Ansbro Subdivision
Final Drainage Report

Site Location

The proposed 10.361 acre subdivision is located at the intersection of Darmstadt Road and Hoing Road, Vanderburgh County, Indiana. The subdivision will create a 3 lot residential subdivision (See Primary Plat) and is located at the northeast quarter of Section 13, Township 5 South, Range 11 West, Scott Township, Vanderburgh County, Indiana (See Figure #1).

It is recommended that the Army Corp of Engineers – Louisville District, Indiana Department of Environmental Management – Section 401 Water Quality Certification Program, and The Department of Natural Resources, Division of Water, Fish and Wildlife, and Botanical Resources and the Heritage Program be contacted to see if any of the property is within their jurisdiction and if permits are required prior to beginning any land disturbing activities.

Any soil disturbing activities totaling more than 1-acre will require an approved Storm Water Pollution Prevention Plan (SWPPP) and a Notice of Intent (NOI) filed with Indiana Department of Natural Resources (IDNR) to comply with 327 Indiana Administrative Code (IAC) 15-5-5 (Rule 5).

Flood Plain Data

The 10.361-acre site is located on rolling terrain of 5% to 10% slopes which the current land use is a meadow and wooded and an approximately 2.65 acre lake. Per Flood Insurance Rate Map (FIRM) Panel Number 180256 0055 C, dated August 5, 1991, Vanderburgh County, Indiana, no portion of this site lies within Zone A (100 year flood zone) (See Figure #2). No wetlands are identified on the site according to the U.S. Department of the Interior National Wetlands Inventory's 7.5-minute quadrangle map for Haubstadt, IN. (See Figures #3 & #4).

Existing Drainage Conditions

The undeveloped 10-year storm discharge rate for the 10.361 acres onsite plus 0.41

offsite acres along the east property limits was calculated to be 27.39 cubic feet per second (cfs) (See Figure #5; Drainage Basins). Additional Offsite Subbasin "A" and "B" (9.566 acres) located to the west and south of the subdivision flows through the development and into the existing 2.66 acre lake. The offsite areas add 15.10 cfs of storm water runoff to the calculations. Subbasin #1 (8.296 acres) storm water runoff flows through the existing lake. The storm water then discharges east through an existing 12-inch corrugated metal pipe (CMP) then into an existing 30-inch CMP under Mr. Robert Kerney's driveway. Subbasin #2 (2.467 acres), which includes Hoing Road, storm water runoff flows south along the existing toe of dam for the lake, then discharges through the existing 30-inch CMP under Mr. Robert Kerney's driveway The allowable discharge rate for the site was calculated to be 34.05 cfs. Existing storm sewer pipes are located under Darmstadt Road and the private driveway along the west property boundary. Design charts from the Hydraulic Design of Highway Culverts, FHWA-IP-85-15, dated September 1985 were used to calculate the capacity of the existing culverts.

The existing 12-inch CMP primary spillway has a capacity of 1.55 cfs with 0.5-foot of headwater available (Elevation =368 feet – Emergency Spillway elevation) and 2.68 cfs with 1.5-feet of headwater available (Elevation = 369 feet – Top of Berm). The existing Emergency Spillway has a calculated discharge rate of 58.81 cfs with 1-foot of water flowing through the weir. The water elevation raises approximately 0.50-foot and 0.75-feet during the 25-year and 100-year storms, respectively.

Lack of proper maintenance on the frontside and backside of the dam is resulting in invasive tree growth that may affect the integrity of the earthen dam and the discharge structure. The trees should be removed by saw cutting at grade level, leaving the root system intact. The discharge end of the existing 12-inch CMP primary spillway and the inlet end of the existing 30-inch CMP under Mr. Kerney's driveway could not be inspected on July 13, 2005. It is recommended that a rip rap aprons be installed per Indiana Handbook for Erosion Control in Developing Areas Practice #3.41 as necessary for erosion control.

The entire 20.33 acre watershed discharges through the 30-inch CMP under Mr. Kerney's Driveway. The storm water runoff to the pipe is only 6.5 cfs due to the detention provided in the existing lake. If the lake was drained and the berm removed, 5.25-feet of headwater (Approximate elevation of 461.5-feet) above the invert elevation of the pipe is required to discharge at the calculated 34.2 cfs runoff rate.

Proposed Drainage Conditions

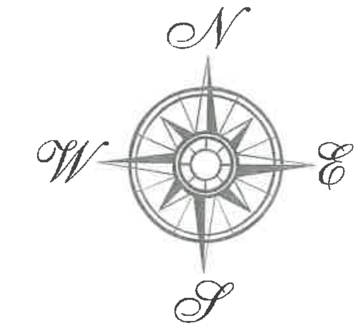
The proposed construction activity of 3 residential lots with driveways and lawns will not significantly increase the storm water runoff. The streets, public utilities, and storm sewers are installed. The new impervious areas are calculated to be approximately 4.6%. Onsite storm water runoff from Developed area was calculated as 22.87 cfs for the 10-year storm event.

New driveways are to be located along Darmstadt Road and Hoing Road. A 12-inch RCP is recommended under each driveway.

Soil Properties

According to the US Department of Agriculture Soil Survey of Vanderburgh County, Indiana, the site contains the following soil types: Hosmer silt loam (HoB2), 2 to 6 percent slopes, eroded; Hosmer silt loam (HoB3), 2 to 6 percent slopes, severely eroded; Zanesville silt loam (ZaC2), 6 to 12 percent slopes, eroded (See Figure #6).

Vanderburgh County



1 inch equals 500 feet

Legend

Wetlands Inventory
- Point
- Stream
- Area

Hydrology
- Ditch line
- Lake, pond or reservoir
- River or stream
- Swamp

Flood Insurance Rate
- A - 100 Year
- AE - 100 Year
- B - 500 Year

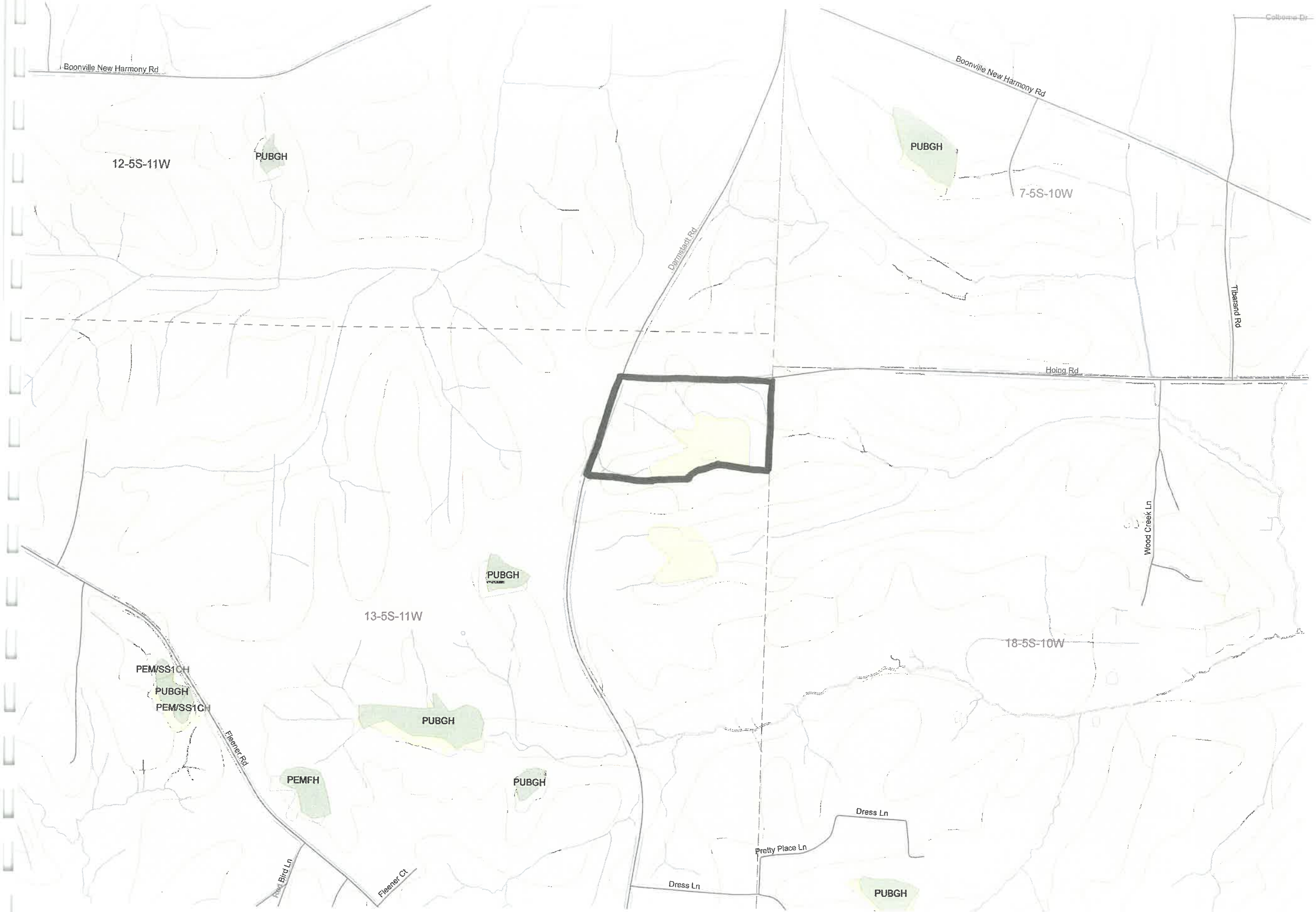
Transportation
- Railroad or abandoned track
- Road

Subdivisions
- Area
- Lots

Sections
- Boundary

Figure #3

Vanderburgh County Hydric Soils Map



1 inch equals 500 feet

Legend

Wetlands Inventory
- Point
- Stream
- Area

Hydrology
- Ditch line
- Lake, pond or reservoir
- River or stream
- Swamp

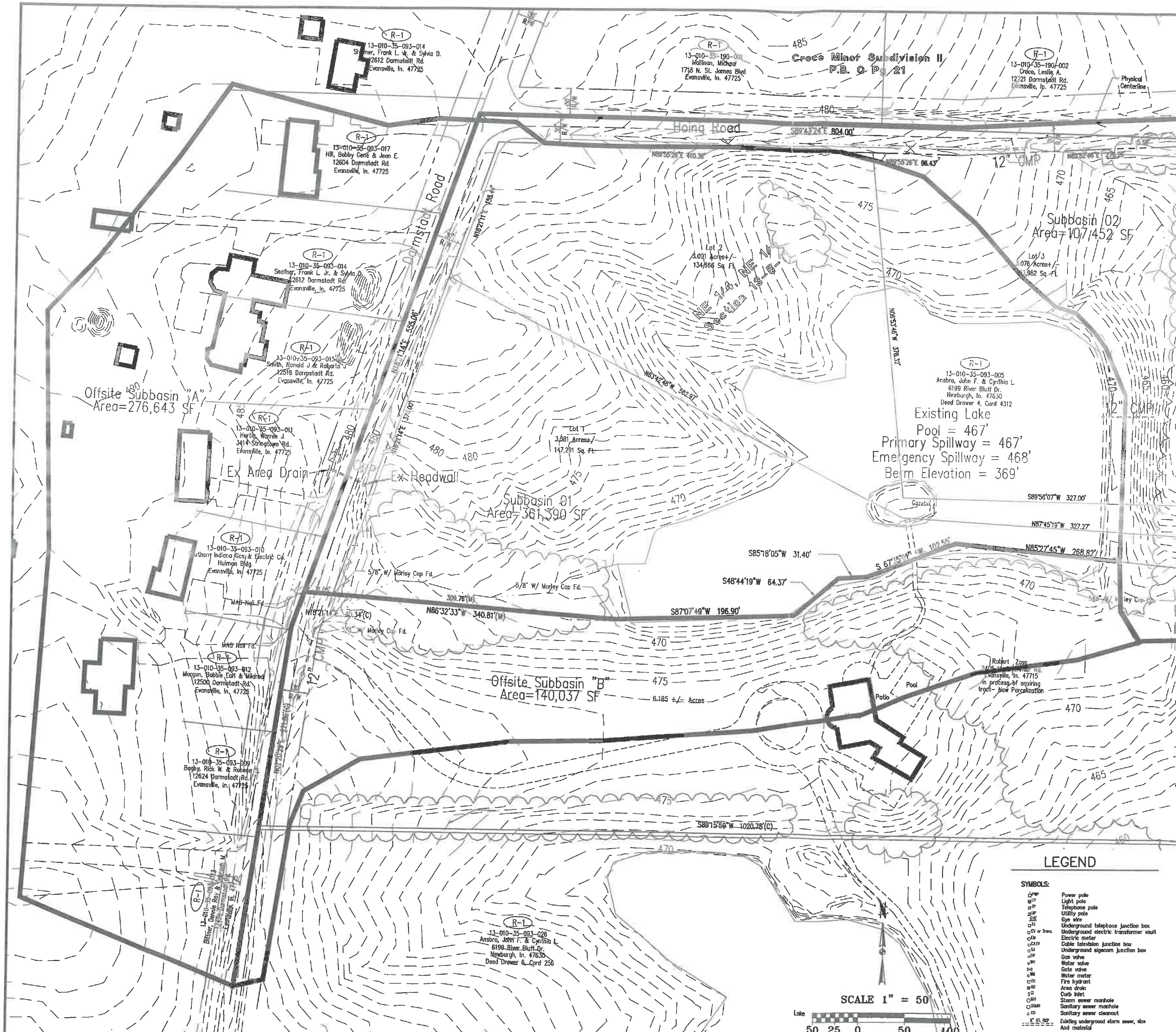
Soil Series
- All hydric
- Not hydric
- Unknown

Transportation
- Railroad or abandoned track
- Road

Subdivisions
- Area
- Lots

Sections
- Boundary

Figure #4



Note:

1. All pipes lengths are measured center of structure to center of structure, except pipes ending in flared end sections. Pipes ending in flared end sections shall be measured to the end of the pipe.
2. Design pipe slopes are calculated from the center of structure to the center of structure, or end of pipe for flared end sections. Construction pipe slopes may vary slightly if the structure cross slope does not match the design pipe slope. Flared end section slopes shall match design pipe slopes.
3. All storm, sanitary, potable water, and lateral pipes under and within 5 feet of a roadway or under a sidewalk shall have compacted sand backfill.

