
39	301-07448	COMPACTED AGGREGATE, NO. 53, BASE	2774.46	TON	23.10	64,090.03	100%	0%	64,090.03	0.00
40	303-07449	COMPACTED AGGREGATE, NO. 73	399.90	TON	1.00	399.90	100%	0%	399.90	0.00
41	306-08034	MILLING, ASPHALT, 1 1/2 IN	132.22	SYS	8.40	1,110.65	100%	0%	1,110.65	0.00
42	402-07432	HMA SURFACE, TYPE A	106.68	TON	67.00	7,147.56	100%	0%	7,147.56	0.00
43	402-07433	HMA SURFACE, TYPE B	420.54	TON	67.00	28,176.18	100%	0%	28,176.18	0.00
44	402-07438	HMA INTERMEDIATE, TYPE B	1127.14	TON	52.00	58,611.28	100%	0%	58,611.28	0.00
45	402-07440	HMA BASE, TYPE A	310.04	TON	52.00	16,122.08	100%	0%	16,122.08	0.00
46	406-09520	ASPHALT FOR TACK COAT	0.00	TON	1.00	0.00	100%	0%	0.00	0.00

Lawson-Fisher Associates P.C.
Project File No. 200707.50
November 8, 2012

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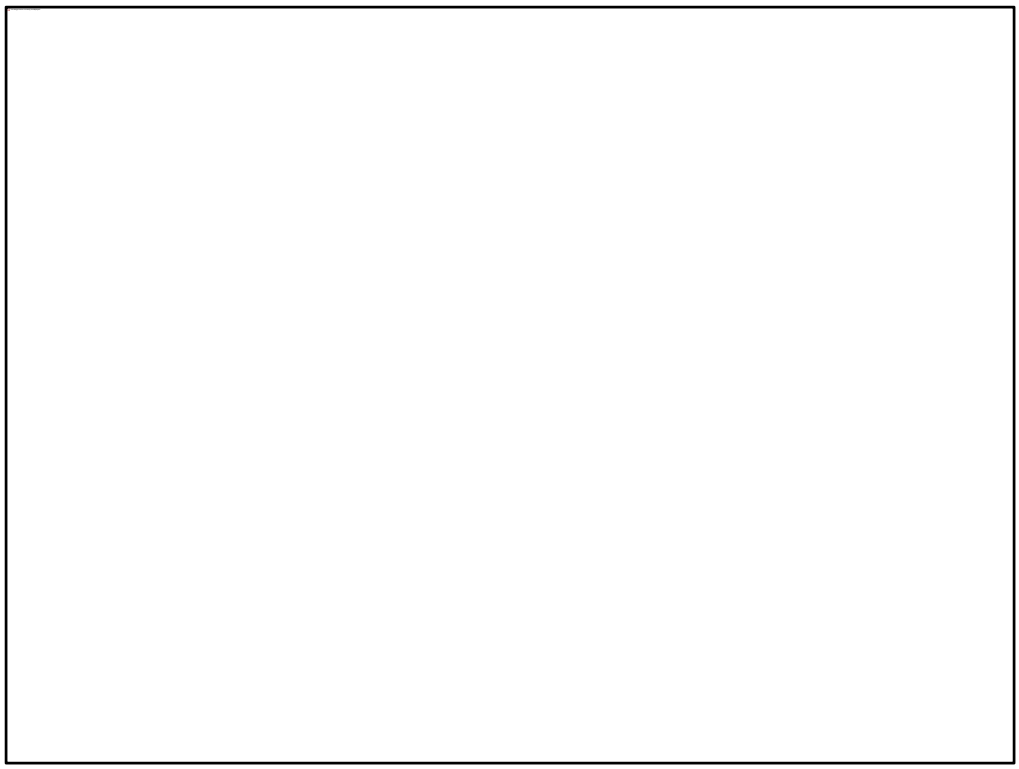

