

APPLICATION FOR OHIO EPA SECTION 401 WATER QUALITY CERTIFICATION

Effective October 1, 1996
Revised August, 1998

This application must be completed whenever a proposed activity requires an individual Clean Water Act Section 401 Water Quality Certification (Section 401 certification) from Ohio EPA. A Section 401 certification from the State is required to obtain a federal Clean Water Act Section 404 permit from the U.S. Army Corps Engineers, or any other federal permits or licenses for projects that will result in a discharge of dredged or fill material to any waters of the State. To determine whether you need to submit this application to Ohio EPA, contact the U.S. Army Corps of Engineers District Office with jurisdiction over your project, or other federal agencies reviewing your application for a federal permit to discharge dredged or fill material to waters of the State, or an Ohio EPA Section 401 Coordinator at (614) 644-2001.

The Ohio EPA Section 401 Water Quality Certification Program is authorized by Section 401 of the Clean Water Act (33 U.S.C. 1251) and the Ohio Revised Code Section 6111.03(P). Ohio Administrative Code (OAC) Chapter 3745-32 outlines the application process and criteria for decision by the Director of Ohio EPA. In order for Ohio EPA to issue a Section 401 certification, the project must comply with Ohio's Water Quality Standards (OAC 3745-1) and not potentially result in an adverse long-term or short-term impact on water quality. Included in the Water Quality Standards is the Antidegradation Rule (OAC Rule 3745-1-05), effective October 1, 1996, revised October, 1997 and May, 1998. The Rule includes additional application requirements and public participation procedures. **Because there is a lowering of water quality associated with every project being reviewed for Section 401 certification, every Section 401 certification applicant must provide the information required in Part 10 (pages 3 and 4) of this application.** In addition, applications for projects that will result in discharges of dredged or fill material to wetlands must include a wetland delineation report approved by the Corps of Engineers, a wetland assessment with a proposed assignment of wetland category (ies), official documentation on evaluation of the wetland for threatened or endangered species, and appropriate avoidance, minimization, and mitigation as prescribed in OAC 3745-1-50 to 3745-1-54. Ohio EPA will evaluate the applicant's proposed wetland category assignment and make the final assignment.

Information provided with the application will be used to evaluate the project for certification and is a matter of public record. If the Director determines that the application lacks information necessary to determine whether the applicant has demonstrated the criteria set forth in OAC Rule 3745-32-05(A) and OAC Chapter 3745-1, Ohio EPA will inform the applicant in writing of the additional information that must be submitted. The application will not be accepted until the application is considered complete by the Section 401 Coordinator. An Ohio EPA Section 401 Coordinator will inform you in writing when your application is determined to be complete.

Please submit the following to "Section 401 Supervisor, Ohio EPA/DSW, P.O. Box 1049, Columbus, Ohio 43216-1049:

- Four (4) sets of the completed application form, including the location of the project (preferably on a USGS quadrangle) and 8-1/2 x 11" scaled plan drawings and sections.
- One (1) set of original scaled plan drawings and cross-sections (or good reproducible copies).

(See Application Primer for detailed instructions)

1. The federal permitting agency has determined this project: (check appropriate box and fill in blanks)

- requires an individual 404 permit/401 certification- Public Notice # (if known) LRH-2009-318-OHR
- requires a Section 401 certification to be authorized by Nationwide Permit # _____
- requires a modified 404 permit/401 certification for original Public Notice # _____
- requires a federal permit under _____ jurisdiction identified by # _____
- requires a modified federal permit under _____ jurisdiction identified by # _____

Click to clear all entered information (on all 4 pages of this form)

2. Application number (to be assigned by Ohio EPA):

3. Name and address of applicant:

Larry Lang
19371 State Route 60
Beverly, Ohio 45715

Telephone number during business hours:

(740) 350-7313 (Residence)

(740) 984-4750 (Office)

3a. Signature of Applicant:

Larry Lang

Date:

08/23/13

4. Name, address and title of authorized agent:

Mark Welch, Pickering Associates
11283 Emerson Avenue
Parkersburg, WV 26104

Telephone number during business hours:

(304) 483-6415 (Residence)

(304) 464-5305 (Office)

4a. Statement of Authorization: I hereby designate and authorize the above-named agent to act in my behalf in the processing of this permit application, and to furnish, upon request, supplemental information in support of the application.

Signature of Applicant:

Larry Lang

Date:

08/23/13

5. Location on land where activity exists or is proposed. Indicate coordinates of a fixed reference point at the impact site (if known) and the coordinate system and datum used.

Address:

North of the intersection of State Route 7 & County House Lane (approximate coordinates N39-24-15.29, W81-24-45.35)
Street, Road, Route, and Coordinates, or other descriptive location

Ohio River	Washington	Marietta	Marietta	Ohio	45750
Watershed	County	Township	City	State	Zip Code

6. Is any portion of the activity for which authorization is sought complete? Yes No

If answer is "yes," give reasons, month and year activity was completed. Indicate the existing work on the drawings.

During Phase I Construction (2009 thru 2012) approximately 450 lineal feet of an unnamed tributary of Duck Creek was realigned. No order to cease work was issued by the U.S. Army Corps of Engineers. See attached drawings for location of activity and details.

7. List all approvals or certifications and denials received from other federal, interstate, state or local agencies for any structures, construction, discharge or other activities described in this application.

Issuing Agency	Type of Approval	Identification No.	Date of Application	Date of Approval	Date of Denial
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*See attached sheets

8. DESCRIPTION OF THE ACTIVITY (fill in information in the following four blocks - 8a, 8b, 8c & 9)

8a. Activity: Describe the Overall Activity:

The First Colony Project is a phased commercial development site, composed of individual lots, public roadways and all required utilities. Phase I of the development included installation of a box culvert (USACE Nationwide permit no. 29, LRH-2009-318-OHR), portions of two public roadways, and (7) individual lots, all of which have been completed. Phase II of the development proposes the installation of a second box culvert downstream of the existing culvert, through which the unnamed tributary of Duck Creek would be re-routed. Approximately 1085 lineal feet of stream would be filled once the water has been re-routed through the culvert. See attached plans for more details.

8b. Purpose: Describe the purpose, need and intended use of the activity:

The purpose of the installation of the second box culvert is to allow for the re-routing of the unnamed tributary of Duck Creek and the placement of fill in the 1085 lineal feet that will no longer carry water. This re-routing and fill placement will allow for the remaining portions (extensions of the Phase I portions) of roadway and utilities, as well as, commercial lots to be developed.

8c. Discharge of dredged or fill material: Describe type, quantity of dredged material (in cubic yards), and quantity of fill material (in cubic yards).

Approximately 1085 lineal feet of Unnamed Tributary of Duck Creek will be filled with typical compacted material (native soil from a nearby site). The tributary has an average depth and width of 2 feet and 14 feet, respectively. The total amount of fill material to be placed in within the limits of the OHWM is 1,125 cubic yards.

9. Waterbody and location of waterbody or upland where activity exists or is proposed, or location in relation to a stream, lake, wetland, wellhead or water intake (if known). Indicate the distance to, and the name of any receiving stream, if appropriate.

Approximately 1085 lineal feet of an Unnamed Tributary of Duck Creek will be affected by this project. This unnamed tributary flows easterly and empties into Duck Creek, which then flows southerly and empties into the Ohio River. The tributary meanders through the entire length of the First Colony Development, which lies North of State Route 7 near the intersection of County House Lane. No wetlands were identified on the development site. See attached drawings and maps for more details.

10. To address the requirements of the Antidegradation Rule, your application must include a report evaluating the:

- Preferred Design (your project) and Mitigative Techniques
- Minimal Degradation Alternative(s) (scaled-down version(s) of your project) and Mitigative Techniques
- Non-Degradation Alternative(s) (project resulting in avoidance of all waters of the state)

At a minimum, item a) below must be completed for the Preferred Design, the Minimal Degradation Alternative(s), and the Non-Degradation Alternative(s), followed by completion of item b) for each alternative, and so on, until all items have been discussed for each alternative (see Primer for specific instructions).

10a) Provide a detailed description of any construction work, fill or other structures to occur or to be placed in or near the surface water. Identify all substances to be discharged, including the cubic yardage of dredged or fill material to be discharged to the surface water.

10b) Describe the magnitude of the proposed lowering of water quality. Include the anticipated impact of the proposed lowering of water quality on aquatic life and wildlife, including threatened and endangered species (include written comments from Ohio Department of Natural Resources and U.S. Fish and Wildlife Service), important commercial or recreational sport fish species, other individual species, and the overall aquatic community structure and function. Include a Corps of Engineers approved wetland delineation.

- 10c) Include a discussion of the technical feasibility, cost effectiveness, and availability. In addition, the reliability of each alternative shall be addressed (including potential recurring operational and maintenance difficulties that could lead to increased surface water degradation.)
- 10d) For regional sewage collection and treatment facilities, include a discussion of the technical feasibility, cost effectiveness and availability, and long-range plans outlined in state or local water quality management planning documents and applicable facility planning documents.
- 10e) To the extent that information is available, list and describe any government and/or privately sponsored conservation projects that exist or may have been formed to specifically target improvement of water quality or enhancement of recreational opportunities on the affected water resource.
- 10f) Provide an outline of the costs of water pollution controls associated with the proposed activity. This may include the cost of best management practices to be used during construction and operation of the project.
- 10g) Describe any impacts on human health and the overall quality and value of the water resource.
- 10h) Describe and provide an estimate of the important social and economic benefits to be realized through this project. Include the number and types of jobs created and tax revenues generated and a brief discussion on the condition of the local economy.
- 10i) Describe and provide an estimate of the important social and economic benefits that may be lost as a result of this project. Include the effect on commercial and recreational use of the water resource, including effects of lower water quality on recreation, tourism, aesthetics, or other use and enjoyment by humans.
- 10j) Describe environmental benefits, including water quality, lost and gained as a result of this project. Include the effects on the aquatic life, wildlife, threatened or endangered species.
- 10k) Describe mitigation techniques proposed (except for the Non-Degradation Alternative):
 - Describe proposed Wetland Mitigation (see **OAC 3745-1-54** and Primer)
 - Describe proposed Stream, Lake, Pond Mitigation (see Primer)

11. Application is hereby made for a Section 401 Water Quality Certification. I certify that I am familiar with the information contained in this application and, to the best of my knowledge and belief, such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities or I am acting as the duly authorized agent of the applicant.



 Signature of Applicant

08/23/13

 Date



 Signature of Agent

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in Block 3 has been filled out and signed.

**ADDITIONAL SHEETS TO ACCOMPANY THE
APPLICATION FOR THE OHIO EPA SECTION 401 WATER QUALITY CERTIFICATION FOR:**

Larry Lang First Colony Development Phase II

QUESTION#7

List all approvals or certifications and denials received from other federal, interstate, state, or local agencies for any structures, construction, discharge or other activities described in this application.

Issuing Agency	Type of Approval	Identification No.	Date of Application	Date of Approval	Date of Denial
U.S. Army Corps	404 Nationwide (Phase I Box Culvert)	LRH-2009-318-OHR	04/10/09	08/11/09	-
Ohio EPA	General	OGC01290*AG	04/16/09	04/16/09	-
Washington County	Floodplain Permit (Phase I)	P0904W214B	04/24/09	04/24/09	-
City of Marietta	Land Development Permit (Phase I)	11-001	07/20/09	02/02/11 (REV)	-
Ohio EPA	PTI (Sewer)	726869	09/17/09 02/28/11 (REV)	03/10/11	-
City of Marietta	Permit to Fill (Phase I)	N/A	10/2010	11/2010	-
U.S. Army Corps	404 After the Fact Permit (Phase II Box Culvert)	LRH-2009-318-OHR	07/25/12	Pending	-
City of Marietta	Land Development Permit (Phase II)	12-083	08/28/12	10/03/12	-
City of Marietta	Permit to Fill (Phase II)	N/A	08/28/12	10/03/12	-
Washington County	Floodplain Permit (Phase II)	Not yet assigned	08/02/12	Pending	-

QUESTION #10

10a) Provide a detailed description of any construction work, fill or other structures to occur or to be placed in or near the surface water. Identify all substances to be discharged, including the cubic yardage of dredged or fill material to be discharged to the surface water.

Preferred Design:

Phase II of the First Colony Development proposes that a concrete box culvert (10'-5"H x 14'-0"W x 545'L) would be installed, along with concrete wingwalls, to allow for re-routing of approximately 1085 lineal feet of an unnamed tributary of Duck Creek. Once the culvert has been installed, the water from the unnamed tributary would be re-routed through the culvert, and fill material would be placed in the location of the tributary. Approximately 1,125 cubic yards of material would be required to fill the 1085 lineal feet of tributary within the limits of the OHWM (approximately 2'D x 14' W). Fill material will be native soil borrowed from a nearby site. (See Appendix A for detailed plans, cross sections, and topographic map)

Minimal Degradation Alternative

As an alternative, a shorter box culvert (10'-5"H x 14'-0"W x 110'L) would be installed, along with wing walls. This shorter box culvert would be installed within the current tributary alignment and would allow a crossing\construction of a public roadway to tie the development together. Approximately 200 lineal feet of the tributary would be affected. Minimal disturbance within the tributary would be required to construct the box culvert (approximately 120 cubic yards of dredged material removed below the OHWM). (See Appendix A for detailed plans, cross sections, and topographic map)

Non-Degradation Alternative

As a non-degradation alternative, no culvert or re-routing of the stream will occur. The existing site would be filled to a desired elevation, while preserving the existing tributary within the OHWM for the entire length of the tributary in the Phase II portion of the development. There will be no dredged or fill material within the limits of the OHWM of the tributary. (See Appendix A for detailed plans, cross sections, and topographic map)

10b) Describe the magnitude if the proposed lowering of water quality. Include the anticipated impact of the proposed lowering of water quality on aquatic life and wildlife, including threatened and endangered species (include written comments from Ohio Department of Natural Resources and U.S. Fish and Wildlife Service), important commercial or recreational sport fish species, other individual species, and the overall aquatic community structure and function. Include Corps of Engineers approved wetland delineation.

Preferred Design

An Unnamed tributary of Duck Creek meanders through the middle of the entire First Colony Development. Approximately 2,005 lineal feet of tributary are contained within the limits of Phase II of the development. Once the tributary leaves the development site, it flows 2,300 feet easterly and empties into Duck Creek. The aquatic life use designation (per OAC 3745-1) has not been assigned for this unnamed tributary. However, QHEI and HHEI forms for the unnamed tributary are included in Appendix D. A copy of Public Notice (U.S. Army Corps of Engineers) and comments

from Ohio Department of Natural Resources and Fish and Wildlife Service are included in Appendix B. According to the comments there were several state and federal endangered species within the range of the project area. However, a closer analysis of the site and its conditions proved to provide only a possible habitat for the Eastern hellbender (a state endangered species), the Ohio lamprey (a state endangered fish), and the Eastern spadefoot toad (a state endangered species). An Eastern spadefoot toad habitat survey (included in Appendix C) was performed per the recommendation of the ODNR, drawing the conclusion that the project area provided a "low quality" habitat and would not impact the Eastern spadefoot toad species. To minimize impact to the Ohio lamprey and Eastern hellbender, proposed work to be done within the species habitat will be performed during months in which the ODNR recommends. Site photographs and an index map are included in Appendix E.

Under the preferred design, approximately 1085 lineal feet of the tributary would be impacted (See Appendix A for Preferred Design Plan) by installing a 545-foot long concrete box culvert and re-routing the unnamed tributary through the proposed culvert. Fill would be placed in the flow path area of the original unnamed tributary.

Minimal Degradation Alternative

As an alternative, the shorter box culvert installation would reduce the length of tributary to be impacted to 200 lineal feet. (See Appendix A for Minimal Degradation Plan) All remaining information regarding streams would be identical to the preferred design. All measures taken to avoid and minimize impacts with the preferred design, would also apply to the 200 lineal feet of tributary to be impacted in this design alternative.

Non-Degradation Alternative

As a non-degradation alternative, no box culverts or in-stream work would occur. (See Appendix A for Non-Degradation Alternative Plan) All remaining information regarding streams would be identical to the preferred design. Proper sediment and erosion control measures will be installed to prevent impact on water quality.