   All storm sewer pipes shall be RCP unless otherwise approved by the engineer. All sanitary sewer pipes shall comply with local sanitary sewer utility standards.
4. Bench Mark – Reference Bench Mark –
5. 100 Year Flood Zone – No Potion of Old Orchard Hill is in the 100-year flood zone according to the F.I.R.M. Panel Number 180256 0075 C for Vanderburgh County, Indiana.
6. Contractor shall comply with all local, state and federal codes, ordinances, rules, regulations, orders and other legal requirements of municipal authorities which bear on the performance of the work.
7. The contractor is cautioned that the location and/or elevation of existing utilities as shown on these plans is based on records of various companies, and where possible measurements taken in the field. The information is not to be relied on as being exact or complete. The contractor must contact the appropriate utility company at least 48 hours before any excavation to request exact field location of utilities.

   Indiana Underground Utility Locate Service,
   Phone 1-800-382-5544
8. Material specifications shall be in conformance with applicable portions of the INDOT standard specifications, (latest edition) unless specifically stated otherwise on these plans, contract documents or local code.
9. Rip Rap Lined Channels per Indiana Handbook for Erosion Control Practice 3.32 or North American Green C-350 permanent erosion control blanket, installed per manufacturers specifications or approved equal.
   Note: See Indiana Handbook for Erosion Control in Developing Areas for Installation and material requirements.
10. Rip Rap Lined Chute per Indiana Handbook for Erosion Control Practice 3.41.
   Note: See Indiana Handbook for Erosion Control in Developing Areas for Installation and material requirements.
   North American Green C-350 permanent erosion control blanket, installed per manufacturers specifications or approved equal in designated areas only.

Morley and Associates Inc.
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Architecture
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Henderson, Ky (270) 830-0300
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www.morleyandassociates.com

Project / Client: Ansbro Subdivision
Darmstadt Road & Hoing Road

Sheet Title: **Drainage Basins**

Scale: 1" = 50'

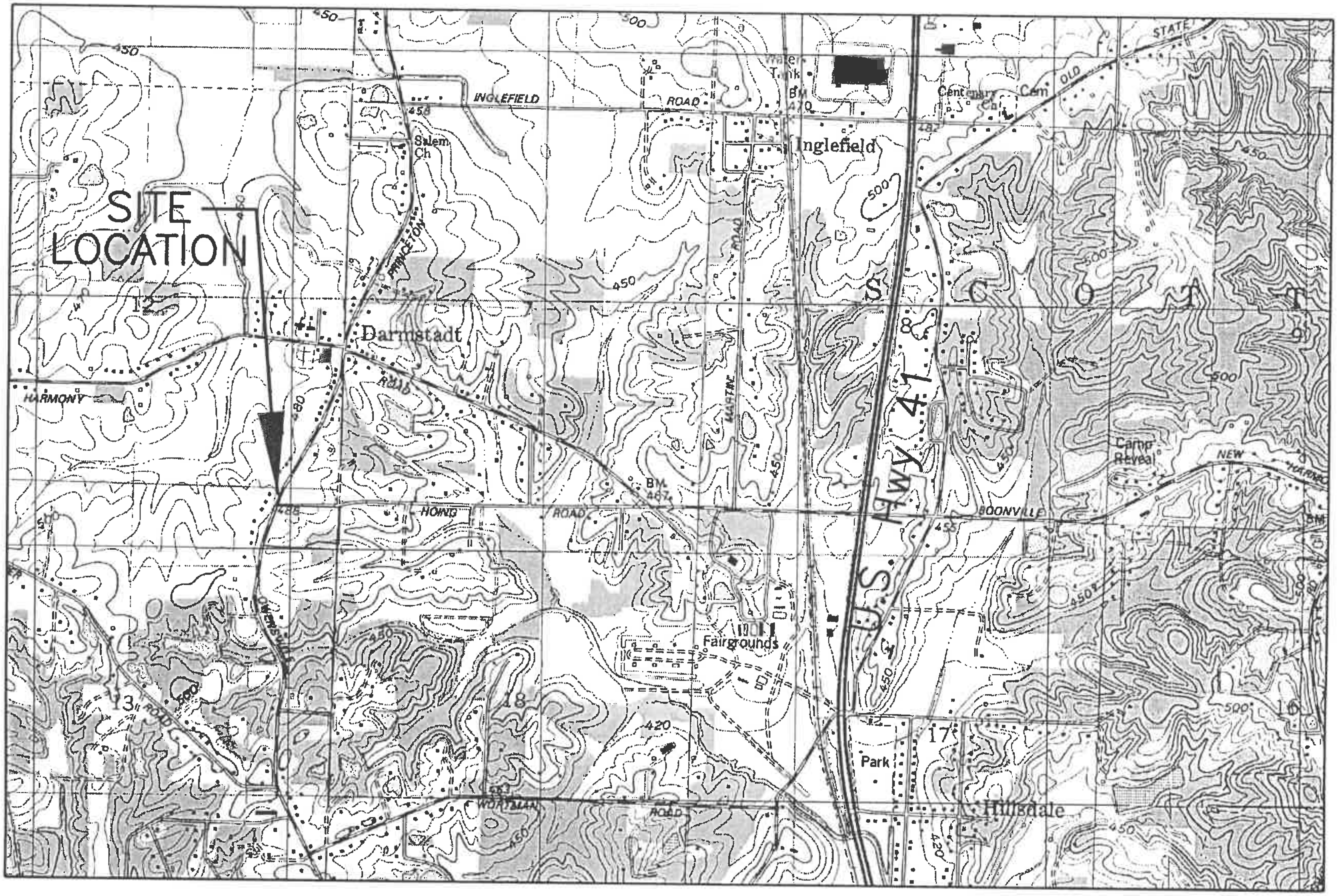
Designed By:	Job Number:
JMK	6408-4B
Drawn By:	Date:
JMK	07/20/05

Filename: 6408base.dwg

Sheet Number: **C-01**

Figure #5

Project Location Map

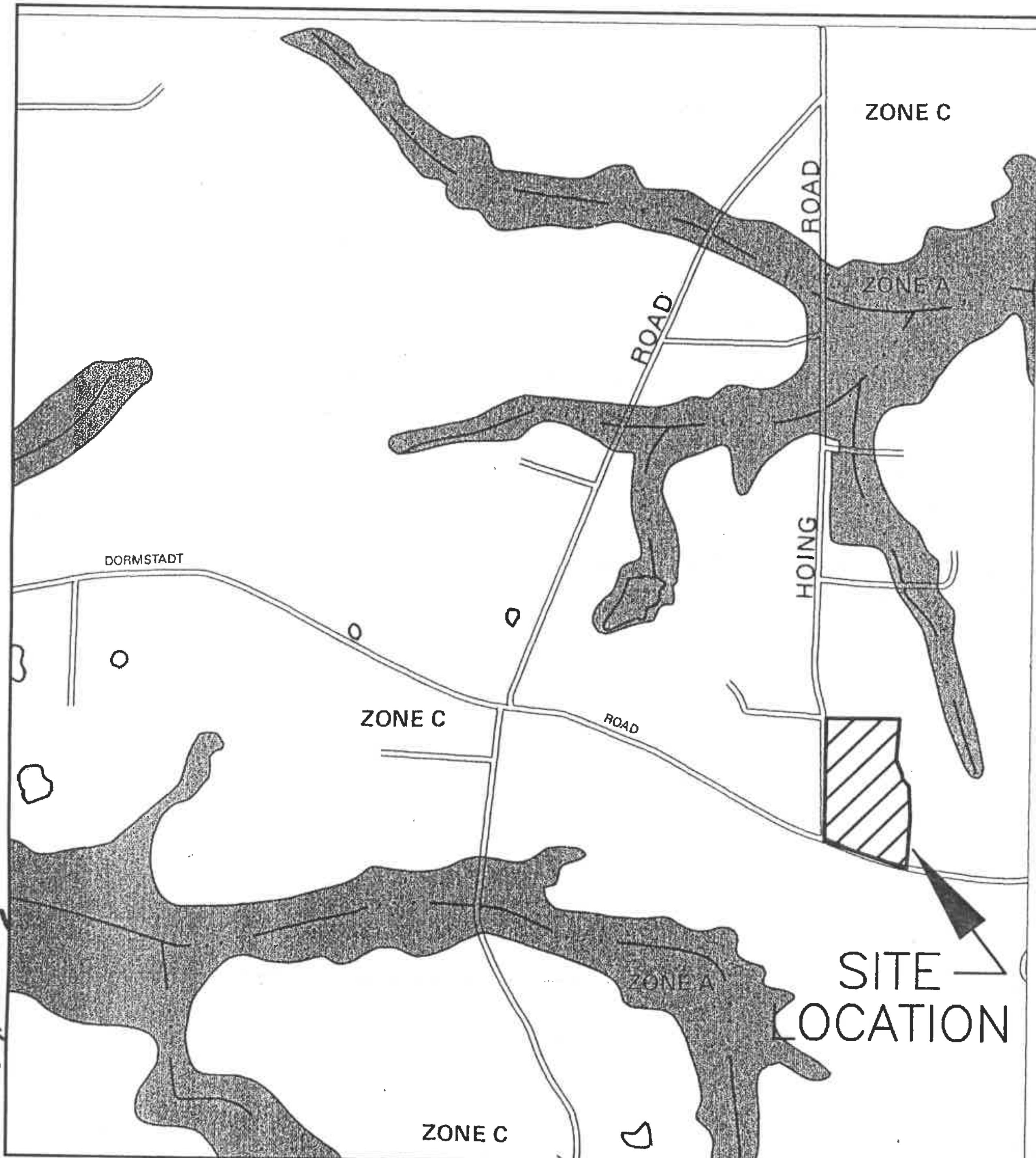


Evansville North, IN 1988 7.5' Quad
j:\6408\civil\Quad Loc Map.dwg
Prepared by: Morley and Associates, Inc. (JMK)
Project Number 6408-4B Date: July 20, 2005

NORTH
Scale: 1" = 2000'

Applicant Name: John F. and Cynthia L. Ansbro
Project Title: Ansbro Subdivision

Figure #1



APPROXIMATE SCALE

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

VANDERBURGH
COUNTY,
INDIANA
UNINCORPORATED AREAS

PANEL 55 OF 100

COMMUNITY-PANEL NUMBER
180256 0055 C

MAP REVISED:
AUGUST 5, 1991

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Figure #2

6296-4B

Developed Conditions

Subbasin	Area (Acres)	C	N
1	8.30	0.613	0.273
2	2.47	0.361	0.414
A	6.35	0.359	0.335
B	3.22	0.315	0.436

Sum of Areas= 20.33 Weighted C= 0.456 Weighted N= 0.335

Developed Drainage Basin

Basin: Sub #1 | Total Area = 361,390 S.F. = 8.296 Ac.

Surface									C	N
Structures	2.5	Total	4,000	S.F.	=	10,000 S.F. =	0.23	Ac.	0.92	0.02
Drives	2	Total	1,200	S.F.	=	2,400 S.F. =	0.06	Ac.	0.70	0.10
Pavement	546	L.F.	10.0	Width	=	5,460 S.F. =	0.13	Ac.	0.92	0.02
Patios	2	Total	2,000	S.F.	=	4,000 S.F. =	0.09	Ac.	0.92	0.02
Sidewalks	0	L.F.	4	Width	=	0 S.F. =	0.00	Ac.	0.92	0.02
Lawn (0-2%)			0	S.F.	=		0.00	Ac.	0.15	0.40
Lawn (2-5%)			0	S.F.	=		0.00	Ac.	0.25	0.40
Lawn (5-10%)			202,808	S.F.	=		4.66	Ac.	0.40	0.40
Lawn (>10%)			0	S.F.	=		0.00	Ac.	0.55	0.40
Woods (2-5%)			21,000	S.F.	=		0.48	Ac.	0.24	0.80
Woods (5-10%)			0	S.F.	=		0.00	Ac.	0.36	0.80
Woods (>10%)			0	S.F.	=		0.00	Ac.	0.48	0.80
Water			115,722	S.F.	=		2.66	Ac.	1.00	0.00
				S.F.	=		0.00	Ac.		

Weighted c =	0.613	
Weighted N =	0.273	
L =	300	Ft.
H =	16.0	Ft.
S =	0.0533	Ft./Ft.
tc =	12.82	Minutes
Tc =	13.46	Minutes

0.64 Min Ditch Flow

I(10) =	3.623	In./Hr.
Q(10) =	18.42	CFS
I(25) =	5.308	In./Hr.
Q(25) =	26.99	CFS
I(100) =	6.481	In./Hr.
Q(100) =	32.95	CFS

Developed Drainage Basin

Basin: Sub #2 | Total Area = 107,452 S.F. = 2.467 Ac.

Surface									C	N
Structures	0.5	Total	4,000	S.F.	=	2,000 S.F. =	0.05	Ac.	0.92	0.02
Drives	1	Total	1,200	S.F.	=	1,200 S.F. =	0.03	Ac.	0.70	0.10
Pavement	807	L.F.	10.0	Width	=	8,070 S.F. =	0.19	Ac.	0.92	0.02
Patios	1	Total	2,000	S.F.	=	2,000 S.F. =	0.05	Ac.	0.92	0.02
Sidewalks	0	L.F.	4	Width	=	0 S.F. =	0.00	Ac.	0.92	0.02
Lawn (0-2%)			0	S.F.	=		0.00	Ac.	0.15	0.40
Lawn (2-5%)			78,142	S.F.	=		1.79	Ac.	0.25	0.40
Lawn (5-10%)			0	S.F.	=		0.00	Ac.	0.40	0.40
Lawn (>10%)			0	S.F.	=		0.00	Ac.	0.55	0.40
Woods (2-5%)			0	S.F.	=		0.00	Ac.	0.24	0.80
Woods (5-10%)			2,840	S.F.	=		0.07	Ac.	0.36	0.80
Woods (>10%)			13,200	S.F.	=		0.30	Ac.	0.48	0.80
Water			0	S.F.	=		0.00	Ac.	1.00	0.00
				S.F.	=		0.00	Ac.		