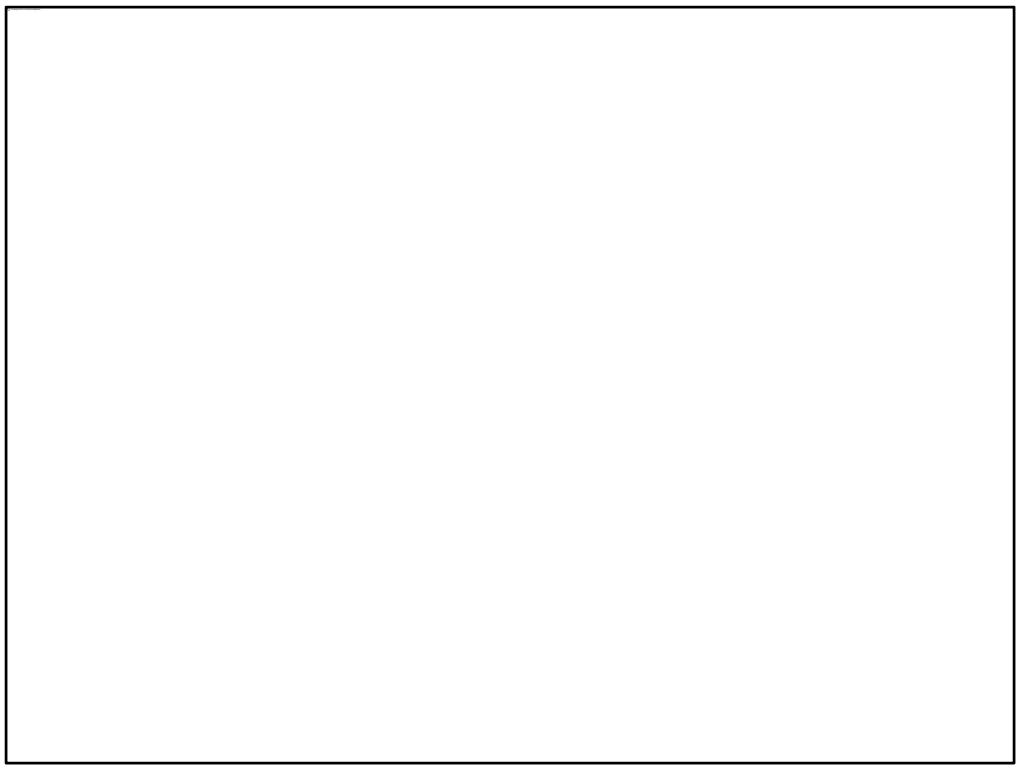

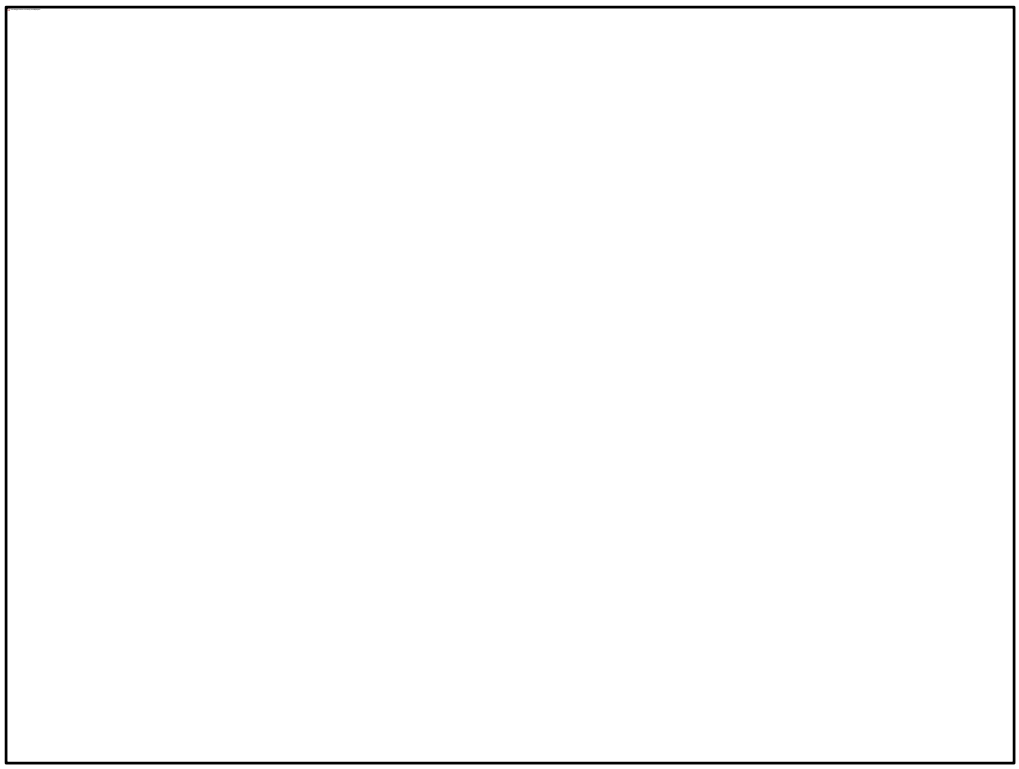