10c) Include a discussion of the technical feasibility, cost effectiveness, and availability. In addition, the reliability of each alternative shall be addressed (including potential recurring operational and maintenance difficulties that could lead to increased surface water degradation.)

Preferred Design

Construction costs for the preferred design are summarized in the following table:

OPINION OF PROBABLE CONSTRUCTION COST					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
624E10000	MOBILIZATION	LS	1	\$3,000.00	\$3,000.00
623E10000	CONSTRUCTION LAYOUT STAKE	LS	1	\$4,500.00	\$4,500.00
	SEED MIXTURE, TEMPORARY	LS	1	\$1,000.00	\$1,000.00
	CONTOUR DITCH	LS	1	\$1,000.00	\$1,000.00
	DITCH CHECK	LS	1	\$1,500.00	\$1,500.00
	SEED MIXTURE, C-2	LS	1	\$1,500.00	\$1,500.00
	SEED MIXTURE, L	LS	1	\$1,500.00	\$1,500.00
	MULCH, FERTILIZER, LIME, WATER, ETC.	LS	1	\$1,500.00	\$1,500.00
614E11000	MAINTAINING TRAFFIC FOR TURNING LANE	LS	1	\$5,000.00	\$5,000.00
203E40000	BORROW	CY	72000	\$10.00	\$720,000.00
	STREET LIGHTING POLES	EA	6	\$3,200.00	\$19,200.00
	4 INCH PLASTIC TELEPHONE CONDUIT*	LF	1100	\$6.00	\$6,600.00
604E31500	MANHOLE NO. 3 (SANITARY ONLY)	EA	4	\$3,500.00	\$14,000.00
604E31500	MANHOLE NO. 3 (STORM ONLY)	EA	2	\$5,000.00	\$10,000.00
604E00800	CATCH BASIN, NO. 3A	EA	12	\$2,500.00	\$30,000.00
603E04400	12" HDPE STORM WATER PIPE, TYPE B CONDUIT	LF	730	\$50.00	\$36,500.00
638E01101	6" PVC WATER PIPE AND FITTINGS	LF	1650	\$35.00	\$57,750.00
	FIRE HYDRANTS, VALVING, ETC.	EA	3	\$5,000.00	\$15,000.00
	6" SEWER CONDUIT, TYPE B (LATERALS)	LF	230	\$35.00	\$8,050.00
603E01800	8" SEWER CONDUIT, TYPE B	LF	500	\$40.00	\$20,000.00
603E03100	10" SEWER CONDUIT, TYPE B	LF	650	\$45.00	\$29,250.00
	4 INCH PE GAS PIPE*	LS	1	\$4,000.00	\$4,000.00
	ELECTRICAL CONDUIT, TRENCH, ETC.*	LS	1	\$10,000.00	\$10,000.00
204E50000	GEOTEXTILE FABRIC, TYPE D	SY	7500	\$1.50	\$11,250.00
304E20000	AGGREGATE BASE COURSE	CY	755	\$65.00	\$49,075.00
301E46000	ASPHALT CONCRETE BASE COURSE, PG64-22	CY	365	\$180.00	\$66,300.00
446E46050	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, PG64-22	CY	211	\$200.00	\$42,200.00
446E47020	ASPHALT CONCRETE SURFACE COURSE, TYPE 1, PG64-22	CY	150	\$220.00	\$33,000.00
609E12000	COMBINATION CURB & GUTTER, TYPE 2	LF	3360	\$28.00	\$94,080.00
608E10000	CONCRETE WALK, 4"	SF	9900	\$5.00	\$49,500.00
642	STRIPING (CENTERLINE, STOP LINES, EDGE LINES, ETC.)	LS	1	\$5,100.00	\$5,100.00
	REINFORCED CONCRETE BOX CULVERT	CY	1010	\$500.00	\$505,000.00

*ITEM WILL NOT BE OWNED BY THE CITY OF MARIETTA

SUBTOTAL	\$1,855,755.00
10% CONTINGENCY	\$185,575.50
DESIGN/SURVEYING SERVICES	\$75,000.00
2.5% GENERAL CONDITIONS	\$46,400.00
2.5% GC OVERHEAD	\$46,400.00
5.0% GC PROFIT	\$92,800.00
TOTAL	\$2,301,930.50

Probable economic profits/losses for the preferred design are summarized in the following table:

PREFERRED DESIGN - OPINION OF PROBABLE ECONOMIC PROFITS/LOSSES				
DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
LOT #11	ACRE	1.244	\$400,000.00	\$497,600.00
LOT #12	ACRE	0.938	\$400,000.00	\$375,200.00
LOT #13	ACRE	1.035	\$400,000.00	\$414,000.00
LOT #14	ACRE	0.784	\$600,000.00	\$470,400.00
LOT #15	ACRE	0.849	\$600,000.00	\$509,400.00
LOT #16	ACRE	0.821	\$600,000.00	\$492,600.00
LOT #17	ACRE	0.72	\$600,000.00	\$432,000.00
LOT #18	ACRE	0.675	\$600,000.00	\$405,000.00
TOTAL SALES =				\$3,596,200.00

In comparison, the preferred design is predicted to generate a profit of \$1,294,269.50 once all of the lots are constructed and sold. The current developer has the equipment and capability to complete Phase 2 of the development in approximately 6 months. Once the infrastructure (roads, utilities, etc.) are approved by the local authorities, they will

be turned over to the City of Marietta for future maintenance. The proposed lots will be constructed to the desired elevations, seeded and mowed/maintained until they are sold.

Minimal Degradation Alternative

Construction costs for the Minimal Degradation design are summarized in the following table:

MINIMUMAL DEGRADATION ALTERNATIVE - OPINION OF PROBABLE CONSTRUCTION COST					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
624E10000	MOBILIZATION	LS	1	\$3,000.00	\$3,000.00
623E10000	CONSTRUCTION LAYOUT STAKE	LS	1	\$4,500.00	\$4,500.00
	SEED MIXTURE, TEMPORARY	LS	1	\$1,000.00	\$1,000.00
	CONTOUR DITCH	LS	1	\$1,000.00	\$1,000.00
	DITCH CHECK	LS	1	\$1,500.00	\$1,500.00
	SEED MIXTURE, C-2	LS	1	\$1,500.00	\$1,500.00
	SEED MIXTURE, L	LS	1	\$1,500.00	\$1,500.00
	MULCH, FERTILIZER, LIME, WATER, ETC	LS	1	\$1,500.00	\$1,500.00
614E11000	MAINTAINING TRAFFIC FOR TURNING LANE	LS	1	\$5,000.00	\$5,000.00
203E40000	BORROW	CY	34000	\$12.00	\$408,000.00
	STREET LIGHTING POLES	EA	5	\$3,200.00	\$16,000.00
	4 INCH PLASTIC TELEPHONE CONDUIT*	LF	1100	\$6.00	\$6,600.00
604E31500	MANHOLE NO. 3 (SANITARY ONLY)	EA	4	\$3,500.00	\$14,000.00
604E31500	MANHOLE NO. 3 (STORM ONLY)	EA	0	\$5,000.00	\$0.00
604E00800	CATCH BASIN, NO. 3A	EA	9	\$2,500.00	\$22,500.00
603E04400	12" HDPE STORM WATER PIPE, TYPE B CONDUIT	LF	700	\$50.00	\$35,000.00
638E01101	6" PVC WATER PIPE AND FITTINGS	LF	1450	\$35.00	\$50,750.00
	FIRE HYDRANTS, VALVING, ETC	EA	3	\$5,000.00	\$15,000.00
	6" SEWER CONDUIT, TYPE B (LATERALS)	LF	175	\$35.00	\$6,125.00
603E01800	8" SEWER CONDUIT, TYPE B	LF	400	\$40.00	\$16,000.00
603E03100	10" SEWER CONDUIT, TYPE B	LF	550	\$45.00	\$24,750.00
	4 INCH PE GAS PIPE*	LS	1	\$4,000.00	\$4,000.00
	ELECTRICAL CONDUIT, TRENCH, ETC*	LS	1	\$10,000.00	\$10,000.00
204E50000	GEOTEXTILE FABRIC, TYPE D	SY	7300	\$1.50	\$10,950.00
304E20000	AGGREGATE BASE COURSE	CY	735	\$65.00	\$47,775.00
301E46000	ASPHALT CONCRETE BASE COURSE, PG64-22	CY	354	\$180.00	\$63,720.00
446E46050	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, PG64-22	CY	205	\$200.00	\$41,000.00
446E47020	ASPHALT CONCRETE SURFACE COURSE, TYPE 1, PG64-22	CY	145	\$220.00	\$31,900.00
609E12000	COMBINATION CURB & GUTTER, TYPE 2	LF	3250	\$28.00	\$91,000.00
608E10000	CONCRETE WALK, 4"	SF	9600	\$5.00	\$48,000.00
642	STRIPING (CENTERLINE, STOP LINES, EDGE LINES, ETC)	LS	1	\$5,100.00	\$5,100.00
	REINFORCED CONCRETE BOX CULVERT	CY	204	\$500.00	\$102,000.00

*ITEM WILL NOT BE OWNED BY THE CITY OF MARIETTA

SUBTOTAL	\$1,090,670.00
10% CONTINGENCY	\$109,067.00
DESIGN/SURVEYING SERVICES	\$75,000.00
2.5% GENERAL CONDITIONS	\$27,300.00
2.5% GC OVERHEAD	\$27,300.00
5.0% GC PROFIT	\$54,600.00
TOTAL	\$1,383,937.00

Probable economic profits/losses for the Minimal degradation design are summarized in the following table:

MINIMAL DEGRADATION DESIGN - OPINION OF PROBABLE ECONOMIC PROFITS/LOSSES				
DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
AREA AVAILABLE TO SELL AS LOTS (SECONDARY ROAD ACCESS)	ACRE	3.182	\$280,000.00	\$890,960.00
AREA AVAILABLE TO SELL AS LOTS (ROAD FRONTAGE/ACCESS)	ACRE	2.637	\$185,000.00	\$487,845.00
TOTAL SALES =				\$1,378,805.00

In comparison, the Minimal degradation design is predicted to generate a loss of \$5,132 once all of the lots are constructed and sold. The developed lots would not be as valuable as in the Preferred Design option due to the layout of the roads. Roadways would become dead end/cul-de-sacs and the general layout of the development would be much less appealing. The current developer has the equipment and capability to complete Phase 2 of the development in approximately 5 months. Once the infrastructure (roads, utilities, etc.) are approved by the local authorities, they will be

turned over to the City of Marietta for future maintenance. The proposed lots will be constructed to the desired elevations, seeded and mowed/maintained until they are sold. Due to the generated loss of this alternative, it would not be feasible to complete the project as designed.

Non-Degradation Alternative

Construction costs for the Non-Degradation design are summarized in the following table:

NO DEGRADATION ALTERNATIVE - OPINION OF PROBABLE CONSTRUCTION COST					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
624E10000	MOBILIZATION	LS	1	\$3,000.00	\$3,000.00
623E10000	CONSTRUCTION LAYOUT STAKE	LS	1	\$4,500.00	\$4,500.00
	SEED MIXTURE, TEMPORARY	LS	1	\$3,000.00	\$3,000.00
	CONTOUR DITCH	LS	1	\$1,000.00	\$1,000.00
	DITCH CHECK	LS	1	\$1,500.00	\$1,500.00
	SEED MIXTURE, C-2	LS	1	\$3,000.00	\$3,000.00
	SEED MIXTURE, L	LS	1	\$3,000.00	\$3,000.00
	MULCH, FERTILIZER, LIME, WATER, ETC	LS	1	\$3,000.00	\$3,000.00
814E11000	MAINTAINING TRAFFIC FOR TURNING LANE	LS	1	\$5,000.00	\$5,000.00
203E40000	BORROW	CY	26550	\$12.00	\$318,600.00
	STREET LIGHTING POLES	EA	5	\$3,200.00	\$16,000.00
	4 INCH PLASTIC TELEPHONE CONDUIT*	LF	1100	\$6.00	\$6,600.00
604E31500	MANHOLE NO. 3 (SANITARY ONLY)	EA	4	\$3,500.00	\$14,000.00
604E31500	MANHOLE NO. 3 (STORM ONLY)	EA	0	\$5,000.00	\$0.00
604E00800	CATCH BASIN, NO. 3A	EA	9	\$2,500.00	\$22,500.00
603E04400	12" HDPE STORM WATER PIPE, TYPE B CONDUIT	LF	730	\$50.00	\$36,500.00
638E01101	6" PVC WATER PIPE AND FITTINGS	LF	1450	\$35.00	\$50,750.00
	FIRE HYDRANTS, VALVING, ETC	EA	3	\$5,000.00	\$15,000.00
	6" SEWER CONDUIT, TYPE B (LATERALS)	LF	175	\$35.00	\$6,125.00
603E01800	8" SEWER CONDUIT, TYPE B	LF	400	\$40.00	\$16,000.00
603E03100	10" SEWER CONDUIT, TYPE B	LF	550	\$45.00	\$24,750.00
	4 INCH PE GAS PIPE*	LS	1	\$4,000.00	\$4,000.00
	ELECTRICAL CONDUIT, TRENCH, ETC*	LS	1	\$10,000.00	\$10,000.00
204E50000	GEOTEXTILE FABRIC, TYPE D	SY	7000	\$1.50	\$10,500.00
304E20000	AGGREGATE BASE COURSE	CY	705	\$65.00	\$45,825.00
301E46000	ASPHALT CONCRETE BASE COURSE, PG64-22	CY	350	\$180.00	\$63,000.00
446E46050	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, PG64-22	CY	200	\$200.00	\$40,000.00
446E47020	ASPHALT CONCRETE SURFACE COURSE, TYPE 1, PG64-22	CY	140	\$220.00	\$30,800.00
609E12000	COMBINATION CURB & GUTTER, TYPE 2	LF	3050	\$28.00	\$85,400.00
608E10000	CONCRETE WALK, 4"	SF	9500	\$5.00	\$47,500.00
642	STRIPING (CENTERLINE, STOP LINES, EDGE LINES, ETC)	LS	1	\$5,100.00	\$5,100.00

*ITEM WILL NOT BE OWNED BY THE CITY OF MARIETTA

SUBTOTAL	\$895,950.00
10% CONTINGENCY	\$89,595.00
DESIGN/SURVEYING SERVICES	\$75,000.00
2.5% GENERAL CONDITIONS	\$22,400.00
2.5% GC OVERHEAD	\$22,400.00
5.0% GC PROFIT	\$44,800.00
TOTAL	\$1,150,145.00

Probable economic profits/losses for the non-degradation design are summarized in the following table:

NON-DEGRDATION DESIGN - OPINION OF PROBABLE ECONOMIC PROFITS/LOSSES				
DESCRIPTION	UNIT	QUANTITY	UNIT COST	AMOUNT
AREA AVAILABLE TO SELL AS LOTS (SECONDARY ROAD ACCESS)	ACRE	3.182	\$225,000.00	\$715,950.00
AREA AVAILABLE TO SELL AS LOTS (ROAD FRONTAGE/ACCESS)	ACRE	3.02	\$125,000.00	\$377,500.00
TOTAL SALES =				\$1,093,450.00

In comparison, the Non-degradation design is predicted to generate a loss of \$56,695.00 once all of the lots are constructed and sold. The current developer has the equipment and capability to complete Phase 2 of the development in approximately 4 months. Once the infrastructure (roads, utilities, etc.) are approved by the local authorities, they will be turned over to the City of Marietta for future maintenance. The proposed lots will be constructed to the desired elevations, seeded and mowed/maintained until they are sold. It is anticipated that the value of the existing lots to be sold as part of Phase I would decrease and generate less profits overall because of the great reduction in the size of the development. Due to the generated loss of this alternative, it would not be feasible to complete the project as designed.

10d) For regional sewage collection and treatment facilities, include a discussion of the technical feasibility, cost effectiveness and availability, and long-range plans outlined in state or local water quality management planning documents and applicable facility planning documents.