Weighted c =	0.361	
Weighted N =	0.414	
L =	100	Ft.
H =	2.0	Ft.
S =	0.0200	Ft./Ft.
tc =	11.73	Minutes
Tc =	14.57	Minutes

2.84 Min Ditch Flow

I(10) =	4.994	In./Hr.
Q(10) =	4.45	CFS
I(25) =	5.527	In./Hr.
Q(25) =	4.93	CFS
I(100) =	7.083	In./Hr.
Q(100) =	6.32	CFS

Developed Drainage Basin

Basin:	Lot #3 Driveway	Total Area =			17,155	S.F. =	0.394	Ac.		

Surface						=					C	N
Structures	0	Total	4,000	S.F.	=	0	S.F. =	0.00	Ac.	0.92	0.02
Drives	1	Total	240	S.F.	=	240	S.F. =	0.01	Ac.	0.70	0.10
Pavement	807	L.F.	10.0	Width	=	8,070	S.F. =	0.19	Ac.	0.92	0.02
Patios	0	Total	2,000	S.F.	=	0	S.F. =	0.00	Ac.	0.92	0.02
Sidewalks	0	L.F.	4	Width	=	0	S.F. =	0.00	Ac.	0.92	0.02
Lawn (0-2%)			0	S.F.	=			0.00	Ac.	0.15	0.40
Lawn (2-5%)			8,845	S.F.	=			0.20	Ac.	0.25	0.40
Lawn (5-10%)			0	S.F.	=			0.00	Ac.	0.40	0.40
Lawn (>10%)			0	S.F.	=			0.00	Ac.	0.55	0.40
Woods (2-5%)			0	S.F.	=			0.00	Ac.	0.24	0.80
Woods (5-10%)			0	S.F.	=			0.00	Ac.	0.36	0.80
Woods (>10%)			0	S.F.	=			0.00	Ac.	0.48	0.80
Water			0	S.F.	=			0.00	Ac.	1.00	0.00
				S.F.	=			0.00	Ac.		

Weighted c =		0.571	
Weighted N =		0.217	
	L =	100	Ft.
	H =	2.0	Ft.
	S =	0.0200	Ft./Ft.
	tc =	8.68	Minutes
	Tc =	10.22	Minutes

1.54 Min Ditch Flow

I(10) =	5.342	In./Hr.
Q(10) =	1.20	CFS
I(25) =	5.886	In./Hr.
Q(25) =	1.32	CFS
I(100) =	7.085	In./Hr.
Q(100) =	1.59	CFS

Lot #3 Driveway

Channel Flow

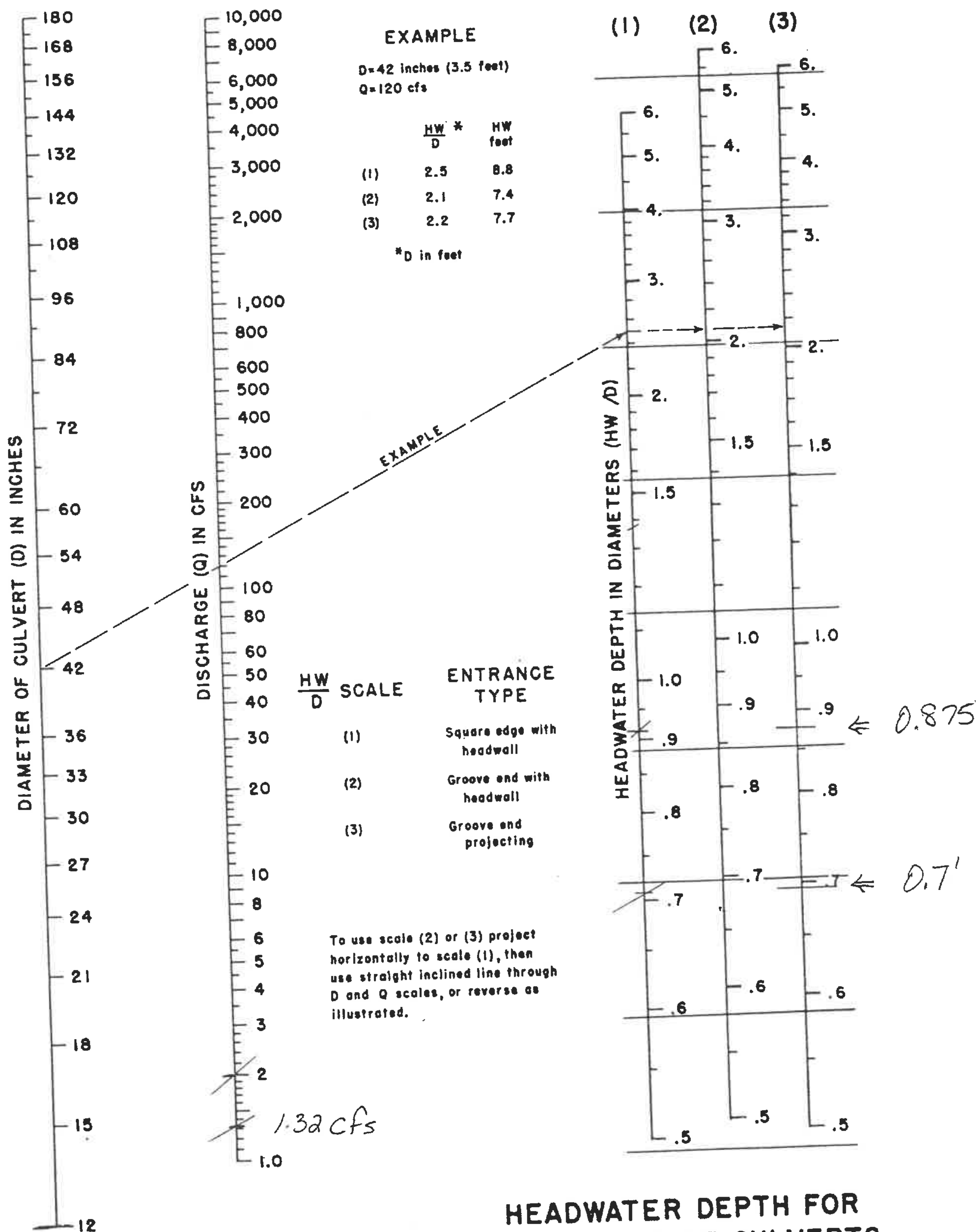
$L = 478'$
$h = 486' - 473' = 13'$
$S = 0.0272$ ft/ft
$n = 0.035$

Typical 1' flat bottom swale ; 3:1 side slopes
Area = $4 ft^2$ Hyd. Radius = 0.6359 ft
Perimeter = 6.29 ft

$$v = \frac{1.49}{0.035} (0.6359)^{2/3} (0.0272)^{1/2} = 5.18 \text{ ft/s}$$

$$t_t = \frac{L}{60 v} = \frac{478'}{60(5.18 \text{ ft/s})} = 1.54 \text{ minutes}$$

CHART 10



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

6296-4B

Undeveloped Conditions

Subbasin	Area (Acres)	C	N
1	8.30	0.566	0.290
2	2.47	0.465	0.431
A	6.35	0.359	0.335
B	3.22	0.315	0.436

Sum of Areas= 20.33 Weighted C= 0.449 Weighted N= 0.344

Undeveloped Drainage Basin

Basin: US-1 | Total Area = 361,390 S.F. = 8.296 Ac.

Surface										C	N
Structures	0	Total	-	S.F.	=	0	S.F. =	0.00	Ac.	0.92	0.02
Drives	0	Total	-	S.F.	=	18	S.F. =	0.00	Ac.	0.70	0.10
Pavement	546	L.F.	10.0	Width	=	5,460	S.F. =	0.13	Ac.	0.92	0.02
Patios	0	Total	-	S.F.	=	0	S.F. =	0.00	Ac.	0.92	0.02
Sidewalks	0	L.F.	-	Width	=	0	S.F. =	0.00	Ac.	0.92	0.02
Meadow (0-2%)			0	S.F.	=			0.00	Ac.	0.12	0.40
Meadow (2-5%)			0	S.F.	=			0.00	Ac.	0.24	0.40
Meadow (5-10%)			219,090	S.F.	=			5.03	Ac.	0.36	0.40
Meadow (>10%)			0	S.F.	=			0.00	Ac.	0.48	0.40
Woods (2-5%)			21,100	S.F.	=			0.48	Ac.	0.24	0.80
Woods (5-10%)			0	S.F.	=			0.00	Ac.	0.36	0.80
Woods (>10%)			0	S.F.	=			0.00	Ac.	0.36	0.80
Water			115,722	S.F.	=			2.66	Ac.	1.00	0.00
				S.F.	=			0.00	Ac.		

Weighted c =	0.566	
Weighted N =	0.290	
L =	300	Ft.
H =	16.0	Ft.
S =	0.0533	Ft./Ft.
tc =	13.19	Minutes
Tc =	13.83	Minutes

0.64 Min Ditch Flow

I(10) =	4.717	In./Hr.
Q(10) =	22.17	CFS
I(25) =	5.242	In./Hr.
Q(25) =	24.63	CFS
I(100) =	6.412	In./Hr.
Q(100) =	30.13	CFS

Undeveloped Drainage Basin

Basin: US-2 | Total Area = 107,452 S.F. = 2.467 Ac.

Surface										C	N
Structures	0	Total	-	S.F.	=	0	S.F. =	0.00	Ac.	0.92	0.02
Drives	0	Total	-	S.F.	=	0	S.F. =	0.00	Ac.	0.70	0.10
Pavement	807	L.F.	10.0	Width	=	8,070	S.F. =	0.19	Ac.	0.92	0.02
Patios	0	Total	-	S.F.	=	0	S.F. =	0.00	Ac.	0.92	0.02
Sidewalks	0	L.F.	-	Width	=	0	S.F. =	0.00	Ac.	0.92	0.02
Meadow (0-2%)			0	S.F.	=			0.00	Ac.	0.12	0.40
Meadow (2-5%)			9,400	S.F.	=			0.22	Ac.	0.24	0.40
Meadow (5-10%)			8,000	S.F.	=			0.18	Ac.	0.36	0.40
Meadow (>10%)			65,942	S.F.	=			1.51	Ac.	0.48	0.40
Woods (2-5%)			0	S.F.	=			0.00	Ac.	0.24	0.80
Woods (5-10%)			2,840	S.F.	=			0.07	Ac.	0.36	0.80
Woods (>10%)			13,200	S.F.	=			0.30	Ac.	0.36	0.80
Water			0	S.F.	=			0.00	Ac.	1.00	0.00
				S.F.	=			0.00	Ac.		

Weighted c =	0.465	
Weighted N =	0.431	
L =	100	Ft.
H =	2.0	Ft.
S =	0.0200	Ft./Ft.
tc =	11.96	Minutes
Tc =	14.80	Minutes

2.84 Min Ditch Flow

I(10) =	4.545	In./Hr.
Q(10) =	5.22	CFS
I(25) =	5.069	In./Hr.
Q(25) =	5.82	CFS
I(100) =	6.231	In./Hr.
Q(100) =	7.15	CFS

Offsite Undeveloped Drainage Basin

Basin: OS-A | Total Area = 276,643 S.F. = 6.351 Ac.

Surface									C	N
Structures	8	Total	-	S.F.	=	17,789	S.F. =	0.41 Ac.	0.92	0.02
Drives	6	Total	-	S.F.	=	21,113	S.F. =	0.48 Ac.	0.70	0.10
Pavement	986	L.F.	10.0	Width	=	9,860	S.F. =	0.23 Ac.	0.92	0.02
Patios	2	Total	-	S.F.	=	3,147	S.F. =	0.07 Ac.	0.92	0.02
Sidewalks	0	L.F.	-	Width	=	0	S.F. =	0.00 Ac.	0.92	0.02
Lawn (0-2%)			0	S.F.	=			0.00 Ac.	0.15	0.40
Lawn (2-5%)			224,734	S.F.	=			5.16 Ac.	0.25	0.40
Lawn (5-10%)			0	S.F.	=			0.00 Ac.	0.40	0.40
Lawn (>10%)			0	S.F.	=			0.00 Ac.	0.55	0.40
Woods (2-5%)			0	S.F.	=			0.00 Ac.	0.24	0.80
Woods (5-10%)			0	S.F.	=			0.00 Ac.	0.36	0.80
Woods (>10%)			0	S.F.	=			0.00 Ac.	0.36	0.80
Water			0	S.F.	=			0.00 Ac.	1.00	0.00
				S.F.	=			0.00 Ac.		

Weighted c =	0.359	
Weighted N =	0.335	
L =	232	Ft.
H =	11.0	Ft.
S =	0.0474	Ft./Ft.
tc =	12.87	Minutes
Tc =	16.07	Minutes

3.20 Min Ditch Flow

I(10) =	4.423	In./Hr.
Q(10) =	10.08	CFS
I(25) =	4.934	In./Hr.
Q(25) =	11.25	CFS
I(100) =	6.081	In./Hr.
Q(100) =	13.86	CFS

Offsite Undeveloped Drainage Basin

Basin: OS-B | Total Area = 140,037 S.F. = 3.215 Ac.