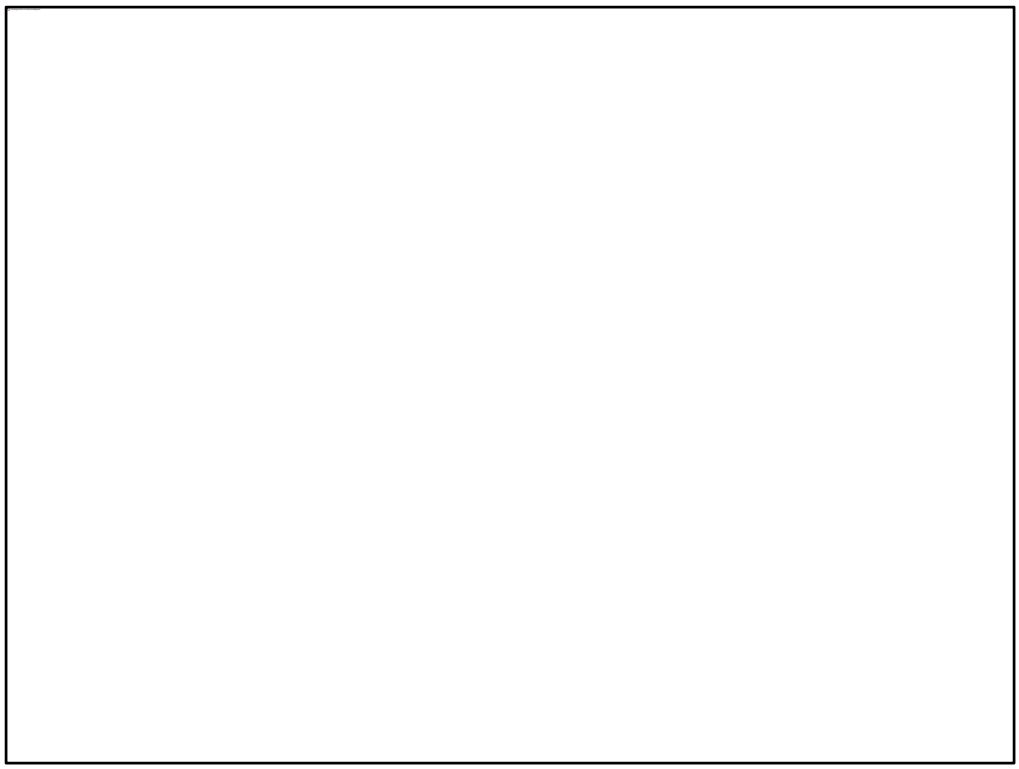

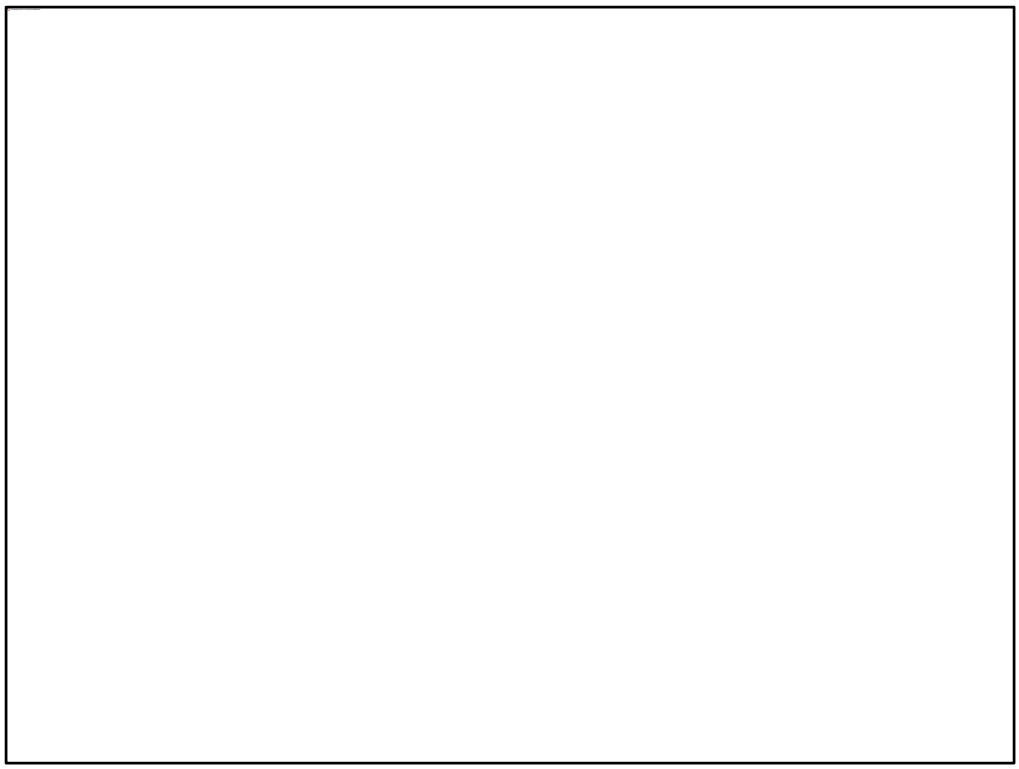