Preferred Design

Not applicable

Minimal Degradation Alternative

Not applicable

Non-Degradation Alternative

Not applicable

10e) To the extent that information is available, list and describe any government and/or privately sponsored conservation projects that exist or may have been formed to specifically target improvement of water quality or enhancement of recreational opportunities on the affected water resource.

Preferred Design

The unnamed tributary that is affected by our design flows into Duck Creek. Muskingum Watershed Conservancy District (MWCD), Washington County Soil and Water Conservation District, City of Marietta, and Friends of the Lower Muskingum (FOLM) were all contacted via email or phone to compile a list of improvement projects and a list of development projects that would affect our unnamed tributary. No known projects were found that would directly impact the unnamed tributary. However, we have included lists that could possibly impact Duck Creek in the vicinity of our site.

Environmental/Recreational Improvement Projects targeting Duck Creek:

- Duck Creek Watershed Action Plan (Ohio EPA)

Development projects adjacent to Duck Creek:

- Remediation project at Cytec Marietta Site (Ohio EPA)

Minimal Degradation Alternative

This item will be identical to the lists provided in the Preferred Design Alternative.

Non-Degradation Alternative

This item will be identical to the lists provided in the Preferred Design Alternative.

10f) Provide an outline of the costs of water pollution controls associated with the proposed activity. This may include the cost of best management practices to be used during construction and operation of the project.

Preferred Design

Best management practices (BMPs) to be used on-site during development include but are not limited to:

- (1) Installation of silt fence to treat sediment-laden water from disturbed areas
- (2) Installation of diversion ditches and sediment traps to treat sediment-laden water from disturbed areas.
- (3) Installation of riprap/rock outlet protection to stabilize concentrated flow outlets at pipes and along stream edges.
- (4) Rock check dams to control concentrated flow in on-site ditches.
- (5) Permanent & Temporary seeding to provide stabilized vegetative cover both during and after construction.
- (6) Mulch, fertilizer, lime, water, etc. as needed to encourage growth of the vegetative cover.

These BMPs will be used prior to, during, and after construction to prevent, control and treat erosion/sediment on the site. Installation and maintenance of the BMPs will be in accordance with ODN Rainwater and Land Development Manual. The project Storm Water Pollution Prevention Plan and BMP specifications are included in Appendix F. An approximation of the costs for each of these items is summarized in the table below.

SEED MIXTURE, TEMPORARY	LS	1	\$1,000.00	\$1,000.00
CONTOUR DITCH	LS	1	\$1,000.00	\$1,000.00
DITCH CHECK	LS	1	\$1,500.00	\$1,500.00
SEED MIXTURE, C-2	LS	1	\$1,500.00	\$1,500.00
SEED MIXTURE, L	LS	1	\$1,500.00	\$1,500.00
MULCH, FERTILIZER, LIME, WATER, ETC.	LS	1	\$1,500.00	\$1,500.00

Minimal Degradation Alternative

Similar BMPs will be utilized in this alternative. The approximate costs would be similar to the Preferred Design Alternative.

Non-Degradation Alternative

Similar BMPs will be utilized in this alternative. The approximate costs would be similar to the Preferred Design Alternative.

10g) Describe any impacts on human health and the overall quality and value of the water resource.

Preferred Design

The unnamed tributary and its downstream receiving water, Duck Creek, are not used by humans for consumption or hygiene. Due to the lower water levels in the unnamed tributary, it is not likely to be used as recreational water. Duck Creek’s primary benefit to humans would be limited recreational uses such as kayaking, swimming, or fishing. Lowering the water quality of the unnamed tributary and Duck Creek would possibly impact fish and plant life in and around the streams. Sediment-laden water may be unpleasant and unsafe for humans to use recreationally.

Minimal Degradation Alternative

The impacts on the water source will be the same as described in the Preferred Design.

Non-Degradation Alternative

The impacts on the water source will be the same as described in the Preferred Design.

10h) Describe and provide an estimate of the important social and economic benefits to be realized through this project. Include the number and type of jobs created and tax revenues generated and a brief discussion on the condition of the local economy.

Preferred Design

From trends of the Phase I development and growth, each lot/future site is anticipated to generate work for (1) local contractors and suppliers for construction of the new buildings/businesses, (2) an average of 20 full-time employees to operate each new businesses, and (3) general grounds care, utility providers, etc. to service the new development. Future lots/sites will be sold as commercial sites and provide state and local tax revenues from their sale/future business. The local economy is primarily centered on educational, health and social services, manufacturing, and retail trade industry. Marietta College, Washington State Community College, and Washington County Career Center provide jobs for educational professionals, while Marietta Memorial and Selby General support medical staff. A good number of manufacturing plants provide a variety of jobs from laborers to technical specialists. Most recently the area has been impacted by the Horizontal Drilling oil & gas boom. Unemployment rates have been recorded around 6.5% to 7.5% through recent years. Median household income is approximately \$29,000, with a range of 66% to 94% poverty levels among individuals and families in 1999. The existing unnamed tributary does not currently provide any type of recreational or commercial benefits directly and therefore, is not impacted by the development of the site. Development of the site would provide a potential location for numerous interested businesses. Potential interested parties include a third chain hotel (in addition to the two existing hotels on the Phase I portion of the development), restaurants, financial/banking institutions, and a Veterans Affairs Clinic. Providing these businesses with a location to serve the local area could benefit not only the new business owners, but also the current residents, tourists, and business owners. Property of the development site, as well as adjacent commercial properties will increase. Adjacent residential property values would not be anticipated to fluctuate greatly due to the fact that project development site was previously zoned and used as a commercial site. The First Colony Development is being designed with a historic and aesthetically pleasing layout. Street lighting poles and other fixtures have been installed/planned to follow the theme of Marietta's historic appearance and appeal. Areas of vegetation and surface water buffer zones are planned to use appropriate native grasses and plants while maintaining a pleasing appearance.

Minimal Degradation Alternative

The minimal degradation alternative limits the amount of developable area, therefore limiting the number and size of lots to be sold to future businesses. In this alternative, the number of lots is reduced to 6. While the same types of jobs/work is anticipated to be generated as in the preferred design, the approximate total jobs created could be nearly 75% less due to the reduced business development area. Current local economy statistics would be the same as in the Preferred Design. Commercial and recreational impacts on the unnamed tributary would be the same as in the Preferred Design. Property values for commercial properties may not increase as much as they would in the Preferred Design. Residential property values would not be noticeably impacted. Aesthetically, this alternative would provide more green areas within the riparian buffer zones. These areas would be maintained according to the mitigation plans (Appendix A)

where appropriate. Remaining, non-mitigation green spaces, would be planted with native grasses and plants just as in the Preferred Design.

Non-Degradation Alternative

The non-degradation alternative would likely generate the same amount of work/jobs as the minimal degradation alternative. The amount of developable area/lots is nearly the same, allowing for similar size businesses to operate on the lots. Current local economy statistics would be the same as in the Preferred Design. Commercial and recreational impacts on the unnamed tributary would be the same as in the Preferred Design. Property values for commercial properties may not increase as much as they would in the Preferred Design. Residential property values would not be noticeably impacted. This alternative would provide the most green areas within the riparian buffer zones and in the undevelopable/inaccessible acreage. These areas would be maintained according to the mitigation plans (Appendix A) where appropriate. Remaining, non-mitigation green spaces, would be planted with native grasses and plants just as in the Preferred Design.

10i) Describe and provide an estimate of the important social and economic benefits that may be lost as a result of this project. Include the effect on commercial and recreational use of the water resource, including effects of lower water quality on recreation, tourism, aesthetics, or other use and enjoyment by humans.

Preferred Design

The site is currently undeveloped and not being used by any businesses. No know loss of jobs or work will be caused by developing this site. State and local tax revenues would not be lost. Local economy statistics are discussed in section 10h – Preferred Design. Property values of the development site, as well as the adjacent properties are not anticipated to decrease. The existing unnamed tributary does not currently provide any type of recreational or commercial benefits directly and therefore, is not impacted by the development of the site. There are no known businesses that would be negatively impacted by the development of the site. During development of the site and any future individual businesses, portions of the site will have a construction period where the ground is disturbed, construction equipment and utility companies will be present. This is a necessary phase that must occur for any development, but it is understandably displeasing for adjacent property or business owners. Proper planning and sound engineering design should minimize the degree of disturbance and length of time for construction phases.

Minimal Degradation Alternative

The Social and Economic Benefits Lost would be the same as in the Preferred Design.

Non-Degradation Alternative

The Social and Economic Benefits Lost would be the same as in the Preferred Design.

10j) Describe environmental benefits, including water quality, lost and gained as a result of this project. Include the effects on the aquatic life, wildlife, threatened or endangered species.

Preferred Design

In this design, a portion of the stream will be re-routed through the proposed box culvert. While the box culvert will follow the current slope of the stream, it eliminates the sinuosity and ripples of the existing waterway. The velocities of the water flowing through the culvert may be higher than existing velocities at times, allowing for better sediment-moving capability. Filtering and recharging of the groundwater can still occur prior to and after the box culvert location.

Minimal Degradation Alternative

In this alternative, a shorter box culvert will be installed, the stream will not be re-routed, and therefore maintain its current slope, sinuosity, and sediment-moving capabilities. Filtering and recharging of the groundwater can still occur throughout all areas of the existing stream, except for the short length occupied by the proposed box culvert.

Non-Degradation Alternative

In this alternative, no impact on the existing stream will occur. Therefore, no effect on the streams sediment moving capability will take place.

10k) Describe mitigation techniques proposed (except for the Non-Degradation Alternative):

- **Describe proposed Wetland Mitigation (see OAC 3745-1-54 and Primer)**
- **Describe proposed Stream, Lake, Pond Mitigation (see Primer)**

Preferred Design

PREFERRED DESIGN – MITIGATION PLAN (UNNAMED TRIBUTARY)

Reasoning for Mitigation Design:

By receipt of the Notice of Violation (NOV) letter, dated on September 17, 2012 from the Army Corps of Engineers (ACOE) Ginger Mullins, approximately 450 linear feet of the unnamed tributary to Duck Creek was channelized during construction at the site. This activity was unauthorized by the issuance of a Department of the Army permit.

A subsequent letter dated on November 27, 2012 from the ACOE representative Teresa Spagna detailed a required compensation program which addressed the NOV letter. "The objective of the compensatory mitigation is to offset environmental losses resulting from unavoidable impacts to waters of the United States."

Approaches to mitigation measures and other assessments

By receipt of the second referenced letter special attention was given to restoration, enhancement, and establishment and in some circumstances preservation of the aquatic environment. "Compensatory mitigation requirements should be based on a watershed and consideration of what is best for the aquatic environment". In addition to this approach this mitigation will also incorporate the enhancements of biological diversity for land supportive fauna as well.

Several studies were also conducted to determine the likelihood of suitable habitat loss for rare and endangered species. Jeffrey Davis of the Ohio Division of Wildlife conducted a 2013 habitat survey for the Eastern Spadefoot (*Scaphiopus holbrookii*) at the First Colony Commercial Development. Under the section of the recommendations he states "The installation of a box culvert, through which the stream along the south edge of the subject site will flow, will not impact the Eastern Spadefoot, even if they exist at the site. The species does not utilize stream habitats nor do they generally cross them."

Further review of Mary Knapp, Ph. D. field supervisor of the United States Department of the Interior, Columbus, Ohio addressed a request of information regarding federally threatened and endangered species at the First Colony Phase II Development in Marietta, Ohio. Her letter was dated August 29, 2012 and written to S. Beth Burdette of Potesta.

Concerns were listed for several potential endangered species. The proposed project lies within the range of the Indiana bat. Mitigative measure will select flora species that address potential habitat enhancements.

The project also lies within the range of the freshwater mussels of fanshell (*Cyprogenia stegaria*), pink mucket pearly mussel (*Lampsilis abrupta*), sheepnose (*Plethobasus cyphus*), and the snuffbox (*Epioblasma triquetra*). "The development of commercial buildings and other impervious surfaces may lead to increased stormwater runoff, pollutants, and increased sediment transport into the stream." Stormwater from the parking lots of the Phase I and Phase II developments are directed into settling ponds. The pipes entering from the Phase I parking discharge to a settling pond with no outlet. The second settling pond will be large enough to increase the settling time resulting in a reduction of TSS levels.

The eastern hellbender (*Cryptobranchus a. alleganiensis*) and the bald eagle (*Haliaeetus leucocephalus*) should not be impacted due to the project type, size, and location.

Area of Mitigation

In the Preferred Design plan, the area of mitigation is defined as an area located between an existing box culvert and the proposed box culvert. It is 0.936 acres and includes approximately 385 lineal feet of stream. The width of the mitigation area is roughly 80 feet.

Concept of Pool Areas, Number and Construction

A site visit on August 6, 2013 revealed a stream flow of approximately 15 gallons per minute. Due to the plentiful rains this summer, the flow would be expected to be less in dryer years. Similar inspections in a late spring have revealed flows in the sixty to seventy gallons per minute range.

Given these facts, this unnamed tributary would not be able to support year-round sport fishing due to fluctuations of flow.

As discussed at a meeting on May 8, 2013 with Amy Zwick, Mark Welch, Michael Gulliver, Aaron Wolfe and Brianne Ciccone, perhaps the best mitigation plan would include the creation of numerous pools throughout the mitigation area.

These pool areas would be placed on approximately 100' apart. Thus, the mitigation area would have 4 pool areas. Different angles of the dike pool areas are shown in details on the mitigation plans.

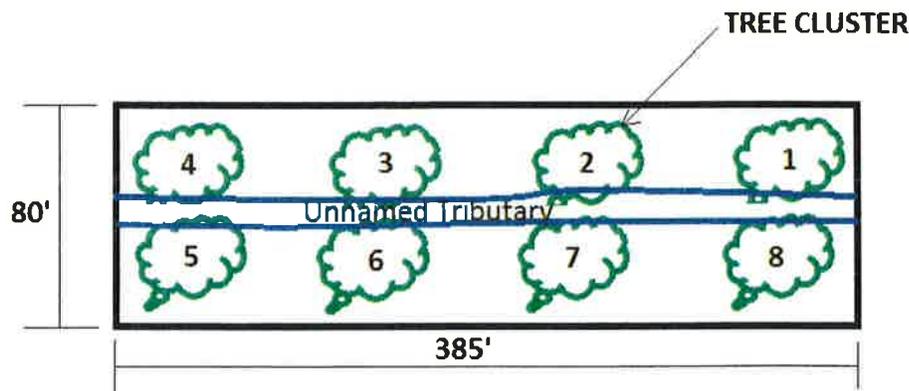
Type A rock is already on site, Type B and C rock would need to be obtained from a quarry or other source. Some riprap would be necessary up the bank to arrest any erosion potential.

Flora Plantings

The flora plantings have been carefully selected with input from Kathy Davis, Ann Bonner, Al Lang and Jim Ludwig. Al Lang, owner of Greenleaf Landscaping was instrumental in the determination of availability of the recommended species. Spring planting would result in more robust plants. Fall plantings would result in potted tree species in the five foot range. Prior to plantings, final soil level would be necessary and topsoil shall be used in all planting areas.

Given the disturbance of the mitigation area, removal of all invasive vegetation species would be required. Such species include sumac (*Rhus typhina* and *Rhus glabra*), multiflora rose (*Rosa Multiflora*), honey suckle (*Lonicera sp.*) and primary colonizers like cottonwood (*Populus detpoides*), boxelder maple (*Acer negundo*), and mulberry (*Morus rubra*).

Furthermore, the planted flora should consider biodiversity to attract local fauna which may live in the area. The flora plantings are as follows:



Due to the large expanse of this mitigative area the tree clusters are planted on the slope areas to provide shade and other benefits along the stream. Numbers 1 through 8 are clusters of crabapple (*Malus sp.*), red bud (*Cercis Canadensis*), and hazelnut (*Corylus Americana*). These species shall be planted approximately 20 feet apart.

Other Considerations

To maintain this biologically diverse ecosystem it would be enhanced by a spring planting. The specimens would be larger and have a longer time to become established. Inspections would be necessary in year 1, 3 and 5 to assure success and replantings as necessary. Selective mowing may be necessary around the tree and shrub species.