Surface									C	N
Structures	0.5	Total	-	S.F.	=	1,655	S.F. =	0.04 Ac.	0.92	0.02
Drives	0.5	Total	-	S.F.	=	5,725	S.F. =	0.13 Ac.	0.70	0.10
Pavement	440	L.F.	10.0	Width	=	4,400	S.F. =	0.10 Ac.	0.92	0.02
Patios	0.5	Total	-	S.F.	=	3,406	S.F. =	0.08 Ac.	0.92	0.02
Sidewalks	140	L.F.	5	Width	=	700	S.F. =	0.02 Ac.	0.92	0.02
Lawn (0-2%)			0	S.F.	=			0.00 Ac.	0.15	0.40
Lawn (2-5%)			97,679	S.F.	=			2.24 Ac.	0.25	0.40
Lawn (5-10%)			0	S.F.	=			0.00 Ac.	0.40	0.40
Lawn (>10%)			0	S.F.	=			0.00 Ac.	0.55	0.40
Woods (2-5%)			26,472	S.F.	=			0.61 Ac.	0.24	0.80
Woods (5-10%)			0	S.F.	=			0.00 Ac.	0.36	0.80
Woods (>10%)			0	S.F.	=			0.00 Ac.	0.36	0.80
Water			0	S.F.	=			0.00 Ac.	1.00	0.00
				S.F.	=			0.00 Ac.		

Weighted c =	0.315	
Weighted N =	0.436	
L =	180	Ft.
H =	10.0	Ft.
S =	0.0556	Ft./Ft.
tc =	12.46	Minutes
Tc =	12.46	Minutes

0.00 Min Ditch Flow

I(10) =	4.960	In./Hr.
Q(10) =	5.02	CFS
I(25) =	5.484	In./Hr.
Q(25) =	5.56	CFS
I(100) =	6.666	In./Hr.
Q(100) =	6.75	CFS

Undeveloped Subbasin #02

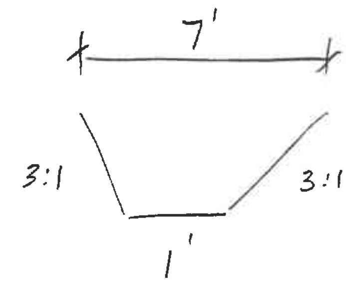
Channel Flow #1

$L = 701'$

$h = 486' - 460' = 26\ ft$

$S = 0.0371\ ft/ft$

$n = 0.035$



* Assumed Cross-Section
No Existing road side ditch

Cross-Section area $= (b + zy)y = (1 + 3(1))(1) = 4\ ft^2$

perimeter $= b + 2y\sqrt{1 + z^2} = (1) + 2(1)\sqrt{1 + (3)^2} = 6.29\ ft$

Hyd Radius $= A/p = 4/6.29 = 0.6359$

$$v = \frac{1.49}{n} R^{2/3} S^{1/2} = \frac{1.49}{0.035} (0.6359)^{2/3} (0.0371)^{1/2} = 6.05\ ft/s$$

$$t_t = \frac{L}{60v} = \frac{701\ ft}{60(6.05\ ft/s)} = 1.93 \text{ minutes}$$

Channel Flow #2

$L = 179'$

$h = 460' - 456' = 4\ ft$

$S = 0.0223$

$n = 0.050$

Use Same ditch Assumption

$R = 0.6359$

$$v = \frac{1.49}{0.05} (0.6359)^{2/3} (0.0223)^{1/2} = 3.29\ ft/s$$

$$t_t = \frac{L}{60v} = \frac{179\ ft}{60(3.29\ ft/s)} = 0.91 \text{ minutes}$$

$$t_t = 1.93 + 0.91 = 2.84 \text{ minutes}$$

Undeveloped Subbasin #01

Shallow Concentrated Flow

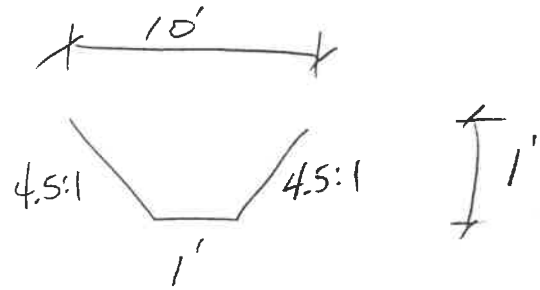
L = 116'
h = 471 − 467 = 4'
S = 0.0345 ft/ft

v = 3.0 ft/s (from chart)

$$t_t = \frac{L}{60v} = \frac{116\,ft}{60(3.0\,ft/s)} = 0.64\ min$$

Offsite Subbasin "A"

Channel Flow



$L = 466'$
$h = 486 - 479 = 7'$
$S = 0.015 \ ft/ft$
$n = 0.035$

Cross Sectional Area $= (1 + 4.5(1))(1) = 5.5 \ ft^2$
Perimeter $= 4.5 + (2)(1)\sqrt{1 + (4.5)^2} = 17.23 ft$
Hyd Radius $(A/P) = 5.5/17.23 = 0.3192$

$$v = \frac{1.49}{n} R^{2/3} S^{1/2} = \frac{1.49}{0.035} (0.3192)^{2/3} (0.015)^{1/2} = 2.43 \ ft/s$$

$$t_t = \frac{L}{60v} = \frac{466 \ ft}{60(2.43 \ ft/s)} = 3.20 \text{ min.}$$

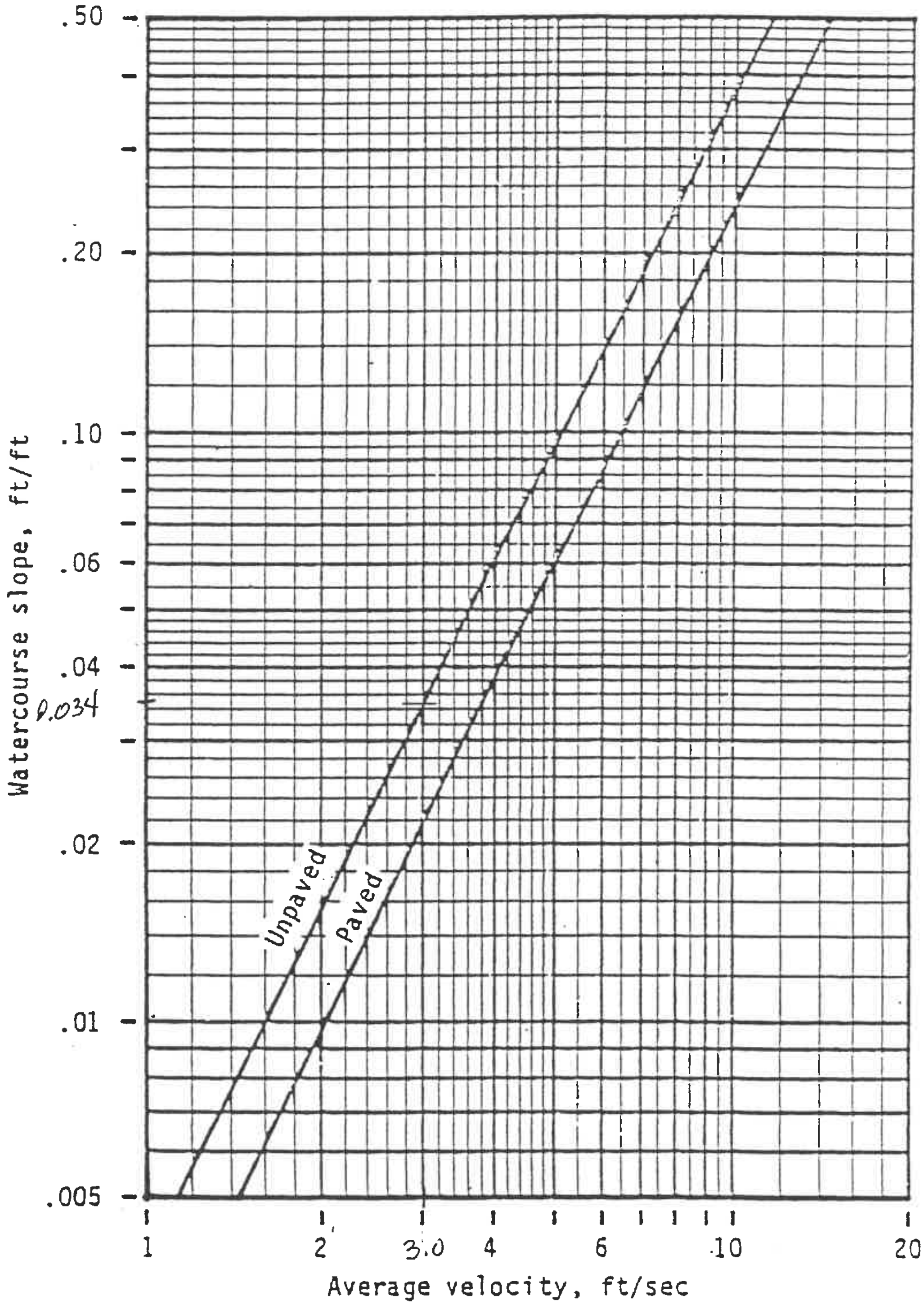


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

TABLE 807

RAINFALL INTENSITY-DURATION-FREQUENCY TABLE FOR EVANSVILLE

INTENSITY IN INCHES PER HOUR

STORM DURATION	STORM RETURN PERIOD IN YEARS				
	5	10	25	50	100
5 MIN	6.063	6.625	7.208	7.936	8.469
10 MIN	4.863	5.380	5.925	6.616	7.126
15 MIN	4.029	4.515	5.033	5.697	6.194
30 MIN	2.837	3.226	3.646	4.194	4.608
60 MIN	1.549	1.819	2.078	2.412	2.663
2.0 HRS	1.053	1.230	1.400	1.620	1.785
3.0 HRS	0.774	0.899	1.019	1.175	1.291
4.0 HRS	0.632	0.736	0.836	0.965	1.062
5.0 HRS	0.524	0.606	0.684	0.785	0.861
6.0 HRS	0.453	0.522	0.589	0.676	0.741
7.0 HRS	0.399	0.459	0.516	0.591	0.647
8.0 HRS	0.358	0.412	0.463	0.530	0.581
9.0 HRS	0.323	0.370	0.415	0.472	0.516
10 HRS	0.297	0.339	0.379	0.431	0.470
11 HRS	0.276	0.314	0.351	0.399	0.435
12 HRS	0.259	0.296	0.331	0.376	0.410
13 HRS	0.245	0.280	0.314	0.357	0.390
14 HRS	0.233	0.267	0.299	0.341	0.372
15 HRS	0.220	0.252	0.281	0.320	0.349
16 HRS	0.209	0.238	0.266	0.302	0.329
17 HRS	0.198	0.225	0.251	0.284	0.310

TABLE 803

UNDEVELOPED RUNOFF COEFFICIENTS (C_u)

SURFACE TYPE:

WOODLAND, TURFED MEADOWS
ROUGH PASTURE, FALLOW BRUSH:

SLOPE:	
Less than 2%	C = 0.12
2% to 5%	C = 0.24
5+% to 10%	C = 0.36
Over 10%	C = 0.48

CULTIVATED FIELDS:

Less than 2%	C = 0.20
2% to 5%	C = 0.35
5+% to 10%	C = 0.50
Over 10%	C = 0.65

TABLE 804

DEVELOPED RUNOFF COEFFICIENTS (C_d)

SURFACE TYPE:

PAVEMENT, ROOFTOP
OTHER IMPERVIOUS SURFACES:

Less than 2%	C = 0.92
2% to 5%	C = 0.94
5+% to 10%	C = 0.96
Over 10%	C = 0.98

LAWNS WITH TURF:

Less than 2%	C = 0.15
2% to 5%	C = 0.25
5+% to 10%	C = 0.40
Over 10%	C = 0.55

ALL WATER SURFACES
BASINS, PONDS & LAKES:

C = 1.00

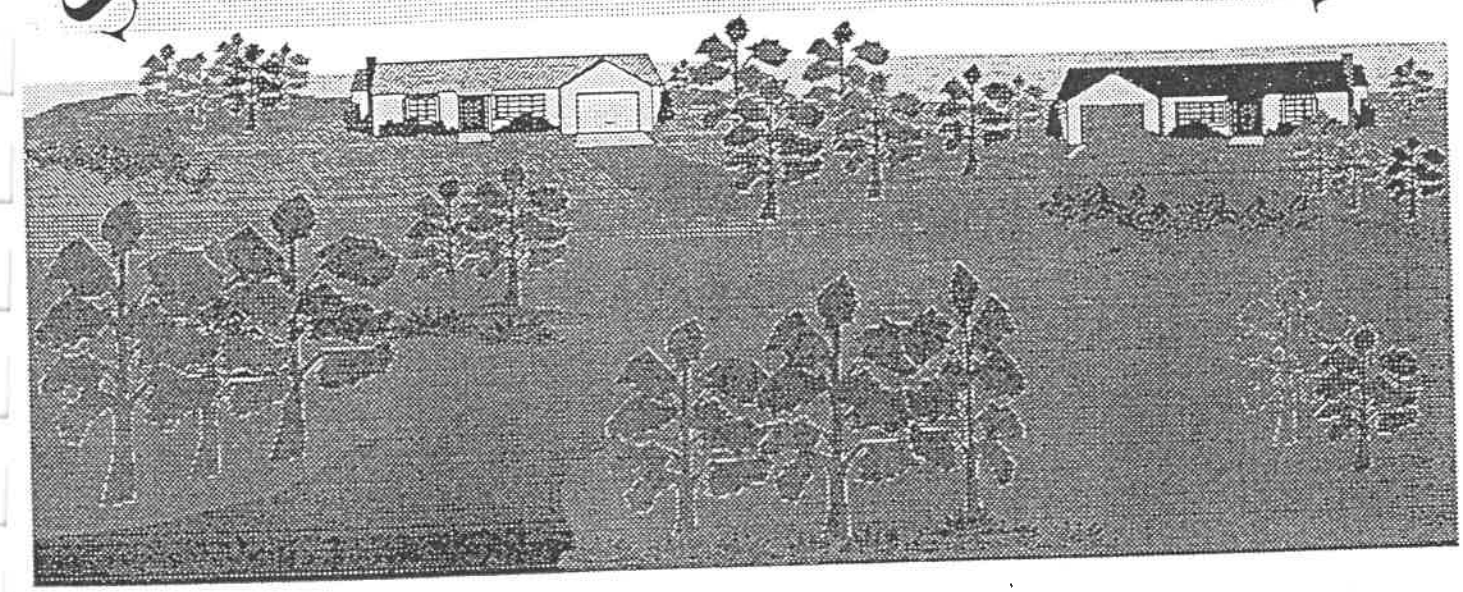
TABLE 1002

TYPICAL VALUES OF MANNING'S "n"