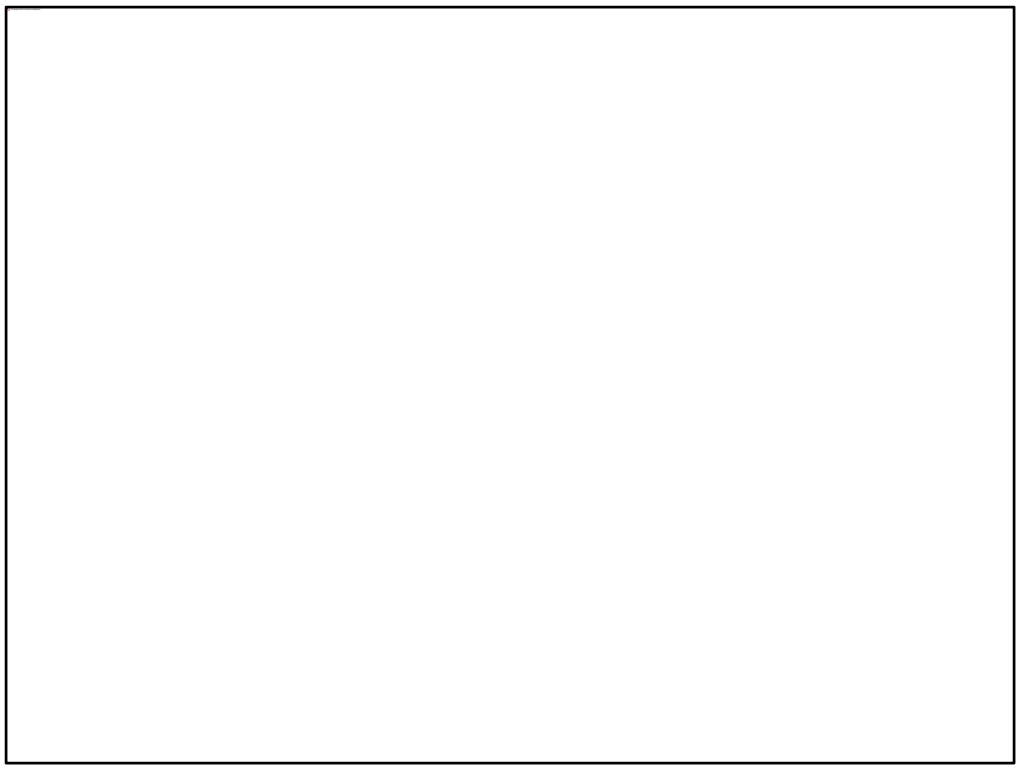