Minimal Degradation Alternative

MINIMAL DEGRADATION DESIGN – MITIGATION PLAN (UNNAMED TRIBUTARY)

The proposed mitigation plan for this alternative is identical to the mitigation plan shown above for the Preferred Design.

Non-Degradation Alternative

Not applicable

Mitigation Design work prepared by:

James D. Ludwig

8/20/13

Name, James D. Ludwig

Date

APPENDIX A

DEVELOPMENT PLANS

TOPOGRAPHIC LOCATION MAP

C1.1: EXISTING CONDITIONS PLAN

C3.1 UNNAMED TRIBUTARY CROSS-SECTIONS

SK-A: PREFERRED DESIGN PLAN

SK-B: MINIMAL DEGRADATION PLAN

SK-C: NON-DEGRADATION ALTERNATIVE PLAN



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

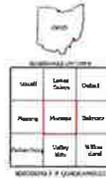


MARIETTA QUADRANGLE
OHIO-WEST VIRGINIA
7.5-MINUTE SERIES



Produced by the United States Geological Survey
using American Datum of 1983 (NAD83)
North American Datum of 1983 (NAD83) - Projection and
1:24,000 scale grid. National Geographic Society, June 1995.
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and all Virginia Quadrangle Centers of 1983
quadrangles.

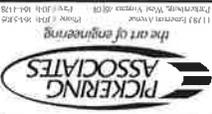
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Projection: UTM
Datum: NAD83
National Geographic Society, 2008
National Geographic Society, 2008



ROAD CLASSIFICATION

Interstate Route	State Route
US Route	Local Road
Route	Other

MARIETTA, OH-WV
2011

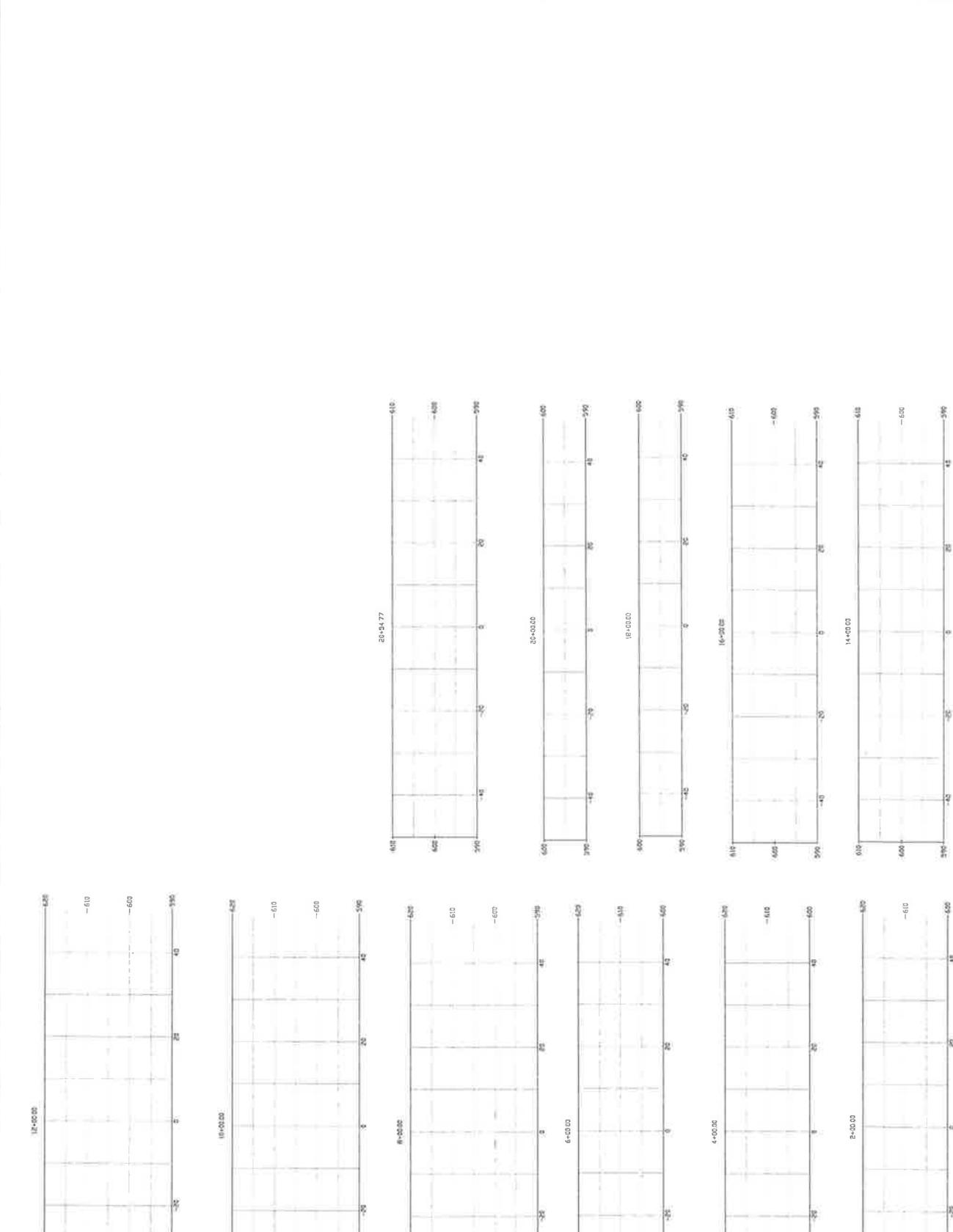


1783 Eastern Avenue
 Parkersburg, West Virginia 26101
 Phone: 304.765.8526
 Fax: 304.765.1139

Rev.	By	Date	Description
0	AMZ		
	AMZ		

Drawing Description
 LARRY LANG EXCAVATING, INC.
 MARBET A. OROO
 FIRST COLONY CENTER
 EXISTING FINISHED TERTIARY CROSS SECTIONS

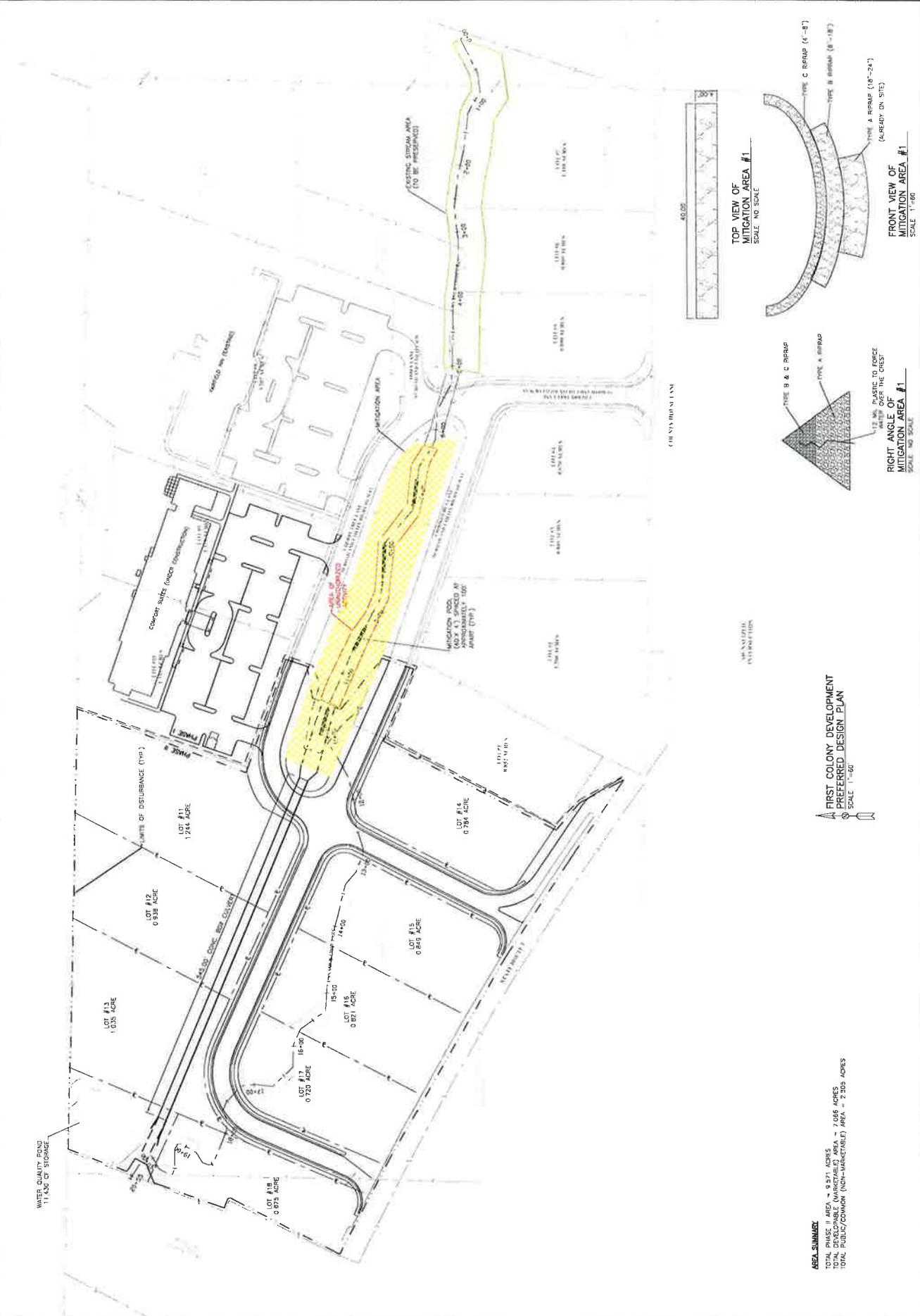
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 Designer: AMZ
 Checker: AMZ
 Scale: AS SHOWN
 Date: 0
 Drawing Number: C3.1



REV	DATE	BY	CHKD	DESCRIPTION

Drawing Description
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NAMIBETTA, OHIO
FIRST COLONY CENTER PHASE II
PREFERRED DESIGN PLAN

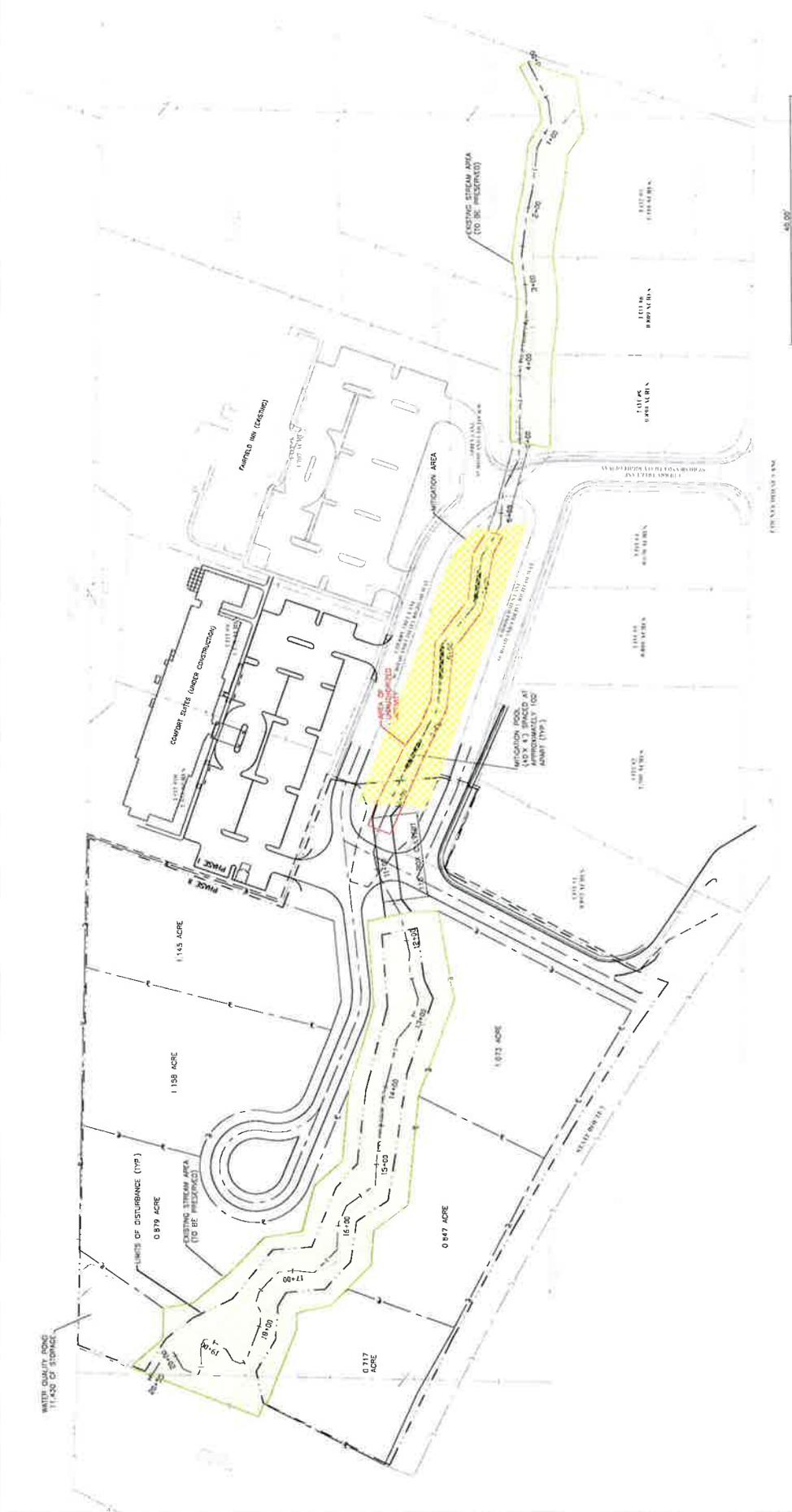
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Checked By: BAW
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Revision #
Drawing Number
SK-A



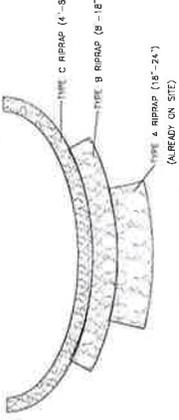
Rev	By	Description
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LARRY LANG EXCAVATING, INC.
 MAHONING, OHIO
FIRST COLONY CENTER PHASE II
 MINIMAL DEGRADATION PLAN

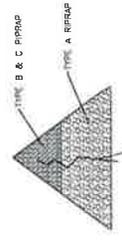
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Designed by: AMZ
Drawn by: AMZ
Checked by: MAW
Scale: AS SHOWN
Rev Date: 08/20/13
Revisions: 0
Drawing Number: SK-B



TOP VIEW OF MITIGATION AREA #1
 SCALE: NO SCALE



FRONT VIEW OF MITIGATION AREA #1
 SCALE: 1"=60'



RIGHT ANGLE OF MITIGATION AREA #1
 SCALE: NO SCALE

AREA SUMMARY
 TOTAL PHASE II AREA = 9,571 ACRES
 TOTAL DISTURBED AREA (MINIMUM REQUIRED) = 3,619 ACRES
 TOTAL PUBLIC COMMON (NON-DEVELOPABLE) AREA = 3,752 ACRES
 SCALE: 1"=60'

FIRST COLONY DEVELOPMENT
 MINIMAL DEGRADATION ALTERNATE
 SCALE: 1"=60'

AREA SUMMARY

TOTAL PHASE II AREA = 9,571 ACRES
 TOTAL DISTURBED AREA (MINIMUM REQUIRED) = 3,619 ACRES
 TOTAL PUBLIC COMMON (NON-DEVELOPABLE) AREA = 3,752 ACRES

FIRST COLONY DEVELOPMENT
 MINIMAL DEGRADATION ALTERNATE
 SCALE: 1"=60'

APPENDIX B

PUBLIC NOTICE & COMMENTS

U.S. ARMY CORPS OF ENGINEERS PUBLIC NOTICE (LRH-2009-318-OHR)

SECTION 7 THREATENED AND ENDANGERED SPECIES CONSULTATION LETTER

FISH AND WILDLIFE SERVICE RESPONSE LETTER

ODNR COMMENTS (EMAIL)

OHIO HISTORY RESPONSE LETTER



Public Notice

**U S Army Corps
of Engineers**
Huntington District
Regulatory Division
North Branch

In reply refer to Public Notice No.