TYPE OF MATERIAL		MANNING'S "n"	MAX. VELOCITY
CLOSED CONDUITS/CULVERTS:			
PVC; STORM SEWER GRADES		0.010	15 fps
CONCRETE (circular or elliptical)		0.011	15 fps
SMOOTH FLOW HDPE		0.010	15 fps
PRECAST CONCRETE BOXES		0.013	15 fps
C.1 or D.1 S.J. Type/Cement Lined		0.013	15 fps
CORRUGATED METAL PIPE:	CIRC. WELD	SPIRAL WELD	
Unpaved	0.024	0.021	7 fps
25% Paved	0.021	0.018	7 fps
50% Paved	0.018	0.015	7 fps
100% Paved	0.013	0.013	7 fps
OTHER CONCRETE CULVERTS		0.013	
OPEN CHANNELS:			
CONCRETE, Trowel Finish		0.013	
CONCRETE, Broom or Float Finish		0.015	
GUNITE		0.018	
RIPRAP, Placed		0.030	
RIPRAP, Dumped		0.035	
GABIONS		0.028	
NEW EARTH		0.025	
MATURE EARTH, Some Weeds		0.030	
MATURE, Dense Weeds		0.040	
MATURE, Weeds & Brush		0.040	
SWALE, Grass Cover		0.035	

OTHER "n" VALUES SHALL BE TAKEN FROM MANUFACTURERS' DATA.

Stormwater Drainage Manual



Research Engineers

Christopher B. Burke

Thomas T. Burke

H-94-6

(July 1994)

HERPICC

Highway Extension and Research Project
for Indiana Counties and Cities

A Federal Highway Administration
LTAP Technology Transfer Center

Table 3.2.4 (cont'd)

Kerby (1959)

$$t_c = K\ (L\ N\ s^{-0.5})^{0.467}$$

where K is equal to 0.83 (US Customary units) or 1.44 (Metric units), L is the length of flow in ft (m), s is the average slope of overland flow, ft/ft (m/m), and N is the retardance roughness coefficient given in Table 3.2.5.

The length used in the equation is the straight-line distance from the most distant point of the watershed to the outlet, measured parallel to the slope of the land until a well-defined channel is reached. Watersheds of less than 10 acres were used to calibrate the model; slopes were less than 1%; N values were 0.8 and less and surface flow dominated (McCuen, 1989).

Izzard (1946)

$$t_c = \frac{K(Bi + c')\ L^{\frac{1}{3}}}{s^{\frac{1}{3}}\ i^{\frac{2}{3}}}$$

where K is equal to 41.025 for U.S. customary units (113.391 for metric), B is equal to 0.0007 for U.S custumary units (0.00027 for metric), c′ is the retardance coefficient given in Table 3.2.7, *i* is the rainfall intensity, in/hr (cm/hr), L is the length of flow path in ft (m), and s is the slope of overland flow path, ft/ft (m/m).

The product of *i* and L must be less than 500 in-ft/hr (390 cm-m/hr) to consider using this formula. In addition, well defined channels should **not** be present. This method was developed in laboratory experiments for the overland flow on roadway and turf surfaces.

Table 3.2.5
Values of N for Kerby's Formula (Kerby, 1959)

Type of Surface	N
Smooth impervious surface	0.02
Smooth bare packed soil	0.10
Poor grass, cultivated row crops or moderately rough bare surface	0.20
Deciduous timberland	0.60
Pasture or Overage grass	0.40
Conifer timberland, deciduous timberland with deep forest litter or dense grass	0.80

PIPE FLOW: For a pipe flowing full, but not under pressure, Manning's Equation (Equation 4.2.1) may be used to calculate the flowrate. As soon as a depth of water develops above the pipe the flowrate must be calculated using a modified form of the Manning equation and must include entrance and exit losses. Equation 6.3.5 is used to calculate the flowrate under these conditions,

$$Q = A_p \left[\frac{h_p}{\frac{K_e + K_o}{2g} + \frac{2.87 n^2 L}{D^{4/3}}} \right]^{1/2} \qquad (6.3.5)$$

where Q is the flowrate in cfs, A_p is the area of the pipe (ft²), K_e is the entrance loss coefficient (given in Table 6.3.3), K_o is the outlet loss coefficient (usually taken as 1.0), D is the pipe diameter (ft), n is Manning's roughness coefficient (Table 4.2.1), L is the length of pipe (ft) (Equation assumes a free jet @ exit), and h_p is the height of water surface above center of pipe opening (ft).

All of the equations presented may be used to calculate the flowrate Q. Often the flowrate is known and the orifice opening, weir size or pipe diameter are the parameters actually required. In these cases the equations are rearranged to solve for the unknown variable. When the computed result does not correspond to a commercially available pipe size, the type of opening, discharge coefficient, or pipe roughness are varied to obtain a readily available pipe of proper size.

Table 6.3.3
Value of K_e (Entrance Losses)
(Bureau of Reclamation, 1987)

Entrance Condition	*K_e range*	*Average*
Square-edged inlets installed flush with vertical headwalls	0.43 to 0.70	0.50
Rounded Inlets installed flush with vertical headwalls, r/D ≤ 0.15	0.08 to 0.27	0.10
Grooved or socket-ended concrete pipe installed flush with vertical headwall	0.10 to 0.33	0.15
Projecting concrete pipe with grooved or socket ends	-	0.20
Projecting steel or corrugated metal pipes	0.5 to 0.9	0.85

where k_e is the entrance loss coefficient
V is the velocity just inside the barrel entrance (ft/s or m/s)
g is gravitational acceleration (ft/s^2 or m/s^2)

The entrance loss coefficient varies depending on the type of inlet that is present. The smoother the transition is from the channel or pond into the culvert, the lower the loss coefficient is. Values for the coefficients are presented in the following table.

Culvert Type	Entrance Type and Description	Entrance Loss Coefficient, k
Pipe, Concrete	Projecting from fill, socket end (groove-end)	0.2
	Projecting from fill, sq. cut end	0.5
	Headwall or Headwall with Wingwalls	
	Socket end of pipe (groove-end)	0.2
	Square-edge	0.5
	Rounded (radius = 1/12D)	0.2
	Mitered to conform to fill slope	0.7
	End-Section conforming to fill slope*	0.5
	Beveled edges, 33.7° or 45° bevels	0.2
	Side- or slope-tapered inlet	0.2
Pipe or Pipe Arch, Corrugated Metal	Projecting from fill (no headwall)	0.9
	Headwall or headwall and wingwalls square-edge	0.5
	Mitered to conform to fill slope, paved or unpaved slope	0.7
	End-Section conforming to fill slope*	0.5
	Beveled edges, 33.7° or 45° bevels	0.2
	Side- or slope-tapered inlet	0.2
Box, Reinforced Concrete	Headwall parallel to embankment (no wingwalls)	
	Square-edged on 3 edges	0.5
	Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
	Wingwalls at 30° to 75° to barrel	
	Square-edged at crown	0.4
	Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
	Wingwall at 10° to 25° to barrel	
	Square-edged at crown	0.5
	Wingwalls parallel (extension of sides)	
	Square-edged at crown	0.7
	Side- or slope-tapered inlet	0.2

Table 3-1: Entrance Loss Coefficients

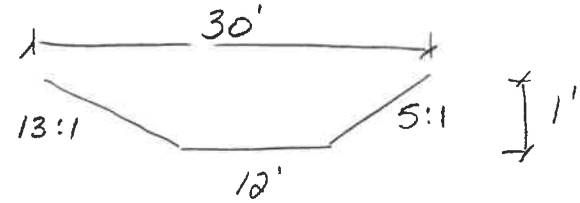
* Note: "End Section conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance.

Existing Lake – Area / Volume

Primary Spillway = 367'

Emergency Spillway = 368'

12-inch CMP



Berm Elevation = 369'

Elevation	Sq Foot Area
467	160,149
468	136,700
469	158,979

$$\text{Volume} = \frac{160{,}149 + 158{,}979}{2} = 159{,}564\ ft^2 (2\ ft)$$

$$= 319{,}128\ ft^3$$

Existing 12-inch primary spillway = reduced Discharge Rate = 1.55 cfs

Allowable Discharge Rate = Peak Undeveloped 10-year rate for Ansbro Subdivision (US-1) minus the 25-year rate for developed rate of Subbasin #2 leaving the site undetained, plus the 25-year rate for existing conditions of offsite subbasins A & B.

Q Allow = 22.17 − 4.93 + 11.25 + 5.56 = 34.05 cfs

User Name: Morley
Project: 6408 Ansbro Subdivision - Civil
Slice Volume Results

Date: 07-19-05
Time: 08:33:15
Page: 1

Slice Volume Results

Original Surface Model: 2000 aerial photo
Final Surface Model: Constant Elevation: 470

Cut Compaction Factor: 0.000000
Fill Compaction Factor: 0.000000

Elevation Interval (CY)	Cut Area (ft^2)	Cut Volume (CY)	Fill Area (ft^2)	Fill Volume (CY)	Cumulative Cut (CY)	Cumulative Fill
467.00 - 467.50	0.00	0.00	160149.42	2965.73	0.00	2965.73
467.50 - 468.00	0.00	0.00	124476.97	2305.13	0.00	5270.86
468.00 - 468.50	0.00	0.00	136700.43	2531.49	0.00	7802.35
468.50 - 469.00	0.00	0.00	147329.31	2728.32	0.00	10530.67
469.00 - 469.50	0.00	0.00	158979.07	2944.06	0.00	13474.73
469.50 - 470.00	0.00	0.00	169303.32	3135.25	0.00	16609.97
470.00 - 470.50	63109.81	1168.70	0.00	0.00	1168.70	16609.97
470.50 - 471.00	53949.77	999.07	0.00	0.00	2167.77	16609.97

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: **Ansbro Subdivision** DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS
DESIGNER: Morley and Assoc. 6408-4B RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	20.33	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHEI	29.53	MINUTES
RAINFALL INTENSITY (Iu):	3.2664	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.449	
UNDEVELOPED RUNOFF RATE - Q = AS CALCULATED	34.05	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.456	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE (I(Td)-O)*Td/12 (ACRE-FT)
0.08	7.208	66.82	34.05	32.77	0.228
0.17	5.925	54.93	34.05	20.88	0.290
0.25	5.033	46.66	34.05	12.61	0.263
0.33	4.571	42.37	34.05	8.32	0.231
0.42	4.108	38.09	34.05	4.04	0.140
0.50	3.646	33.80	34.05	-0.25	-0.010
0.58	3.385	31.38	34.05	-2.67	-0.130
0.67	3.123	28.95	34.05	-5.10	-0.283
0.75	2.862	26.53	34.05	-7.52	-0.470
0.83	2.601	24.11	34.05	-9.94	-0.690
0.92	2.339	21.68	34.05	-12.37	-0.945
1.00	2.078	19.26	34.05	-14.79	-1.232
1.25	1.909	17.69	34.05	-16.36	-1.704
1.50	1.739	16.12	34.05	-17.93	-2.241
1.75	1.570	14.55	34.05	-19.50	-2.844
2.00	1.400	12.98	34.05	-21.07	-3.512
2.50	1.210	11.21	34.05	-22.84	-4.758
3.00	1.019	9.45	34.05	-24.60	-6.151
4.00	0.836	7.75	34.05	-26.30	-8.767

PEAK STORAGE (ACRE/FT):	0.29
PEAK STORAGE (CUBIC FT):	12,631

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: Ansbro Subdivision — DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS

DESIGNER: MORLEY & ASSOC. 6408-4B — RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	20.33	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED	29.53	MINUTES
RAINFALL INTENSITY (Iu):	3.2664	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.449	
UNDEVELOPED RUNOFF RATE - Q = AS CALCULATED	34.05	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.456	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE (I(Td)-O)*Td/12 (ACRE-FT)
0.08	8.469	78.51	34.05	44.46	0.296
0.17	7.126	66.06	34.05	32.01	0.453
0.25	6.194	57.42	34.05	23.37	0.487
0.33	5.665	52.52	34.05	18.47	0.508
0.42	5.137	47.62	34.05	13.57	0.475
0.50	4.608	42.72	34.05	8.67	0.361
0.58	4.284	39.71	34.05	5.66	0.274
0.67	3.960	36.71	34.05	2.66	0.148
0.75	3.636	33.70	34.05	-0.35	-0.022
0.83	3.311	30.70	34.05	-3.35	-0.232
0.92	2.987	27.69	34.05	-6.36	-0.487
1.00	2.663	24.69	34.05	-9.36	-0.780
1.25	2.444	22.65	34.05	-11.40	-1.187
1.50	2.224	20.62	34.05	-13.43	-1.679
1.75	2.005	18.58	34.05	-15.47	-2.256
2.00	1.785	16.55	34.05	-17.50	-2.917
2.50	1.538	14.26	34.05	-19.79	-4.123
3.00	1.291	11.97	34.05	-22.08	-5.520
4.00	1.062	9.85	34.05	-24.20	-8.068