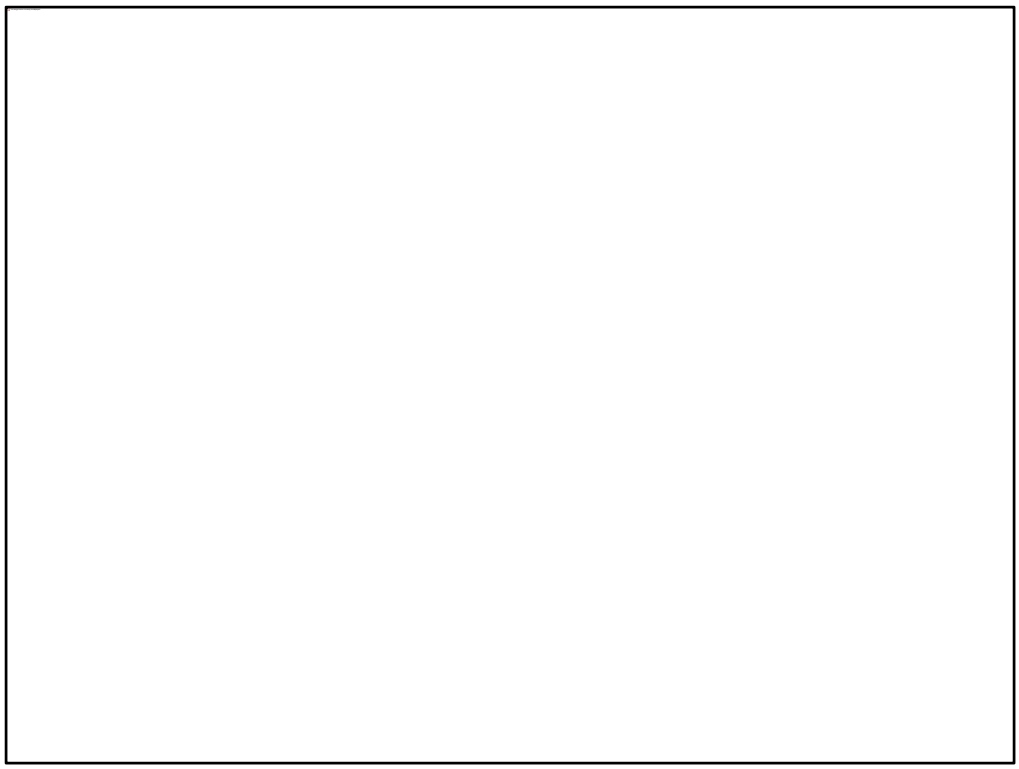


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