Issuance Date: **FEB 28 2013**

LRH-2009-318-OHR

Stream: Unnamed Tributary to Duck Creek

Closing Date: **MAR 29 2013**

Please address all comments and inquiries to:

U.S. Army Corps of Engineers, Huntington District

ATTN: CELRH-RD-N Public Notice No. (reference above)

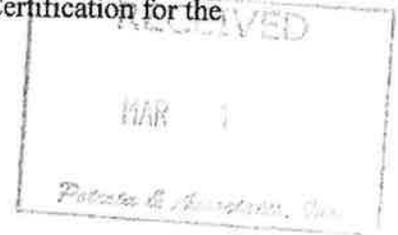
502 Eighth Street

Huntington, West Virginia 25701-2070

Phone: (304) 399-5210

TO WHOM IT MAY CONCERN: The following application has been submitted for a Department of the Army (DA) Permit under the provisions of Section 404 of the Clean Water Act. This notice serves as the United States Corps of Engineers' (Corps) request to the Ohio Environmental Protection Agency to act on Section 401 Water Quality Certification for the following application.

APPLICANT: Mr. Larry Lang
Larry Lang Excavating, Incorporated
19371 State Route 60
Beverly, Ohio 45715



LOCATION: The proposed project is within the Duck Creek watershed in Marietta, Washington County, Ohio as depicted on Figure 1. Proposed discharges of dredged and/or fill material would occur in the unnamed tributary of Duck Creek. The unnamed tributary to Duck Creek is an indirect tributary to the Ohio River, a traditionally navigable water. The project site is located at latitude 39.40647°N and longitude -81.41404°W.

PROJECT HISTORY: On August 11, 2009, the Corps authorized under Nationwide Permit 29 under the March 12, 2007 Federal Register, Notice of Reissuance of Nationwide Permits (72 FR 11092) for the applicant to discharge dredged and/or fill material into 54 linear feet of an unnamed tributary of Duck Creek in conjunction with the installation of a concrete box culvert associated with Phase I of the First Colony project. Phase I of the project involved the construction of a hotel and 1,190 linear feet of public roadway. In 2012, the applicant provided information to the Corps indicating an additional 450 linear feet of the unnamed tributary of Duck Creek had been impacted by the discharge of dredged and/or fill material. The applicant has requested an after-the-fact (ATF) DA authorization for this unauthorized work.

As required by the rules and regulations governing the DA permit program, it was determined that since the unauthorized work did not present an immediate threat to life or property, and the applicant had signed a tolling agreement, an ATF application would be accepted and processed. All investigations and legal proceedings have been suspended pending the outcome of the permit review process. This DA application is being evaluated on its own merits and no consideration has been given to the applicant's unauthorized work activities or prior expenditures.

DESCRIPTION OF THE PROPOSED WORK: The applicant has also requested DA authorization for the additional discharge of dredged and/or fill material into 1,085 linear feet linear of waters of the United States to facilitate the construction of Phase II of the commercial development as depicted on Figure 2. The overall 26.3 acre commercial development would involve discharges of dredged and/or fill material into a total of 1,445 linear feet of waters of the United States and would include eighteen (18) lots, two (2) public roadways and associated utilities as depicted on Figure 3. Plans of the proposal are attached to this notice.

ALTERNATIVE ANALYSIS: The project is not considered to be water dependent; therefore, the applicant is required to show that other less damaging practicable alternatives, which do not require the discharge of dredged and/or fill material into waters of the United States, are not available that would achieve the applicant's overall project purpose. No permit will be issued until our review of the alternative analysis clearly shows that upland alternatives are not available to achieve the overall project purpose.

AVOIDANCE AND MINIMIZATION: In evaluating a project area containing waters of the United States, consideration must be given to avoiding impacts on this site. If waters of the United States cannot be avoided, impacts must be minimized. A total of 2,038 linear feet of the unnamed tributary to Duck Creek, subject to Section 404 Clean Water Act regulation, exists on the project site. Avoidance and minimization efforts were incorporated into the proposal. The applicant has indicated that impacts would be minimized by staging construction and implementing proper erosion and sediment control devices to reduce downstream impacts. The proposed project has been designed to completely avoid impacts to the remaining 953 linear feet of the unnamed tributary to Duck Creek on-site. The applicant would be required to obtain stormwater permits and implement stormwater protection plans as needed for site construction following the requirements of the National Pollutant Discharge Elimination System program.

COMPENSATORY MITIGATION PLAN: The applicant has submitted a conceptual compensatory mitigation statement to compensate for completed and proposed losses of waters of the United States regulated by the Corps. To compensate for permanent impacts to waters of the United States, the applicant proposes to mitigate in the unnamed tributary to Duck Creek watershed by utilizing stream restoration, enhancement and establishment methods.

WATER QUALITY CERTIFICATION: A Section 401 Water Quality Certification is required for this project. It is the applicant's responsibility to obtain certification from the Ohio Environmental Protection Agency.

HISTORIC AND CULTURAL RESOURCES: The National Register of Historic Places (NRHP) has been consulted and it has been determined there are no properties currently listed on the NRHP which would be indirectly or directly affected by the project. A copy of this public notice will be furnished to the Ohio State Historic Preservation Office for their review. Comments concerning archeological sensitivity of the project area should be based upon collection data.

ENDANGERED/THREATENED SPECIES REVIEW: The project is located within the known or historic range of the following endangered species: Indiana bat (*Myotis sodalis*); Fanshell mussel (*Cyprogenia stegaria*); Pink mucket pearly mussel (*Lampsilis abrupta*); Sheepnose mussel (*Plethobasus cyphus*); and the Snuffbox mussel (*Epioblasma triquetra*). The Huntington District has consulted the most recently available information and has determined that no suitable habitat for the Indiana bat or aforementioned mussel species is present within the proposed project area. We have determined the proposed project would have no effect on Indiana bat or the aforementioned mussel species.

Based on this information, the project is not likely to adversely affect the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of habitat of such species which has been determined to be critical. This public notice serves as a request to the United States Fish and Wildlife Service for any additional information they may have on whether any listed or proposed to be listed endangered or threatened species may be present in the area which would be affected by the activity, pursuant to Section 7(c) of the Endangered Species Act of 1972 (as amended).

PUBLIC INTEREST REVIEW AND COMMENT: This application will be reviewed in accordance with 33 CFR 320-332, the Regulatory Program of the Corps, and other pertinent laws, regulations, and executive orders. Our evaluation will also follow the guidelines published by the United States Environmental Protection Agency pursuant to Section 404(b)(1) of the Clean Water Act (40 CFR 230). Interested parties are invited to state any objections they may have to the proposed work. The decision whether to issue a permit will be based on an evaluation of the probable impact, including cumulative impacts of the proposed activity, on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit that reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors that may be relevant to the proposal will be considered including the cumulative effects thereof; among those factors are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people.

SOLICITATION OF COMMENTS: The Corps is soliciting comments from the public, Federal, state and local agencies and officials, Indian Tribes and other interested parties in order to consider and evaluate the impacts of this proposed activity. For accuracy and completeness of the administrative record, all data in support of or in opposition to the proposed work should be submitted in writing setting forth sufficient detail to furnish a clear understanding of the reasons for support or opposition. Any person may request, in writing, within the comment period specified in the notice, that a public hearing be held to consider the application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing. Any comments received will be considered by the Corps to determine whether to issue, modify, condition or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects,

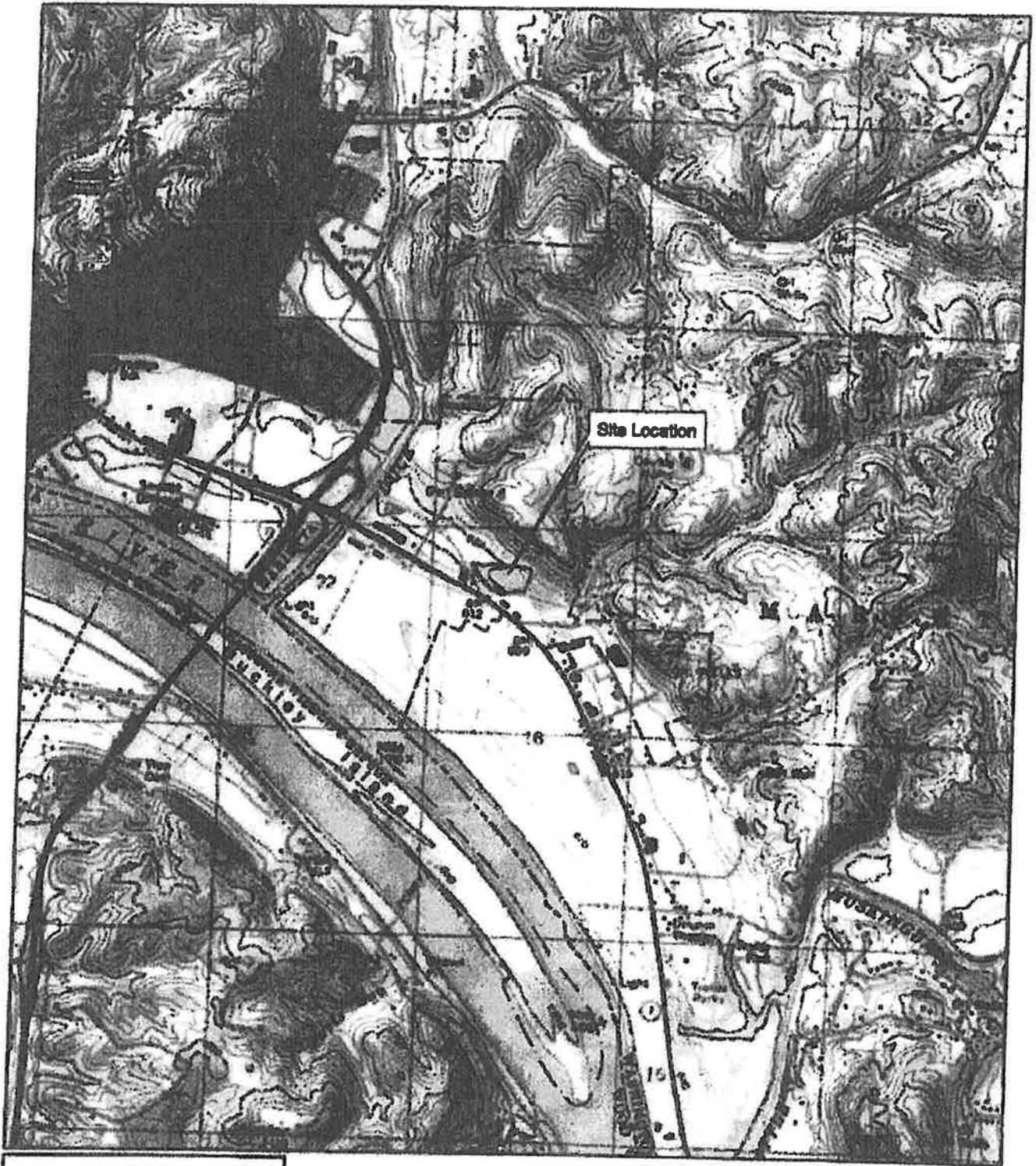
and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity. Written statements on these factors received in this office on or before the expiration date of this public notice will become a part of the record and will be considered in the final determination. A permit will be granted unless its issuance is found to be contrary to the public interest.

CLOSE OF COMMENT PERIOD: All comments pertaining to this Public Notice must reach this office on or before the close of the comment period listed on page one of this Public Notice. If no comments are received by that date, it will be considered that there are no objections. Comments and requests for additional information should be submitted to:

United States Army Corps of Engineers
ATTN: CELRH-RD-N
Public Notice No. LRH-2009-318-0HR
502 Eighth Street
Huntington, West Virginia 25701-2070.

Please note names and addresses of those who submit comments in response to this Public Notice become part of our administrative record and, as such, are available to the public under provisions of the Freedom of Information Act. Thank you for your interest in our nation's water resources. If you have any questions concerning this Public Notice, please contact Mr. Christopher L. Carson of the North Branch at 304 399-5210, by mail at the above address, or by email at Christopher.l.carson@usace.army.mil.

(O)



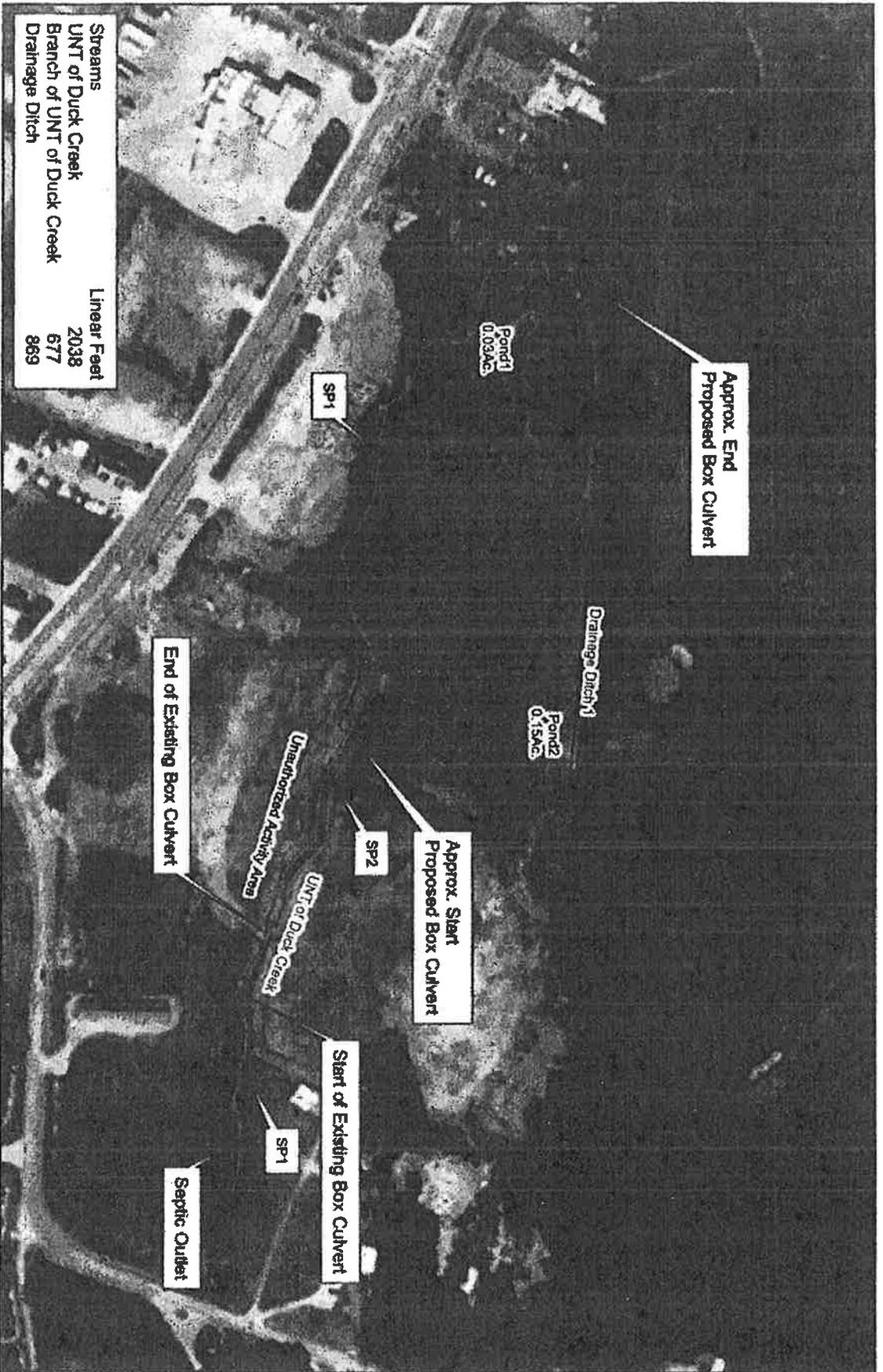
**FIGURE 1
SITE LOCATION MAP
FIRST COLONY
PICKERING
WASHINGTON COUNTY,
OHIO**

DATE: APRIL 24, 2012

 Area of Interest

0 1,000 2,000 4,000
Feet





Streams	Linear Feet
UNT of Duck Creek	2038
Branch of UNT of Duck Creek	677
Drainage Ditch	869