PEAK STORAGE (ACRE/FT):	0.51
PEAK STORAGE (CUBIC FT):	22,126

6408-4B

Ex 12" CMP Primary Spillway
Friction Loss Calculations

Q= Flowrate (cfs)
Ke= Entrance Loss coefficient
Ko= Outlet Loss coefficient
g= Gravity (ft/sec^2)
h= Height of water above the centerline of the pipe (ft)
d= Diameter of the pipe (ft)
A= Area of the pipe (ft^2)
L= Length of pipe (ft)
n= Mannings roughness coefficient
v= velocity (ft/sec)

Q= A * [h/ ((Ke+Ko)/2g) + ((2.87*n^2*L)/d^4/3)]^1/2

Q=	1.548	cubic feet per second
v=Q/A	1.97	feet per second
Ke=	0.90	see table
Ko=	1.0	assumed
g=	32.20	ft^2 per second
h=	0.50	ft
d=	1.000	ft
A=	0.79	ft^2 (12-inch Dia. Pipe)
L=	60.0	ft
n=	0.024	(Corrugated Metal Pipe)

Q Avail < Q Req'd 1.548 cfs* < 33.530 cfs Allowable 10-year storm runoff rate

* Q Available with water ponded to 368' (1.0' deep)

6408-4B

Ex 12" CMP Primary Spillway
Friction Loss Calculations

Q= Flowrate (cfs)
Ke= Entrance Loss coefficient
Ko= Outlet Loss coefficient
g= Gravity (ft/sec^2)
h= Height of water above the centerline of the pipe (ft)
d= Diameter of the pipe (ft)
A= Area of the pipe (ft^2)
L= Length of pipe (ft)
n= Mannings roughness coefficient
v= velocity (ft/sec)

Q= A * [h/ ((Ke+Ko)/2g) + ((2.87*n^2*L)/d^4/3)]^1/2

Q=	2.681	cubic feet per second
v=Q/A	3.41	feet per second
Ke=	0.90	see table
Ko=	1.0	assumed
g=	32.20	ft^2 per second
h=	1.50	ft
d=	1.000	ft
A=	0.79	ft^2 (12-inch Dia. Pipe)
L=	60.0	ft
n=	0.024	(Corrugated Metal Pipe)

Q Avail < Q Req'd 2.681 cfs* < 33.530 cfs Allowable 10-year storm runoff rate

* Q Available with water ponded to 370' (3.0' deep)

6408-4B

Existing Emergency Weir Spillway
Trapeziodal Weir Design Calculations

Q = Flowrate (cfs)
g = Gravity (ft/sec^2)
h = Height of water flowing over the weir (ft)
b = Width of weir (ft)
Cd = Discharge coefficient
O = Angle of triangle
A = Area of weir

Q = 2/3*Cd*(2g)^0.5*b*(h)^3/2 + 8/15*Cd*(2g)^0.5*tan(O/2)*(h)^5/2

Q =	58.81	cubic feet per second
v =	2.74	feet per second
head =	1.00	(Height of water flowing over the weir)
g =	32.20	feet per second^2
b =	12.00	feet
side slope left =	5.00	ft/ft (left side)
side slope right =	14.00	ft/ft (right side)
Cd =	0.63	Rectangular coefficient
Cd =	0.58	Triangular coefficient
O=	164.60	Degrees
A =	21.50	square feet

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: **Ansbro Subdivision** DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS
DESIGNER: Morley and Assoc. 6408-4B RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	20.33	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHEI	29.53	MINUTES
RAINFALL INTENSITY (Iu):	3.2664	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.449	
UNDEVELOPED RUNOFF RATE - Q = AS CALCULATED	1.55	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.456	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE (I(Td)-O)*Td/12 (ACRE-FT)
0.08	7.208	66.82	1.55	65.27	0.453
0.17	5.925	54.93	1.55	53.38	0.741
0.25	5.033	46.66	1.55	45.11	0.940
0.33	4.571	42.37	1.55	40.82	1.134
0.42	4.108	38.09	1.55	36.54	1.269
0.50	3.646	33.80	1.55	32.25	1.344
0.58	3.385	31.38	1.55	29.83	1.450
0.67	3.123	28.95	1.55	27.40	1.522
0.75	2.862	26.53	1.55	24.98	1.561
0.83	2.601	24.11	1.55	22.56	1.567
0.92	2.339	21.68	1.55	20.13	1.538
1.00	2.078	19.26	1.55	17.71	1.476
1.25	1.909	17.69	1.55	16.14	1.682
1.50	1.739	16.12	1.55	14.57	1.821
1.75	1.570	14.55	1.55	13.00	1.896
2.00	1.400	12.98	1.55	11.43	1.905
2.50	1.210	11.21	1.55	9.66	2.013
3.00	1.019	9.45	1.55	7.90	1.974
4.00	0.836	7.75	1.55	6.20	2.067

PEAK STORAGE (ACRE/FT):	2.07
PEAK STORAGE (CUBIC FT):	90,026

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: Ansbro Subdivision — DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS

DESIGNER: MORLEY & ASSOC. 6408-4B — RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	20.33	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED	29.53	MINUTES
RAINFALL INTENSITY (Iu):	3.2664	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.449	
UNDEVELOPED RUNOFF RATE - Q = AS CALCULATED	1.55	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.456	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE (I(Td)-O)*Td/12 (ACRE-FT)
0.08	8.469	78.51	1.55	76.96	0.513
0.17	7.126	66.06	1.55	64.51	0.914
0.25	6.194	57.42	1.55	55.87	1.164
0.33	5.665	52.52	1.55	50.97	1.402
0.42	5.137	47.62	1.55	46.07	1.612
0.50	4.608	42.72	1.55	41.17	1.715
0.58	4.284	39.71	1.55	38.16	1.845
0.67	3.960	36.71	1.55	35.16	1.963
0.75	3.636	33.70	1.55	32.15	2.010
0.83	3.311	30.70	1.55	29.15	2.016
0.92	2.987	27.69	1.55	26.14	2.004
1.00	2.663	24.69	1.55	23.14	1.928
1.25	2.444	22.65	1.55	21.10	2.198
1.50	2.224	20.62	1.55	19.07	2.383
1.75	2.005	18.58	1.55	17.03	2.484
2.00	1.785	16.55	1.55	15.00	2.500
2.50	1.538	14.26	1.55	12.71	2.647
3.00	1.291	11.97	1.55	10.42	2.605
4.00	1.062	9.85	1.55	8.30	2.765

PEAK STORAGE (ACRE/FT):	2.77
PEAK STORAGE (CUBIC FT):	120,447

6408-4B

Ex 30" CMP Primary Spillway
Friction Loss Calculations

Q= Flowrate (cfs)
Ke= Entrance Loss coefficient
Ko= Outlet Loss coefficient
g= Gravity (ft/sec^2)
h= Height of water above the centerline of the pipe (ft)
d= Diameter of the pipe (ft)
A= Area of the pipe (ft^2)
L= Length of pipe (ft)
n= Mannings roughness coefficient
v= velocity (ft/sec)

Q= A * [h/ ((Ke+Ko)/2g) + ((2.87*n^2*L)/d^4/3)]^1/2

Q=	34.564	cubic feet per second
v=Q/A	7.04	feet per second
Ke=	0.90	see table
Ko=	1.0	assumed
g=	32.20	ft^2 per second
h=	4.00	ft
d=	2.500	ft
A=	4.91	ft^2 (30-inch Dia. Pipe)
L=	105.0	ft
n=	0.024	(Corrugated Metal Pipe)

Q Avail < Q Req'd 34.564 cfs* < 34.210 cfs 25-year storm runoff rate (No Lake)

* Q Available with water ponded to Elevation 461.5' (5.25' deep)

...Ex. 30-inch CMP @ East Property Line

Drainage Area = 20.33 acres

T_c = 29.53 minutes

I_{10} = 3.266 IN/Hr

I_{25} = 3.690 IN/Hr

I_{100} = 4.658 IN/Hr

C = 0.456 developed conditions

Q = Cia

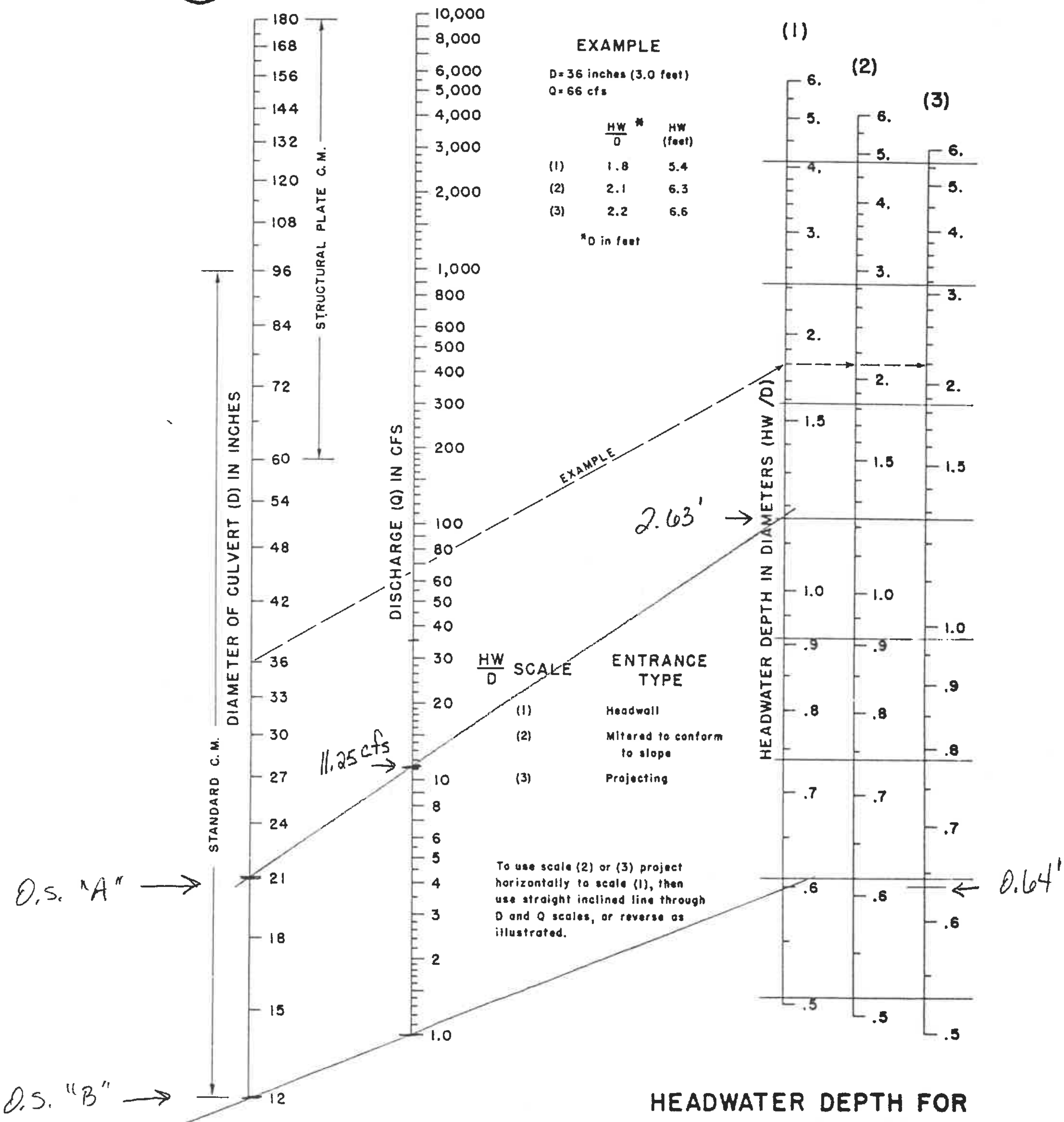
Q_{25} = (0.456)(3.690 IN/Hr)(20.33 acres) = <u>34.21 cfs</u>

Q_{100} = (0.456)(4.658 IN/Hr)(20.33 acres) = 43.18 cfs

Reduced discharge Rate due to lake

Q_{25} = 1.55 cfs + 4.93 cfs = <u>6.48 cfs</u>

CHART 2



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Offsite Undeveloped Drainage Basin

Basin: 12-inch CMP Driveway OS "B"	Total Area =	12,790 S.F. =	0.294 Ac.

Surface											C	N
Structures	0	Total	-	S.F.	=	0	S.F. =	0.00	Ac.		0.92	0.02
Drives	1	Total	-	S.F.	=	566	S.F. =	0.01	Ac.		0.70	0.10
Pavement	398	L.F.	10.0	Width	=	3,980	S.F. =	0.09	Ac.		0.92	0.02
Patios	0	Total	-	S.F.	=	0	S.F. =	0.00	Ac.		0.92	0.02
Sidewalks	0	L.F.	-	Width	=	0	S.F. =	0.00	Ac.		0.92	0.02
Lawn (0-2%)			0	S.F.	=			0.00	Ac.		0.15	0.40
Lawn (2-5%)			8,244	S.F.	=			0.19	Ac.		0.25	0.40
Lawn (5-10%)			0	S.F.	=			0.00	Ac.		0.40	0.40
Lawn (>10%)			0	S.F.	=			0.00	Ac.		0.55	0.40
Woods (2-5%)			0	S.F.	=			0.00	Ac.		0.24	0.80
Woods (5-10%)			0	S.F.	=			0.00	Ac.		0.36	0.80
Woods (>10%)			0	S.F.	=			0.00	Ac.		0.36	0.80
Water			0	S.F.	=			0.00	Ac.		1.00	0.00
				S.F.	=			0.00	Ac.			

Weighted c =	0.478	
Weighted N =	0.268	
L =	25	Ft.
H =	2.0	Ft.
S =	0.0800	Ft./Ft.
tc =	3.63	Minutes
Tc =	3.63	Minutes

0.00 Min Ditch Flow

I(10) =	6.625	In./Hr.
Q(10) =	0.93	CFS
I(25) =	7.208	In./Hr.
Q(25) =	1.01	CFS
I(100) =	8.469	In./Hr.
Q(100) =	1.19	CFS

SOIL SURVEY OF

Vanderburgh County, Indiana

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Purdue University Agricultural
Experiment Station

VANDERBURGH COUNTY, INDIANA — SHEET NUMBER 10

Figure #6

SOIL LEGEND

The first capital letter is the initial one of the soil name. The lowercase letter that follows separates mapping units having names that begin with the same letter except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for soils with a slope range of 0 to 2 percent or they are for land types with a considerable range of slope. A final number, 2 or 3, in the symbol indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
AlB2	Alford silt loam, 2 to 6 percent slopes, eroded
AlC2	Alford silt loam, 6 to 12 percent slopes, eroded
AlC3	Alford silt loam, 6 to 12 percent slopes, severely eroded
AlD3	Alford silt loam, 12 to 18 percent slopes, severely eroded
Ba	Bartle silt loam
Bd	Birds silt loam
Bo	Bonnie silt loam
Br	Borrow pits
Ev	Evansville silt loam
Gn	Ginat silt loam
Gu	Gullied land
He	Henshaw silt loam
HoA	Hosmer silt loam, 0 to 2 percent slopes
HoB2	Hosmer silt loam, 2 to 6 percent slopes, eroded
HoB3	Hosmer silt loam, 2 to 6 percent slopes, severely eroded
HoC2	Hosmer silt loam, 6 to 12 percent slopes, eroded
HoC3	Hosmer silt loam, 6 to 12 percent slopes, severely eroded
HoD3	Hosmer silt loam, 12 to 18 percent slopes, severely eroded
Ht	Huntington silty clay loam
Hu	Huntington fine sandy loam, sandy variant
IoA	Iona silt loam, 0 to 2 percent slopes
IoB2	Iona silt loam, 2 to 6 percent slopes, eroded
Iv	Iva silt loam
Ln	Lindside silty clay loam
Ma	Made land
MkB2	Markland silt loam, 2 to 6 percent slopes, eroded
MkC2	Markland silt loam, 6 to 18 percent slopes, eroded
MlC3	Markland silty clay loam, 6 to 18 percent slopes, severely eroded
Mr	McGary silt loam
MuA	Muren silt loam, 0 to 2 percent slopes
MuB2	Muren silt loam, 2 to 6 percent slopes, eroded
Nw	Newark silty clay loam
Pa	Patton silty clay loam
PrB	Princeton fine sandy loam, 2 to 6 percent slopes
Ra	Ragsdale silt loam
Rh	Rahm silty clay loam
Rs	Reesville silt loam
ScA	Sciotoville silt loam, 0 to 2 percent slopes
ScB2	Sciotoville silt loam, 2 to 6 percent slopes, eroded
St	Stendal silt loam
UnB2	Uniontown silt loam, 2 to 6 percent slopes, eroded
Wa	Wakeland silt loam
Wb	Weinbach silt loam
WeD2	Wellston silt loam, 12 to 18 percent slopes, eroded
WeD3	Wellston silt loam, 12 to 18 percent slopes, severely eroded
WeE2	Wellston silt loam, 18 to 25 percent slopes, eroded
WeF	Wellston silt loam, 25 to 50 percent slopes
WhA	Wheeling loam, 0 to 2 percent slopes
WhB2	Wheeling loam, 2 to 6 percent slopes, eroded
Wm	Wilbur silt loam
Wo	Woodmere silty clay loam
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded
ZaD2	Zanesville silt loam, 12 to 18 percent slopes, eroded
ZaD3	Zanesville silt loam, 12 to 18 percent slopes, severely eroded
Zp	Zipp silty clay

WORI

Highways and ro

Divided ......

Good motor

Poor motor ..

Trail ....

Highway markers

National Inters

U. S. ....

State or county

Railroads

Single track .

Multiple track

Abandoned ..

Bridges and cros

Road ....

Trail ....

Railroad .....

Ferry ....

Ford ....

Grade ....

R. R. over ...

R. R. under .

Buildings ......

School ......

Church ......

Mine and quarry

Gravel pit ......

Power line .....

Pipeline ....

Cemetery ......

Dams ....

Levee ....

Tanks ....

Well, oil or gas

Forest fire or lool

Indian mound

Located object

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry (QU.)

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Indian mound

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Limit of soil survey
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot

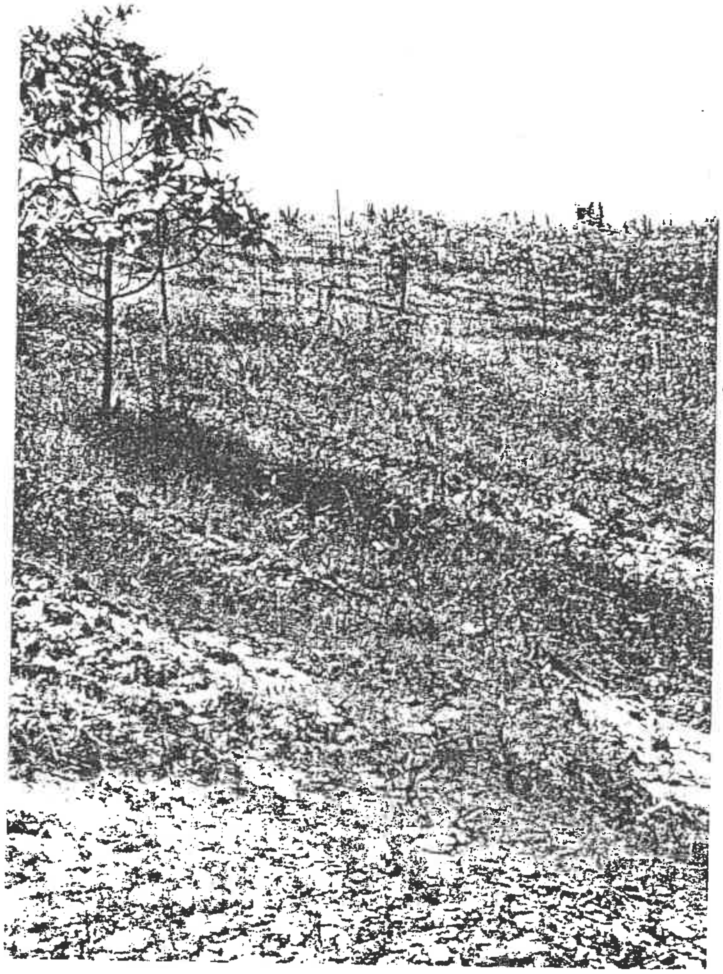


Figure 18.—**Gullied land that was formerly farmland but has been abandoned.**

B23t—28 to 36 inches, light olive-brown (2.5Y 5/6) heavy silty clay loam; common, medium, distinct light brownish-gray (2.5Y 6/2) mottles; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; firm; thin, discontinuous, light brownish-gray (10YR 6/2) clay films on faces of peds; common, fine, very dark brown (10YR 2/2) concretions; medium acid; gradual, smooth boundary.

B3t—36 to 43 inches, light olive-brown (2.5Y 5/4-5/6) light silty clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; distinct, light brownish-gray (10YR 6/2) mottles; weak, coarse, prismatic structure; firm; thin, patchy, light brownish-gray (10YR 6/2) clay films on faces of peds; few, fine, very dark brown (10YR 2/2) concretions; slightly acid; gradual, smooth boundary.

C—43 to 60 inches, light olive-brown (2.5Y 5/6), light brownish-gray (2.5Y 6/2), and dark yellowish-brown (10YR 4/4) stratified silty clay loam and silt loam; massive; firm; common lime concretions; moderately alkaline (calcareous).

The solum ranges from 34 to 60 inches in thickness. The Ap horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) or brown (10YR 5/3) in color. The B2 horizon is olive-brown (2.5Y 4/4) to light yellowish-brown (10YR 6/4) heavy silty clay loam or silty clay loam. It has few to many mottles of light brownish gray (2.5Y 6/2) to grayish brown (10YR 5/2). Depth to mottling ranges from 8 to 12 inches.

Henshaw soils are associated with and have drainage characteristics similar to those of McGary and Bartle soils. They contain less clay than McGary soils. Henshaw soils lack the fragipan of Bartle soils and are less acid.

Henshaw silt loam (0 to 2 percent slopes) (He).—This soil is mostly in large areas in broad lakebeds on terraces. Included in mapping are small areas of moderately eroded soils at the head of drainageways. Also included are some small areas of very poorly drained Patton soils.

Runoff is slow on this soil, and wetness is the major limitation in use and management. If a suitable drainage system is established and maintained, this soil is suited to corn, small grain, hay, and pasture.

Because of the moderately slow permeability and seasonal high water table, this soil has severe limitations for residential development unless public sewers are available. If public sewers are available, wetness is a moderate limitation for this use. Capability unit IIw-2.

Hosmer Series

The Hosmer series consists of deep, well-drained, nearly level to strongly sloping soils on uplands. These soils have a firm and brittle fragipan in the lower part of the subsoil. They formed in 4 to 8 feet of loess over sandstone and shale bedrock. The native vegetation is mixed hardwood trees.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The subsoil is about 61 inches thick. The upper 5 inches is yellowish-brown, friable silt loam; the next 17 inches is strong-brown, firm light silty clay loam; and the lower 39 inches is a yellowish-brown and strong-brown, very firm and brittle, silt loam fragipan (fig. 19). The underlying material, to a depth of 73 inches, is yellowish-brown silt loam.

Available water capacity is moderate in Hosmer soils, and permeability is very slow. The content of organic matter is low.

Representative profile of Hosmer silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 1,310 feet east and 30 feet north of center of sec. 25, T. 4 S., R. 10 W.:

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; weak, medium, granular structure; friable; medium acid; abrupt, smooth boundary.

B1—7 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

B21t—12 to 20 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; firm; thin, discontinuous, dark-brown (7.5YR 4/4) clay films on faces of peds; few pale-brown (10YR 6/3) silt coatings; strongly acid; clear, smooth boundary.

B22t—20 to 29 inches, strong-brown (7.5YR 4/6) light silty clay loam; weak, medium to coarse, prismatic structure that parts to moderate, medium, subangular blocky; firm; thin, continuous, dark-brown (7.5YR 5/4) clay films on faces of peds; thin brown (10YR 5/3) silt coatings on faces of peds and in cracks; very strongly acid; clear, wavy boundary.

A'2&B'x1—29 to 32 inches, yellowish-brown (10YR 5/6) silt loam; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky; firm and brittle; the A'2 material consists of thin to thick, light brownish-gray (10YR 6/2) silt cappings on peds and fillings in krotovinas; very strongly acid; abrupt, irregular boundary.

B'x2—32 to 48 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, very coarse, prismatic structure; very firm and brittle; thick, continuous, brown (7.5YR 5/4) clay films on faces of peds and linings in pores; light brownish-gray (10YR 6/2) silt coatings on faces of peds and in vertical cracks; very strongly acid; diffuse, irregular boundary.

B'x3—48 to 68 inches, yellowish-brown (10YR 5/6) and light yellowish-brown (10YR 6/4) silt loam; very coarse prismatic structure; very firm and brittle; discontinuous brown (7.5YR 5/4) clay films in vertical cracks; light brownish-gray (10YR 6/2) silt coatings in cracks; very strongly acid; gradual, irregular boundary.

Figure 19.—**A weathered road cut on Hosmer soils exposing the light-gray, loess-capped prisms of the fragipan.**

C—68 to 73 inches, yellowish-brown (10YR 5/4) silt loam; massive; friable; light brownish-gray (10YR 6/2) silt coatings along vertical cracks; very strongly acid.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) or brown (10YR 5/3) in color. The Bt horizon, above the fragipan, ranges from brown to strong-brown or yellowish-brown silty clay loam to heavy silt loam. The B'x horizon is 30 to 50 inches thick. It is silt loam or light silty clay loam. Reaction in the C horizon ranges from strongly acid to medium acid.

Hosmer soils are associated with Alford, Wellston, and Zanesville soils. They are more deeply leached than Alford soils and have a fragipan which Alford and Wellston soils do not have. Hosmer soils, unlike Zanesville soils, lack sandstone fragments in the lower part of the solum.

Hosmer silt loam, 0 to 2 percent slopes (HoA).—This soil is in long, narrow areas, 3 to 10 acres in size, on ridgetops. It has a profile similar to that described as representative of the series, but it has a thicker surface layer, and depth to the fragipan is about 32 inches.

Included with this soil in mapping are small areas where slopes are more than 2 percent.

Runoff is slow on this soil. The very slowly permeable fragipan and the moderate available water capacity are limitations in use and management. This soil is suited to most crops commonly grown in the county. It is not well suited to alfalfa and other deep-rooted crops, because the fragipan restricts downward root growth and movement of water. In years of below-average rainfall or poor rainfall distribution, crops are damaged by drought.

Because of the very slow permeability, this soil has severe limitations for residential development unless public sewers are available. If public sewers are available, limitations for this use are slight. Capability unit IIw-5.

Hosmer silt loam, 2 to 6 percent slopes, eroded (HoB2).—This soil is on ridgetops and side slopes. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of nearly level or moderately sloping soils. Also included are small areas of severely eroded soils that have a surface layer of mostly yellowish-brown material that was formerly the upper part of the subsoil.

Runoff is medium on this soil. The hazard of further erosion, the very slowly permeable fragipan, and the moderate available water capacity limit use. This soil is suited to most crops commonly grown in the county. It is not well suited to alfalfa and other deep-rooted crops, because the fragipan restricts downward root growth and movement of water. In years of below-average rainfall or poor rainfall distribution, crops are damaged by drought.

Because of the very slowly permeable fragipan, this soil has severe limitations for residential development unless sewers are available. If public sewers are available, limitations for this use are slight. Capability unit IIe-7.

Hosmer silt loam, 2 to 6 percent slopes, severely eroded (HoB3).—This soil is on ridgetops and sides of natural draws. The areas range from 3 to 8 acres in size. The profile is similar to that described as representative of the series, but erosion has removed 6 inches to all of the original surface layer. The present surface layer is mostly yellowish-brown subsoil material.