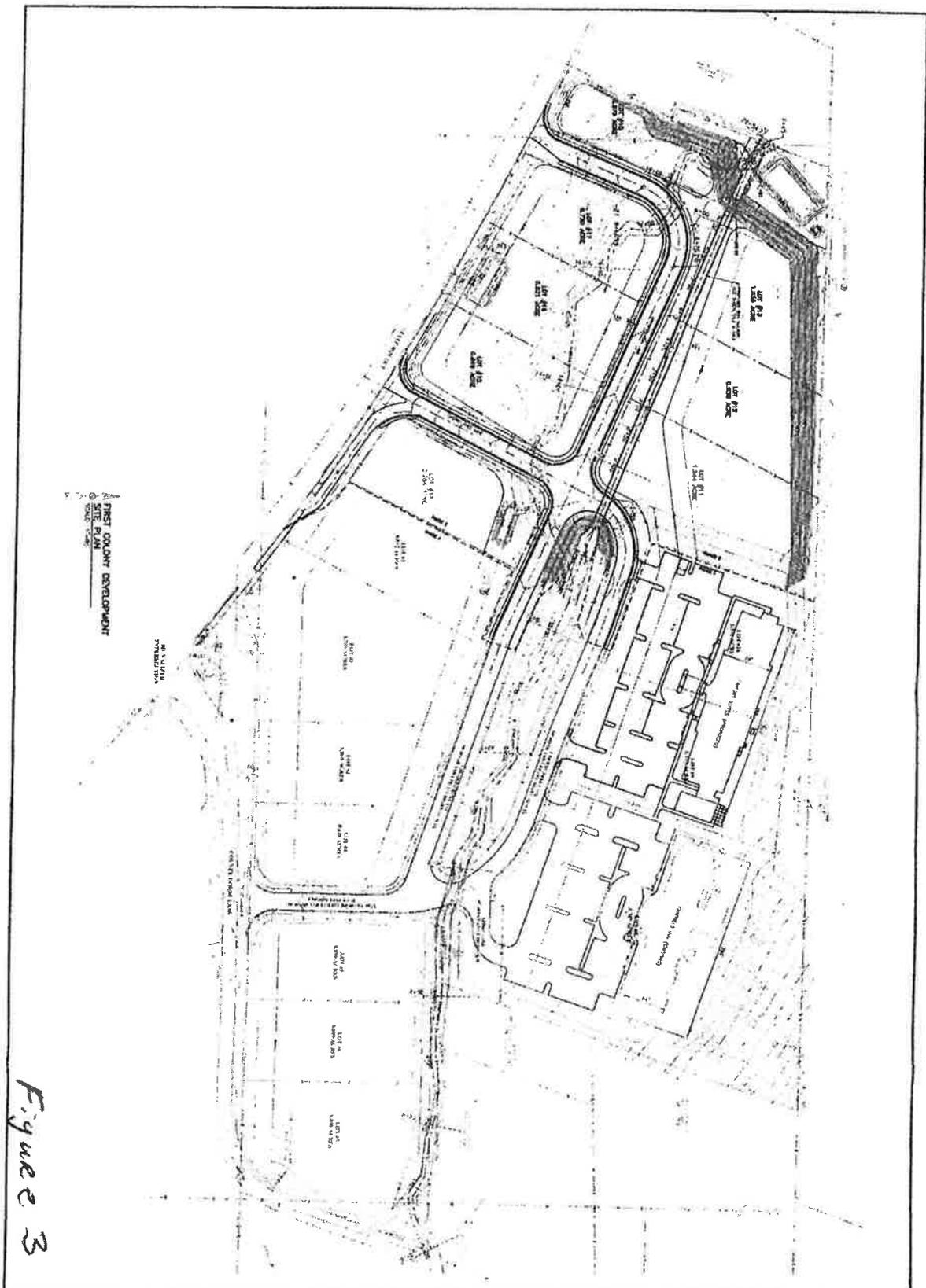
FIGURE 2
DELINEATION MAP
FIRST COLONY
PICKERING
WASHINGTON COUNTY,
OHIO

DATE: DECEMBER 17, 2012

- Delineated Streams**
- Ephemeral
 - Intermittent
 - Perennial
 - Branch of UNT of Duck Creek

- Delineated Wetlands**
- Area of Interest
 - Unauthorized Activity Area
 - Pond





A FIRST COLONY DEVELOPMENT
 SITE PLAN
 0000 1/2" = 1'

Figure 3

Drawing Description LARRY LAND EXCAVATING, INC. MAKRITA, OHIO FIRST COLONY CENTER SITE PLAN		Project Number Drawn By: JAZZ Checked By: JAZZ Title: AS SHOWN Date: 12/01/12 Version: 0 Drawing Number	Date By Description	MAN DWG	PICKERING ASSOCIATES <i>the art of engineering</i> 11013 Routes Avenue Pickering, Ohio 44139 Phone: 440-484-2300 Fax: 440-484-2320
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Engineers and Environmental Consultants

7012 MacCorkle Avenue, SE, Charleston, WV 25304 • (304)342-1400 • FAX (304)343-9031; www.potesta.com

August 7, 2012

United States Fish & Wildlife Service
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, Ohio 43230

RE: Section 7 Threatened and Endangered Species Consultation
First Colony Phase II Development
Washington County, Ohio
POTESTA Project No. 0101-12-0097

To Whom It May Concern:

Potesta & Associates, Inc. (POTESTA) has been retained by Pickering Associates (Pickering) to provide professional environmental consulting services for the proposed First Colony Phase II Development Project (Project) located in Washington County, Ohio.

The Project involves commercial site development within the city limits of Marietta (OH) and is located at approximately 39°24'20.10"N and 81°24'42.68"W (**Figures 1 and 2**). The project location is within the Marietta (OH) USGS 7.5" Topographic Quadrangle. The area has previously been clear cut and the adjacent property has recently been developed; a hotel and parking lot are on the adjacent property.

The developer is proposing to install a box culvert which would impact approximately 600 feet of an unnamed tributary (UNT) of Duck Creek. Duck Creek is a tributary of the Ohio River. It is our understanding that the United States Army Corps of Engineers (USACE) made a jurisdictional determination (JD) of the UNT and, in a letter dated August 2009, stated the UNT is a perennial relatively permanent water. This determination is valid for a 5-year period (Expires August 2014). Also, POTESTA performed a stream and wetland delineation of the Project area of interest (AOI). Wetlands were not identified; however, two open water ponds were identified, in addition to a Branch of UNT of Duck Creek, UNT of Duck Creek, and a drainage ditch (**Figure 3**). The Project AOI is located in Flood Zone AE (100-year flood zone) of the Ohio River (**Figure 4**). The pond areas and areas of inundation all appear to be a result of the tree clearing and are man-made depressional areas. The areas within the AOI did not demonstrate all the necessary characteristics for consideration as wetlands.

This letter serves as a formal request for Section 7 (Endangered Species Act) consultation with your agency. Pickering is requesting information related to all federally threatened or endangered species and their critical habitat, or significant biological or geological features, within a 0.25-mile radius of the proposed Project (**Figure 1**). Information is also requested

POTESTA & ASSOCIATES, INC.

Charleston, West Virginia • Morgantown, West Virginia • Winchester, Virginia

United States Fish & Wildlife Service
August 7, 2012
Page 2

concerning listed species occurring in wetlands hydrologically connected to, located within, or adjacent to the proposed Project area.

We appreciate your timely review of this request. If you have any questions, or require additional information, please do not hesitate to contact me at (304) 342-1400 or sbburdette@potesta.com.

Sincerely,

POTESTA & ASSOCIATES, INC.

S. Beth Burdette

S. Beth Burdette, M.S.
Senior Scientist

SBB/rh

Enclosures

c: Mark Welch, Pickering

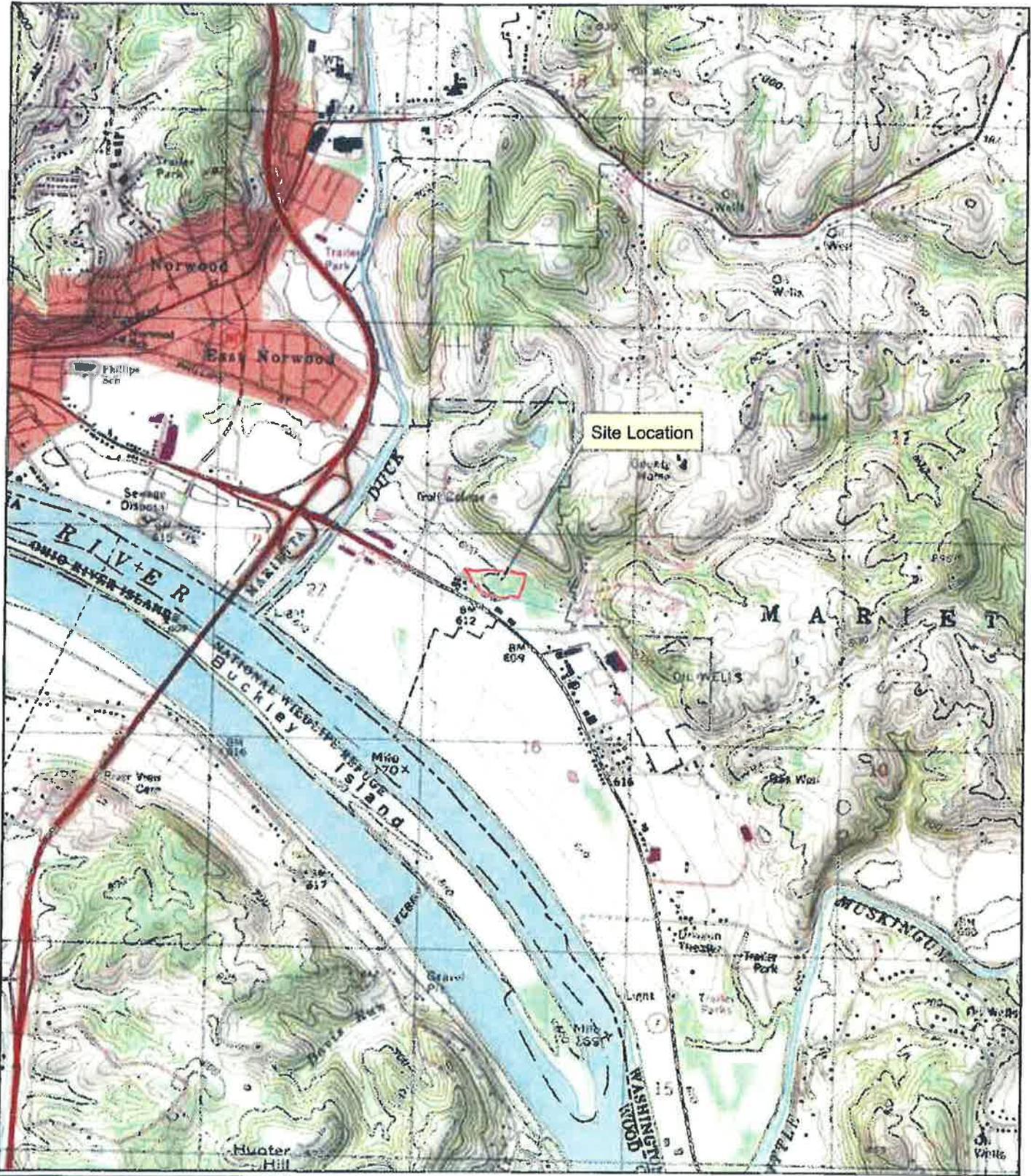
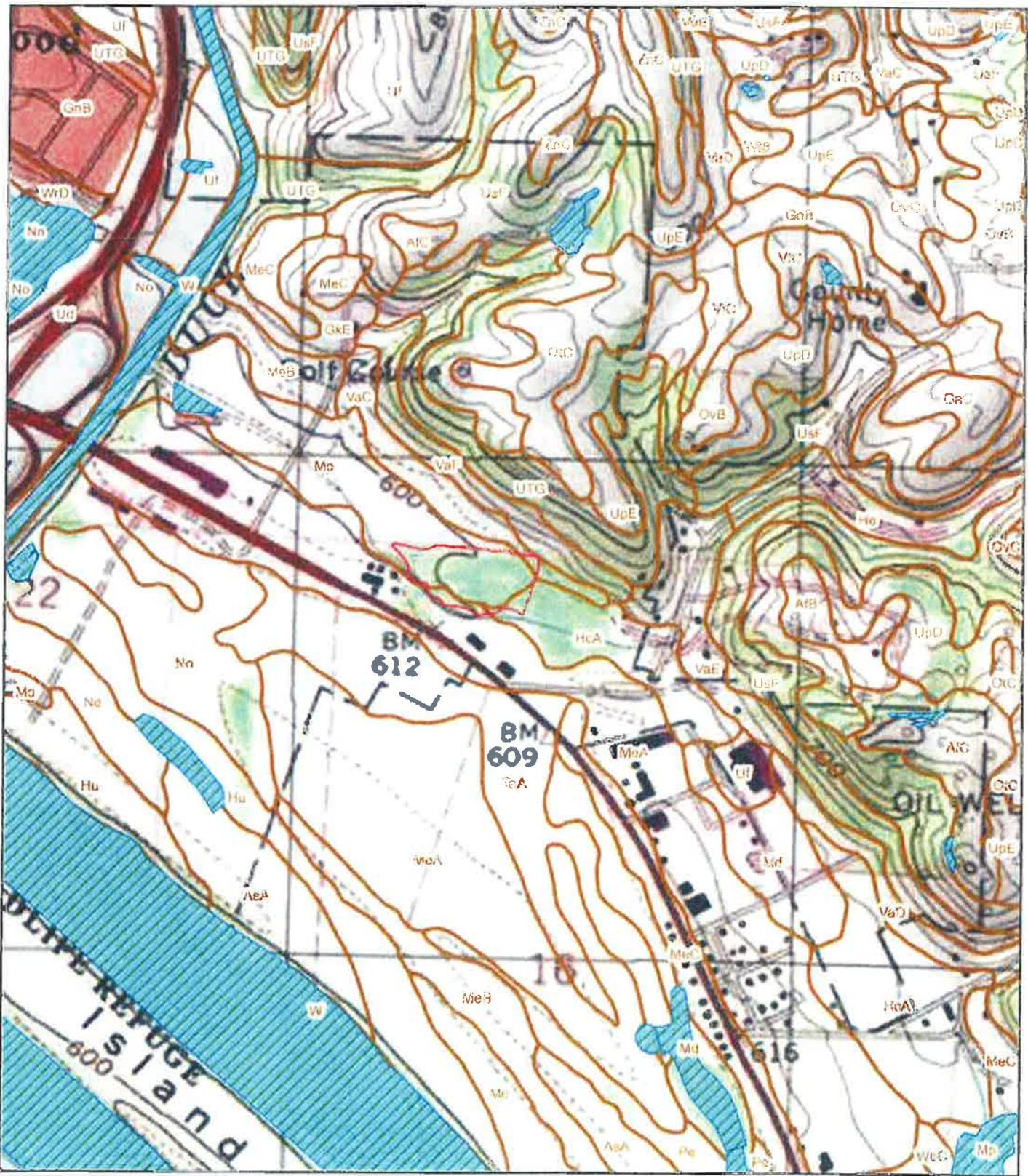


FIGURE 1
SITE LOCATION MAP
FIRST COLONY
PICKERING
WASHINGTON COUNTY,
OHIO
 DATE: APRIL 24, 2012

 Area of Interest





**FIGURE 2
NWI & SOIL MAP
FIRST COLONY
PICKERING
WASHINGTON COUNTY,
OHIO**

DATE: APRIL 24, 2012

- Area of Interest
- National Wetlands Inventory
- Soil



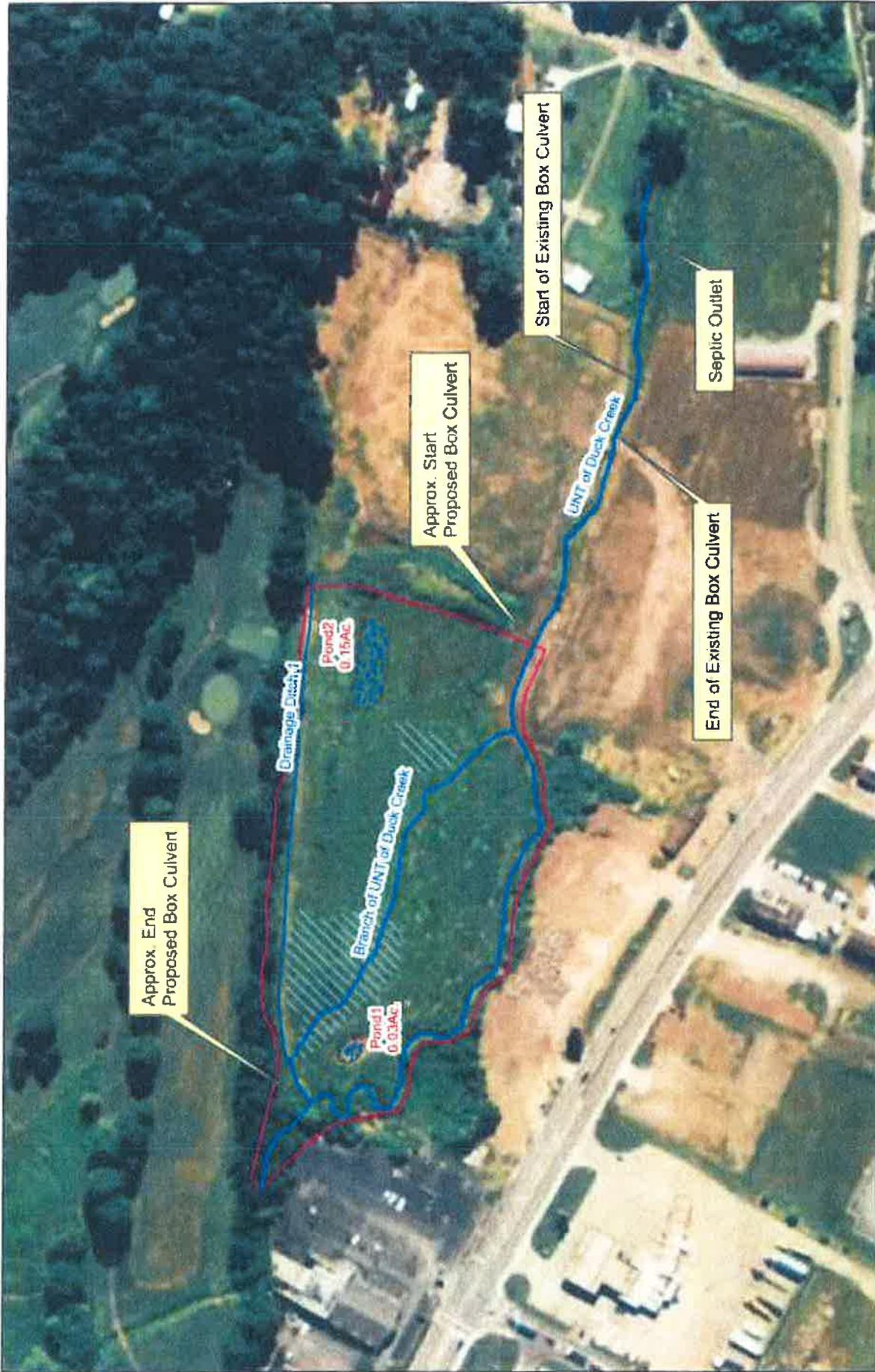


FIGURE 3
DELINEATION MAP
FIRST COLONY
PICKERING
WASHINGTON COUNTY,
OHIO
 DATE: APRIL 24, 2012

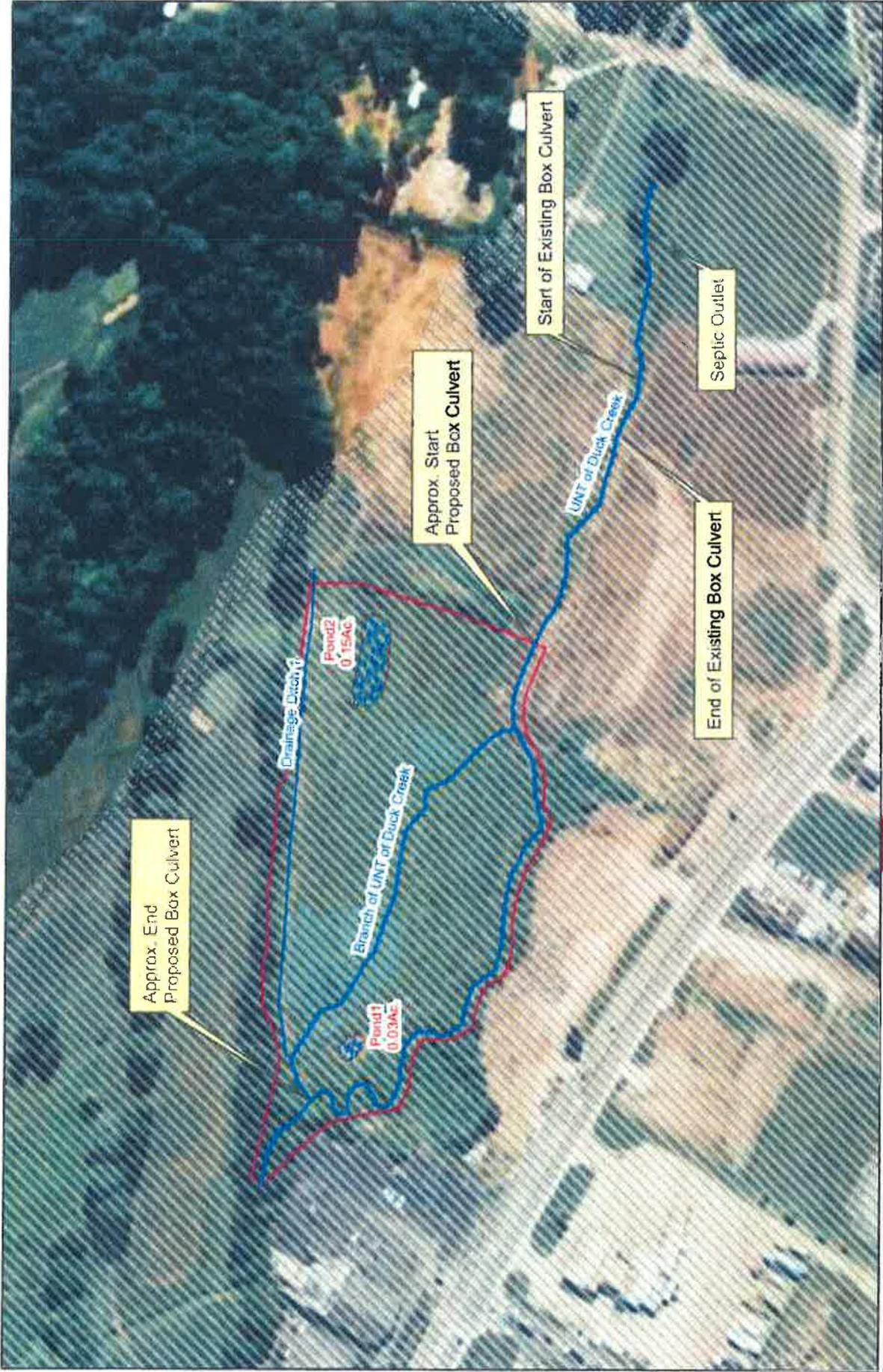
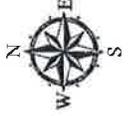


FIGURE 4
FLOOD ZONE MAP
FIRST COLONY
PICKERING
WASHINGTON COUNTY,
OHIO
 DATE: APRIL 24, 2012

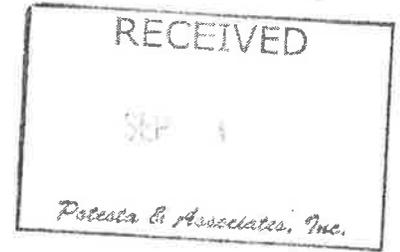




United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994



August 29, 2012

POTESTA Consultants
Attn: S. Beth Burdette
7012 MacCorkle Avenue, SE
Charleston, WV 25304

TAILS: 03E15000-2012-TA-1261

Re: First Colony Phase II Development
POTESTA Project No. 0101-12-0097
Marietta, Washington County, Ohio

Dear Ms. Burdette:

This is in response to your August 7, 2012 letter requesting information regarding federally threatened and endangered species at the above-referenced project site. The proposed project involves the construction of a commercial development on an approximately 7.5 acre site. The site has been recently clear-cut and lies adjacent to a recently constructed hotel and parking lot. The project as proposed would impact approximately 600 linear feet of an unnamed tributary to Duck Creek.

There are no Federal wilderness areas, wildlife refuges, or designated Critical Habitat within the vicinity of the proposed sites.

We recommend that proposed developments avoid and minimize water quality impacts and impacts to high quality fish and wildlife habitat, such as forests, streams, and wetlands. Best construction techniques should be used to minimize erosion, particularly on slopes. Additionally, natural buffers around streams and wetlands should be preserved to enhance beneficial functions. In addition, we support and recommend mitigation activities that reduce the likelihood of invasive plant spread and encourage native plant colonization. Prevention of non-native, invasive plant establishment is critical in maintaining high quality habitats. All disturbed areas in the project vicinity should be mulched and revegetated with native plant species. Staging areas should be kept well away from streams and wetlands, and construction areas should be quickly replanted with native vegetation following construction.

ENDANGERED SPECIES COMMENTS: The proposed project lies within the range of the **Indiana bat** (*Myotis sodalis*), a federally listed endangered species. Since first listed as endangered in 1967, their population has declined by nearly 60%. Several factors have contributed to the decline of the Indiana bat, including the loss and degradation of suitable hibernacula, human disturbance during hibernation, pesticides, and the loss and degradation of forested habitat, particularly stands of large, mature trees. Fragmentation of forest habitat may also contribute to declines. During winter, Indiana bats hibernate in caves and abandoned mines. Summer habitat requirements for the species are not well defined but the following are considered important:

- (1) dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas;
- (2) live trees (such as shagbark hickory and oaks) which have exfoliating bark;
- (3) stream corridors, riparian areas, and upland woodlots which provide forage sites.

You have indicated that the site has been recently clear cut. Previous aerial photography of the project site indicates that the site may have supported suitable Indiana bat roosting and foraging habitat. The Service is concerned that the clearing of this forested area may have resulted in direct adverse effects to Indiana bats by removing potentially occupied roost trees and altering the overall character of the surrounding landscape when bats are present. If clearing of potential Indiana bat habitat occurs without a completed Endangered Species Act (ESA) section 7 consultation, this activity may constitute a violation of the ESA section 9 take prohibition. To ensure compliance with section 7 and section 9 of the ESA, the Service strongly recommends that projects be submitted to this office for review and that no onsite work occur until the Service has had the opportunity to review and comment on the proposed action, the section 7 consultation with the Army Corps of Engineers is complete, and all necessary permits for the project have been issued.

The proposed project lies within the range of four federally endangered freshwater mussels, the **fanshell** (*Cyprogenia stegaria*), the **pink mucket pearly mussel**, (*Lampsilis abrupta*) the **sheepnose** (*Plethobasus cyphus*), and the **snuffbox** (*Epioblasma triquetra*). While it is unlikely that the on-site stream supports native mussel populations, the proposed project may indirectly affect mussel populations known to exist in the Ohio River. The Service is concerned that the proposed project activity will dramatically alter the hydrology of the area. The development of commercial buildings and other impervious surfaces may lead to increased stormwater runoff, pollutants, and increased sediment transport into the streams. Therefore, we recommend that low impact development (LID) practices, such as rain gardens, permeable pavement, pollution discharge prevention, and subsurface cisterns be implemented to decrease the effects of stormwater runoff and indirect effects to freshwater mussels.

The proposed project also lies within the range of the **eastern hellbender** (*Cryptobranchus a. alleganiensis*), a Federal amphibian species of concern. Due to the project type, size, and location, the project, as proposed, should not impact this species or their habitat.

MIGRATORY BIRD COMMENTS: The proposed project lies within the range of the **bald eagle** (*Haliaeetus leucocephalus*), a species protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The nearest known nest is several miles from the project area. Therefore, due to the project type, size, and location, the project, as proposed, should not impact this species or its habitat. This precludes the need for further action on this project as required by the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act.

Should additional information on listed or proposed species or their critical habitat become available or if new information reveals effects of the action that were not previously considered, our comments and recommendations may be reconsidered. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973 (ESA), as amended, and are consistent with the intent of the National Environmental Policy Act of 1969 and the U. S. Fish and Wildlife Service's Mitigation Policy. This letter provides technical assistance only and does not serve as a completed section 7 consultation document. If you have questions, or if we may be of further assistance in this matter, please contact David Henry at extension 27 in this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Field Supervisor

cc: ODNR, DOW, SCEA Unit, Columbus, OH

Sarah Beth Burdette

From: Kessler, John [John.Kessler@dnr.state.oh.us]
Sent: Monday, September 10, 2012 4:43 PM
To: Sarah Beth Burdette
Subject: FW: 12-545 comments Potesta First Colony Phase II Development



ODNR COMMENTS TO: S. Beth Burdette, sburdette@potesta.com; Potesta & Associates

Project: Potesta First Colony Phase II Development 0101-12-0097

Location: Marietta, Washington Co.

The Ohio Department of Natural Resources (ODNR) has completed a review of the above referenced project. These comments were generated by an inter-disciplinary review within the Department. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the National Environmental Policy Act, the Coastal Zone Management Act, Ohio Revised Code and other applicable laws and regulations. These comments are also based on ODNR's experience as the state natural resource management agency and do not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

Fish and Wildlife: The Division of Wildlife (DOW) has the following comments.

The project is within the range of the Indiana bat (*Myotis sodalis*), a state and federally endangered species. The following species of trees have relatively high value as potential Indiana bat roost trees: Shagbark hickory (*Carya ovata*), Shellbark hickory (*Carya laciniosa*), Bitternut hickory (*Carya cordiformis*), Black ash (*Fraxinus nigra*), Green ash (*Fraxinus pennsylvanica*), White ash (*Fraxinus americana*), Shingle oak (*Quercus imbricaria*), Northern red oak (*Quercus rubra*), Slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), Eastern cottonwood (*Populus deltoides*), Silver maple (*Acer saccharinum*), Sassafras (*Sassafras albidum*), Post oak (*Quercus stellata*), and White oak (*Quercus alba*). Indiana bat habitat consists of suitable trees that include dead and dying trees of the species listed above with exfoliating bark, crevices, or cavities in upland areas or riparian corridors and living trees of the species listed above with exfoliating bark, cavities, or hollow areas formed from broken branches or tops. If suitable trees occur within the project area, these trees must be conserved. If suitable habitat occurs on the project area and trees must be cut, cutting must occur between September 30 and April 1. If suitable trees must be cut during the summer months of April 2 to September 29, a net survey must be conducted in May or June prior to cutting. Net surveys shall incorporate either two net sites per square kilometer of project area with each net site containing a minimum of two nets used for two consecutive nights, or one net site per kilometer of stream within the project limits with each net site containing a minimum of two nets used for two consecutive nights. If no tree removal is proposed, the project is not likely to impact this species.