Included with this soil in mapping are a few small areas of moderately eroded soils. Also included are small areas where the slope is more than 6 percent.

Runoff is rapid on this soil. The hazard of further erosion, the very slowly permeable fragipan, and the moderate available moisture capacity limit use. This soil is suited to most crops commonly grown in the county. It is not well suited to alfalfa and other deep-rooted crops, because the fragipan restricts downward root growth and movement of water. In years of below-average rainfall or poor rainfall distribution, crops are damaged by drought. Seedbed preparation is more difficult on this soil than on the moderately eroded soils.

Because of the very slowly permeable fragipan, this soil has severe limitations for residential development unless public sewers are available. If public sewers are available, limitations for this use are slight. Capability unit IIIe-7.

Hosmer silt loam, 6 to 12 percent slopes, eroded (HoC2).—This soil is on sides of natural draws and on uniform side slopes below ridgetops. The areas are 5 to 15 acres in size. This soil has a thinner surface layer and subsoil than those in the soil described as representative of the series.

Included with this soil in mapping are small areas of severely eroded soils and a few areas where the slope is more than 12 percent.

Runoff is medium on this soil. The hazard of further erosion, the very slowly permeable fragipan (fig. 20), and the this material is brown and yellowish brown, the next 15 inches is light brownish gray, and the lower 20 inches is brown. Mottles are present between depths of 13 and 60 inches.

Available water capacity is high in Wilbur soils, and permeability is moderate. These soils have a seasonal high water table. The content of organic matter is moderate.

Representative profile of Wilbur silt loam in a cultivated field, 250 feet north of center of sec. 6, T. 7 S., R. 11 W.:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; weak fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

C1—9 to 13 inches, brown (10YR 5/3) silt loam; weak, thick, platy structure that parts to weak, medium, granular; friable; slightly acid; clear, wavy boundary.

C2—13 to 20 inches, brown (10YR 5/3) and yellowish-brown (10YR 5/4) silt loam; common, fine, faint, grayish-brown (10YR 5/2) mottles; weak, medium, granular structure; friable; neutral; clear, smooth boundary.

C3—20 to 25 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, gray (10YR 6/1) mottles; weak, medium, granular structure; friable; neutral; gradual, wavy boundary.

C4g—25 to 40 inches, light brownish-gray (10YR 6/2) silt loam; common, medium, distinct, brown (10YR 5/3) mottles; massive; friable; neutral; gradual, smooth boundary.

C5—40 to 60 inches, brown (10YR 5/3) silt loam; common, fine, distinct, gray (10YR 6/1) mottles; massive; friable; neutral.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), or brown (10YR 5/3). Few to common gray mottles are present in the C2 and C3 horizons. The C1 and C2 horizons are medium acid to neutral. The C5 horizon has strata of sandy loam in places.

Wilbur soils are associated with Lindside, Wakeland, and Birds soils. They have drainage characteristics similar to those of Lindside soils, but they contain less clay than the Lindside soils. Wilbur soils are better drained than Wakeland and Birds soils.

Wilbur silt loam (0 to 2 percent slopes) (Wm).—This soil is on bottom lands along small streams. Included in mapping are small areas of somewhat poorly drained Wakeland soils. Also included are small areas where the soil is underlain by dark-gray silt loam or light silty clay loam at a depth of 25 to 30 inches.

Occasional flooding is the major hazard in use and management of this soil. The soil is suited to most crops commonly grown in the county. Corn, soybeans, hay, and pasture are the main crops.

Because of the hazard of flooding, this soil has severe limitations for residential development. Capability unit I-2.

Woodmere Series

The Woodmere series consists of deep, well-drained, nearly level soils on bottom lands. These soils formed in Ohio River sediment. The native vegetation is mixed hardwood trees.

In a representative profile the surface layer is dark-brown silty clay loam about 10 inches thick. The subsoil is about 49 inches thick. The upper 20 inches is dark-brown, firm silty clay loam, and the lower 29 inches is brown, firm silty clay and silty clay loam. The underlying material, to a depth of 82 inches, is strong-brown silty clay loam.

Available water capacity is high in Woodmere soils, and permeability is moderately slow. The content of organic matter is moderate.

Representative profile of Woodmere silty clay loam in a cultivated field, 1,300 feet north and 30 feet east of the SW. corner of sec. 34, T. 7 S., R. 11 W.:

Ap—0 to 10 inches, dark-brown (10YR 4/3) silty clay loam; moderate, medium, granular structure; friable; few mica flakes; neutral; abrupt, smooth boundary.

B2—10 to 30 inches, dark-brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; firm; few mica flakes; neutral; abrupt, wavy boundary.

IIBb1—30 to 42 inches, brown (7.5YR 4/4) silty clay; weak, prismatic structure that parts to moderate, medium, s lar blocky; firm; common mica flakes; medium aci wavy boundary.

IIBb2—42 to 59 inches, brown (7.5YR 4/4) silty clay loam medium, prismatic structure that parts to weak, m coarse, subangular blocky; firm; thin, discontinu brown (10YR 3/3) clay films on faces of peds; f brownish-gray (10YR 6/2) coatings; common mic strongly acid; gradual, wavy boundary.

IIC—59 to 82 inches, strong-brown (7.5YR 5/6) silty clay lo sive; firm; thin, patchy, brown (7.5YR 4/4) clay films brownish-gray (10YR 6/2) coatings on faces of peds; (10YR 2/1) manganese concretions; common mic strongly acid.

The Ap horizon ranges from dark brown (10YR 4/3) to dark brown (10YR 4/4) in color. The IIBb1 horizon is silty clay to loam. Depth to the IIBb1 horizon ranges from 28 to 34 inch

Woodmere soils are associated with Huntington and Lind They contain more clay and are more strongly acid in the low the B horizon than the associated soils.

Woodmere silty clay loam (0 to 2 percent (Wo).—This soil is on long narrow areas on bottom la slightly higher elevation than the Huntington and l soils. Included in mapping are small areas of gently soils on breaks that have thinner neutral alluvium o older acid material. In some areas a part of the bro material is mixed in with the material in the dark-b horizon. Also included are small areas where the layer is heavy silt loam.

Runoff is slow on this soil, and occasional floo hazard in use and management. This soil is suited soybeans, small grain, hay, and pasture. Alfalfa a grain are sometimes damaged by flooding in winter in spring.

Because of the hazard of flooding, this soil ha limitations for residential development. Capability

Zanesville Series

The Zanesville series consists of deep, well-drai erately sloping and strongly sloping soils on uplan soils formed in loess and the underlying material th ered from sandstone and shale bedrock. A firm a fragipan is at a depth of about 30 inches. The nativ tion is mixed hardwood trees.

In a representative profile the surface laye yellowish-brown silt loam about 6 inches thick. The about 44 inches thick. The upper 20 inches is stro firm light silty clay loam and heavy silt loam, and th inches is a fragipan of strong-brown and yellowi very firm and brittle heavy silt loam and silt l underlying material, to a depth of 60 inches, is brown and light yellowish-brown silt loam and loam.

Available water capacity is moderate in Zanes and permeability is very slow. The content of orga is low.

Representative profile of Zanesville silt loam, (cent slopes, eroded, 660 feet south and 30 feet v NE. corner of the NW¼ sec. 26, T. 4 S., R. 10

Ap—0 to 6 inches, dark yellowish-brown (10YR 4/4) sil medium, granular structure; friable; strongly smooth boundary.

B21t—6 to 14 inches, strong-brown (7.5YR 5/6) light si moderate, medium, subangular blocky structu patchy, reddish-brown (5YR 4/3) clay films on few grayish-brown (10YR 5/2) silt coatings in voi very strongly acid; clear, smooth boundary.

Figure 27.—An area of Wheeling loam, 2 to 6 percent slopes, eroded, at high elevation is not flooded, but the Newark, Lindside, and Hu at lower elevations are.

B22t—14 to 26 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium and coarse, subangular blocky structure; firm; thin, discontinuous, reddish-brown (5YR 4/4) clay films on faces of peds; pale-brown (10YR 6/3) and light-gray (10YR 7/2) silt coatings on faces of peds and in old root channels; very strongly acid; clear, wavy boundary.

Bx1—26 to 34 inches, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/4) heavy silt loam; weak, very coarse, prismatic structure that parts to weak, coarse, subangular blocky; very firm and brittle; reddish-brown (5YR 4/4) clay films on faces of prisms and in cracks; thin to thick coatings of gray (10YR 6/1) silt cappings on prisms; light-gray (10YR 7/2) silt coatings in crack fills and old root channels; very strongly acid; gradual, smooth boundary.

IIBx2—34 to 50 inches, yellowish-brown (10YR 5/6) silt loam that contains few weathered sandstone fragments; weak, very coarse, prismatic structure; very firm and brittle; thin, discontinuous, brown (10YR 5/3) clay films on faces of peds; light-gray (10YR 7/1) silt coatings along vertical peds and in cracks; very strongly acid; gradual, diffuse boundary.

IIC—50 to 60 inches, yellowish-brown (10YR 5/6) and light yellowish-brown (10YR 6/4) silt loam and silty clay loam that contains numerous weathered sandstone and shale fragments; massive; friable; common, medium, very dark brown (10YR 2/2) concretions; strongly acid.

The Ap horizon ranges from dark grayish brown to dark yellowish brown in color. In wooded areas an Al horizon 1 to 3 inches thick that ranges from very dark gray to grayish brown is present. Depth to the fragipan is 23 to 30 inches. The B21t and B22t horizons are heavy silt loam or light silty clay loam. A B1 horizon 3 to 6 inches thick is present in places. Depth to the IIBx2 horizon is 26 to 48 inches.

The Zanesville soils are associated with the Wellston and Hosmer soils. Unlike Wellston soils, Zanesville soils have a fragipan, and they have more sandstone fragments in the lower part of the solum than Hosmer soils.

Zanesville silt loam, 6 to 12 percent slopes, eroded (ZaC2).—This soil is on narrow ridges and side slopes. It has the profile described as representative of the s

Included with this soil in mapping are small ar sloping soil. Also included are small areas of seve soil.

Runoff is medium on this soil. The hazard of sion, the very slowly permeable fragipan, and t available water capacity are limitations in use a ment. This soil is suited to most crops commonly county. Corn, soybeans, small grain, hay, and the main crops. Because the fragipan restrict root growth and movement of water, alfalfa and rooted crops are not well suited to this soil. In rainfall is below average or poorly distribute subject to damage from drought.

Because of the very slowly permeable fragi has severe limitations for residential develop public sewers are available. Limitations for moderate if public sewers are available. The and fills and control of erosion is also a limitatio Capability unit IIIe-7.

Zanesville silt loam, 6 to 12 percent slo eroded (ZaC3).—This soil is on narrow rid slopes. It has a profile similar to that describe ative of the series, but erosion has removed 4 the original surface layer. Also, depth to the fr soil ranges from 20 to 24 inches. Small gullies areas and exposed the light-gray silt capped

Runoff is rapid on this soil. The hazard of the very slowly permeable fragipan, and the m able water capacity are limitations in use and

Site Photographs

for
Ansbro Subdivision
Vanderburgh County, IN

<u>Prepared For:</u>

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Morley and Associates Inc.

Proj. No.: 6408-4B
July 13, 2005

Looking East – Hoing Road & existing driveway at Lot #3

Looking West – Hoing Road & existing driveway at Lot #3

Looking West – Northside Hoing Road & existing driveway

Looking East – Northside Hoing Road & existing driveway

Looking South – Hoing Road & existing driveway for Mr. Kerney's property

Looking West – Existing 30-inch CMP under Mr. Kerney's driveway

Looking East – Existing 30-inch CMP under Mr. Kerney's driveway

Looking East – Hoing Road; east of Mr. Kerney's driveway

Looking East – Existing 36-inch CMP under gravel driveway on Mr. Kerney's property

Looking East – Existing ditch east of gravel driveway on Mr. Kerney's property

Looking West toward 30-inch CMP – Existing ditch east of gravel driveway on Mr. Kerney's property

Looking West – Existing 36-inch CMP under gravel driveway on Mr. Kerney's property

Looking North – Existing 20-inch Steel Pipe under Hoing Road; discharges onto Mr. Kerney's property

Looking North – Intersection of Hoing Road and Darmstadt Road

Looking South – Intersection of Hoing Road and Darmstadt Road

Looking East – Intersection of Hoing Road and Darmstadt Road

Looking South – Darmstadt Road at existing driveway for 12421 Darmstadt Road

Looking North – Darmstadt Road; existing Area Drain

Looking East – Darmstadt Road; existing Area Drain

Looking South – Darmstadt Road; existing Area Drain

Looking East – Darmstadt Road; existing Area Drain

Looking East – Darmstadt Road; existing headwall downstream from existing AD

Looking West along Lot #1 – existing Lake and ditch from Darmstadt Road

Looking West along Lot #1 – ditch from Darmstadt Road

Looking West along Lot #1 – ditch from Darmstadt Road

Looking West along Lot #1 – existing 12-inch CMP under driveway for 12421 Darmstadt Road

Looking East along Lot #1 – drainage way for existing 12-inch CMP under driveway for 12421 Darmstadt Road

Looking West – Darmstadt Road; existing headwall downstream from existing AD

Looking East along Lot #1 – ditch from Darmstadt Road

Looking West – Darmstadt Road; existing headwall downstream from existing AD

Looking East – high ground within Lot #1

Looking south – existing ditch on Lot #2 south property line

Looking East – along Lot #1 south property line; existing lake

Looking Northeast – existing lake; earthen dam

Looking East – existing lake; earthen dam

Looking North – existing lake; earthen dam

Looking North – existing lake; earthen dam; emergency spillway in background

Looking East –emergency spillway

Looking West – Existing 12-inch CMP Primary Spillway

Looking East – Existing 12-inch CMP Primary Spillway discharge point; Mr. Kerney's driveway in background