The project is within the range of the sheepsnose (*Plethobasus cyphus*), a state endangered and federal endangered mussel, the fanshell (*Cyprogenia stegaria*), a state and federal endangered mussel, the pink mucket (*Lampsilis orbiculata*), a state and federal endangered mussel, the washboard (*Megaloniaias nervosa*), a state endangered mussel, the snuffbox (*Epioblasma triquetra*), a state endangered and federal endangered mussel, the butterfly (*Ellipsaria lineolata*), a state endangered mussel, the Ohio pigtoe (*Pleurobema cordatum*), a state endangered mussel, the pyramid pigtoe (*Pleurobema rubrum*), a state endangered mussel, and the monkeyface (*Quadrula metanevra*), a state endangered mussel.

If there is a history of mussels near the proposed project area, it may be necessary for a professional malacologist approved by the DOW to conduct a mussel survey in the project area.

The project is within the range of the Eastern hellbender (*Cryptobranchus alleganiensis*), a state endangered amphibian currently being evaluated for Federal Candidate status. We recommend that the proposed project be developed to minimize indirect stream impacts (e.g., preserve wide riparian buffers, maximize erosion control, maximize permeable surfaces and storm-water retention).

The project is within the range of the Ohio lamprey (*Ichthyomyzon bdellium*), a state endangered fish. The DOW recommends no in-water work in perennial streams from April 15 to June 30 to reduce impacts to indigenous aquatic species and their habitat. If no in-water work is proposed, the project is not likely to impact this species.

The project is within the range of the black bear (*Ursus americanus*), a state endangered species. Due to the mobility of this species, the project is not likely to impact this species.

The project is also within the range of the Eastern spadefoot toad (*Scaphiopus holbrookii*), a state endangered species. This species is found in areas of sandy soils that are associated with river valleys. Breeding habitats may include flooded agricultural fields or other water holding depressions. Based on its close proximity to known sites for this species, if the type of habitat described above exists at the project site, the DOW recommends an Eastern spadefoot toad habitat survey be done to determine the potential for impacts to this species. Because of their fossorial habits, unpredictable breeding season, and short larval period, the survey should only be conducted by a herpetologist approved by the ODNR, Division of Wildlife.

The project is within the range of the timber rattlesnake (*Crotalus horridus*), a state endangered species. Due to the location of the project, the project is not likely to impact this species.

The ODNR, Ohio Natural Heritage Database has no records for rare or endangered species at this project site. We are unaware of any unique ecological sites, geologic features, animal assemblages, scenic rivers, state wildlife areas, nature preserves, parks or forests, national wildlife refuges or other protected natural areas within the project area. Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area.

ODNR appreciates the opportunity to provide these comments. Please contact John Kessler at (614) 265-6621 if you have questions about these comments or need additional information.

John Kessler, P.E.
Ohio Department of Natural Resources
Office of Real Estate
2045 Morse Rd., Columbus, OH 43229-6605
phone: 614-265-6621
email: john.kessler@dnr.state.oh.us



March 28, 2013

S. Beth Burdette
Potesta & Associates, Inc.
7012 MacCorkle Avenue, SE
Charleston, WV 25304

Dear Ms. Burdette:

Re: First Colony Phase II Development, Marietta, Washington County, Ohio

This is in response to your correspondence, received on February 6, 2013, regarding the proposed commercial development at the above address. Our comments are provided in accordance with the provisions of Section 106 of the National Historic Preservation Act, as revised (36 CFR 800) and the 2005 Nationwide Programmatic Agreement for cell tower projects.

The information you submitted documents that construction on the parent parcel has already been started. Unfortunately, this occurred before Section 106 compliance was completed. Therefore, we can not comment further and recommend that you gather information as outlined in 36 CFR Section 800.9 and consult with the Advisory Council on Historic Preservation about how to proceed.

If you have any questions please contact Nathan J. Young at (614) 298-2000 or through e-mail at nyoung@ohiohistory.org.

Sincerely,

Mark J. Epstein, Department Head
Resource Protection and Review

Please refer to OHPO Project ID number 2013-WAS-23323 for all future correspondence for this project

xc: COEH, ACHP

APPENDIX C
EASTERN SPADEFOOT HABITAT SURVEY



Jeffrey G. Davis
625 Crescent Road
Hamilton, Ohio 45013
(513) 868-3154
E-mail anura@fuse.net

February 19, 2013

Sarah Beth Burdette
Potesta & Associates, Inc.
7012 MacCorkle Ave., SE
Charleston, WV 25304

Dear Ms. Burdette,

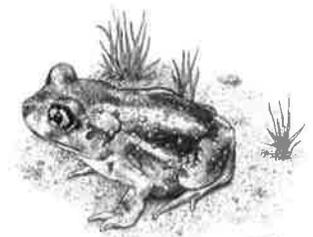
Please find the attached Eastern Spadefoot Habitat Survey Report and Invoice. The Habitat Survey resulted in the site be rated as **having low quality Eastern Spadefoot habitat**. I am **not recommending** a Presence-Absence Survey at the site. Because of the amount of fill that had been moved to the site, it was difficult to complete the survey but during one discussion you and I had, I learned that the site was under a dense canopy of deciduous trees until 2009. The original soil was not friable, nor was it on a sandy or loamy terrace, the habitat used by the species. The silty loam that was the original soil in the area of interest holds water as evidenced by the ponded water at the south end of the Marietta Country Club's golf course, but Spadefoots do not breed in pools under a dense canopy. Therefore in my best judgment, the area of interest was likely never used by Eastern Spadefoots.

I appreciate the opportunity to work with you. If I can be of further service or if you have questions regarding the current report, please do not hesitate to contact me.

Sincerely,

A handwritten signature in cursive script that reads "Jeffrey G. Davis".

Jeffrey G. Davis



Eastern Spadefoot (*Scaphiopus holbrookii*) Habitat Survey at the First Colony Commercial Development. Marietta, Ohio

Submitted to:

**Sarah Beth Burdette
Potesta & Associates, Inc.
7012 MacCorkle Ave., SE
Charleston, WV 25304**

**Submitted by: Jeffrey G. Davis, Ohio Division of
Wildlife Approved *S. holbrookii* Surveyor**

February 17, 2013

they may become cannibalistic. While most Ohio species of frogs and toads require eight weeks to two years to metamorphose, Eastern Spadefoots may do so in as few as two or three weeks. Reproduction can be repeated several times in a season but during dry years it may not take place at all.

Eastern Spadefoots spend most of their time burrowed into friable soils such as sand or loam (Figure 9). They do not venture far from their burrows except to reproduce. On rainy nights they may leave their burrow to forage on a variety of small invertebrates, especially insects, and typically return to the same burrow. If the weather is dry, Spadefoots ambush passing insects from the mouth of their burrow. In Ohio Eastern Spadefoots are restricted to the Hocking, Muskingum, Tuscarawas and Ohio River valleys, and the Sandy Creek drainage in Tuscarawas County. There is one historical record (1957) from Pike County in the Scioto River drainage. The distribution of the Eastern Spadefoot in Ohio is illustrated in Figure 10.

2.0 METHODS

2.1 Desktop Survey

A literature review and a search for museum specimens were conducted to determine the history of Eastern Spadefoot distribution in the vicinity of the study site. Because river floodplains serve as migration corridors for this species, historical records in the Ohio and Muskingum River valleys in Washington County in the vicinity of the subject site were given careful consideration.

Soil and topographic maps and aerial photographs were examined to determine if a site reconnaissance visit was necessary based on available potential habitat (terraces adjacent to floodplains) and soil type (sandy or loamy soils).

2.2 Habitat Quality Ranking

The results of desktop survey and site visit were combined to assess the suitability of the subject site as Eastern Spadefoot habitat. If potential Eastern Spadefoot habitat (habitat ranked **moderate** or **high quality**) was present on site, a Presence-Absence Survey at the subject site would be recommended to confirm the presence or absence of the species.

Eastern Spadefoot habitat quality is ranked by the number of habitat indicators present and the history of known populations in the vicinity of the study site. Also considered in the evaluation are any anecdotal records (word of mouth but no conclusive evidence is available), and information from herpetologists familiar with the region and the species. Finally, consideration is given based on what is known about the herpetological community in the county. If herpetologists have made significant efforts to document the amphibians and reptiles in the county one can assume an increased probability that most species that occur in the region will have been found.

It is very important to understand that due to the Eastern Spadefoot's unpredictable breeding season, fossorial habits, and short larval period it can be easily overlooked.

West of the subject site, along State Route 7 there are more businesses and the southern extremes of the golf course which appear to periodically flood and hold water (Figure 11).

Significant disturbance to the soil and alterations to the vegetation has occurred at the subject site making the habitat assessment difficult. The present assessment is based on remnants of the original topography, soils immediately east and north of the subject site, and an aerial photograph dated 24 August 2007 (Figure 12). The results of the habitat survey are presented in the "Recommendations" section.

The original soils were Moshannon silt loams (Figure 13). Described as poorly drained (<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>), these soils have been buried under approximately 2–4 meters of fill, from east to west respectively (Figure 14). The source of the fill appears to be the hillsides overlooking the subject site from the north. The soils on the overlooking hillsides are Vandalia silty clay loams. The fill raises the grade of the subject site to that of the adjoining level where the Fairfield Inn and Suites is situated. The fill also changes the surface soil from the fine silty alluvium of the Moshannon silt loams which hold water (as evidenced in Figure 11) to well drained Vandalia silty clay loam. In its present state there is no canopy at the subject site (see Figure 1), but historically the area was under a dense canopy (Figure 12). All trees were removed from the subject site in late summer, 2009.

Remnants of the original soils and topography adjacent to the subject site can be seen north of it on the terrace where a green for the golf course is situated and immediately east of the Fairfield Inn and Suites where three houses were built on the first terrace above the Ohio River flood plain on Hackers silt loams and Vandalia silt loams. These soils are soft and friable. A handful of soil was easily scooped from the surface without the use of a shovel or other tool (see Figure 9). Silt loams are consistent with some other soils at other Eastern Spadefoot sites along the Ohio River.

Evaluation of habitat quality indicators are summarized in Table 2.

4.0 RECOMMENDATIONS

This habitat survey ranks the subject site as providing **low quality** Eastern Spadefoot habitat (3 of 5 indicators). Because it was originally covered by a dense canopy any pools that would have formed would not have been suitable breeding sites and because the original soils were not friable, Eastern Spadefoots would not have used them as non-breeding habitat. It is noteworthy, however, that the remnants of the terrace east of the subject site do provide suitable soils for burrowing and the portions of the golf course that flood may have provided potential breeding habitat.

The installation of a box culvert, through which the stream along the south edge of the subject site will flow, **will not** impact Eastern Spadefoots, even if they exist at the site. The species does not utilize stream habitats nor do they generally cross them.

A Presence-Absence Survey is not recommended at the subject site as defined by Figure 1.

Figures

Figure 3. An unnamed tributary of Duck Creek flows from east to west across the southern edge of the subject site. This view looks east toward an existing box culvert.



Figure 4. Eastern Spadefoot, *Scaphiopus holbrookii*, from Meigs Co., Ohio.



Figure 10. The distribution of the Eastern Spadefoot in Ohio is limited to the valleys of the Hocking, Ohio, Scioto, and Muskingum Rivers.

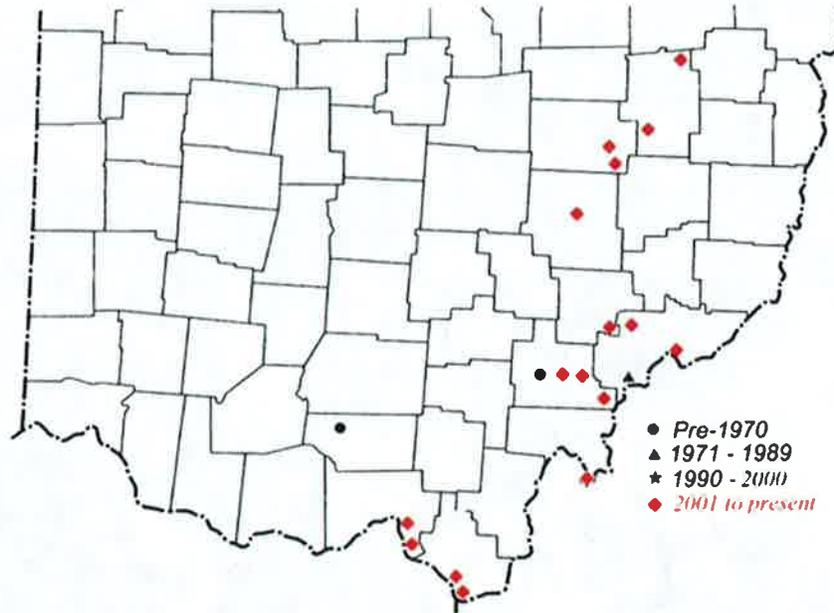


Figure 11. Aerial photo dated 3 June 2004. The southern end of the golf course is under water. The yellow push pin marks the approximate center of the subject site. Note that it was covered by a dense canopy in 2004.

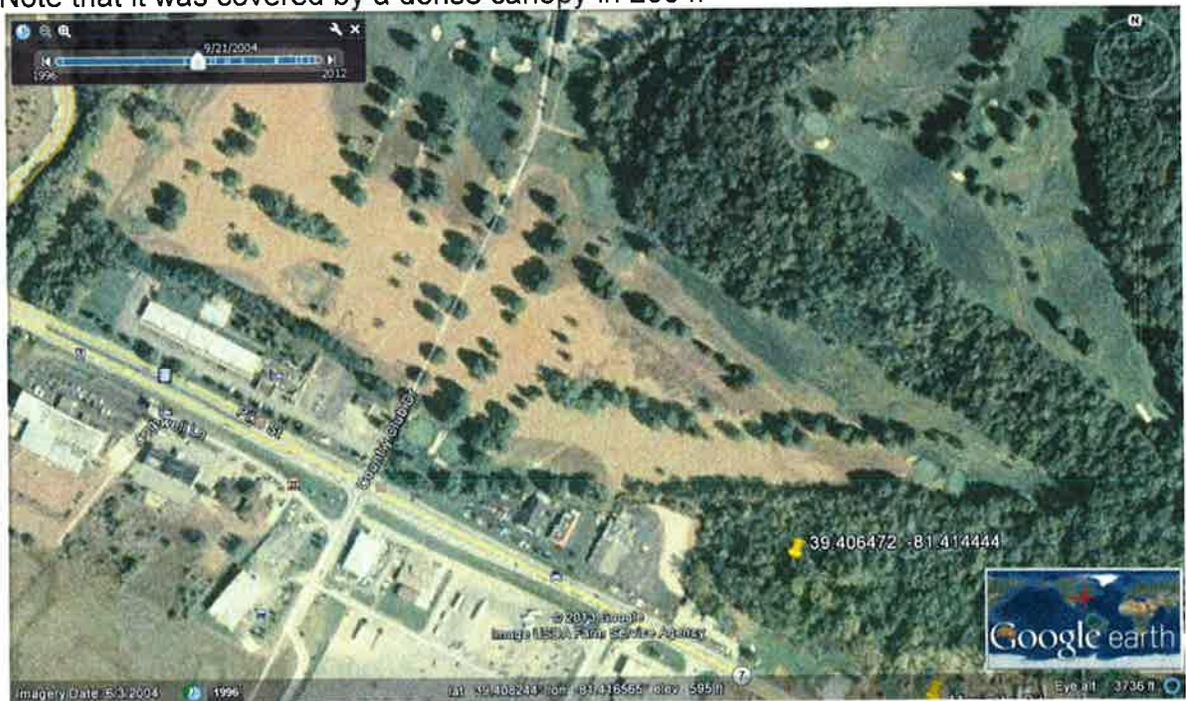


Figure 14. View of the fill at the subject site looking south from the golf course. The earth moving equipment is on top of the fill. The grass is at the level of the original grade.



Table 1. Museum records for the Eastern Spadefoot, *Scaphiopus holbrookii*, in Washington County, Ohio.

Museum	Township	Year	Museum No.
OSM	Belpre	1982	4599–4600, 4669, 4782, 4783
OUVC	Belpre	1986	8492, 8527, 8528, 9089
CMC	Marietta	2002	9239–9263
CMC	Waterford	2002	9233–9238

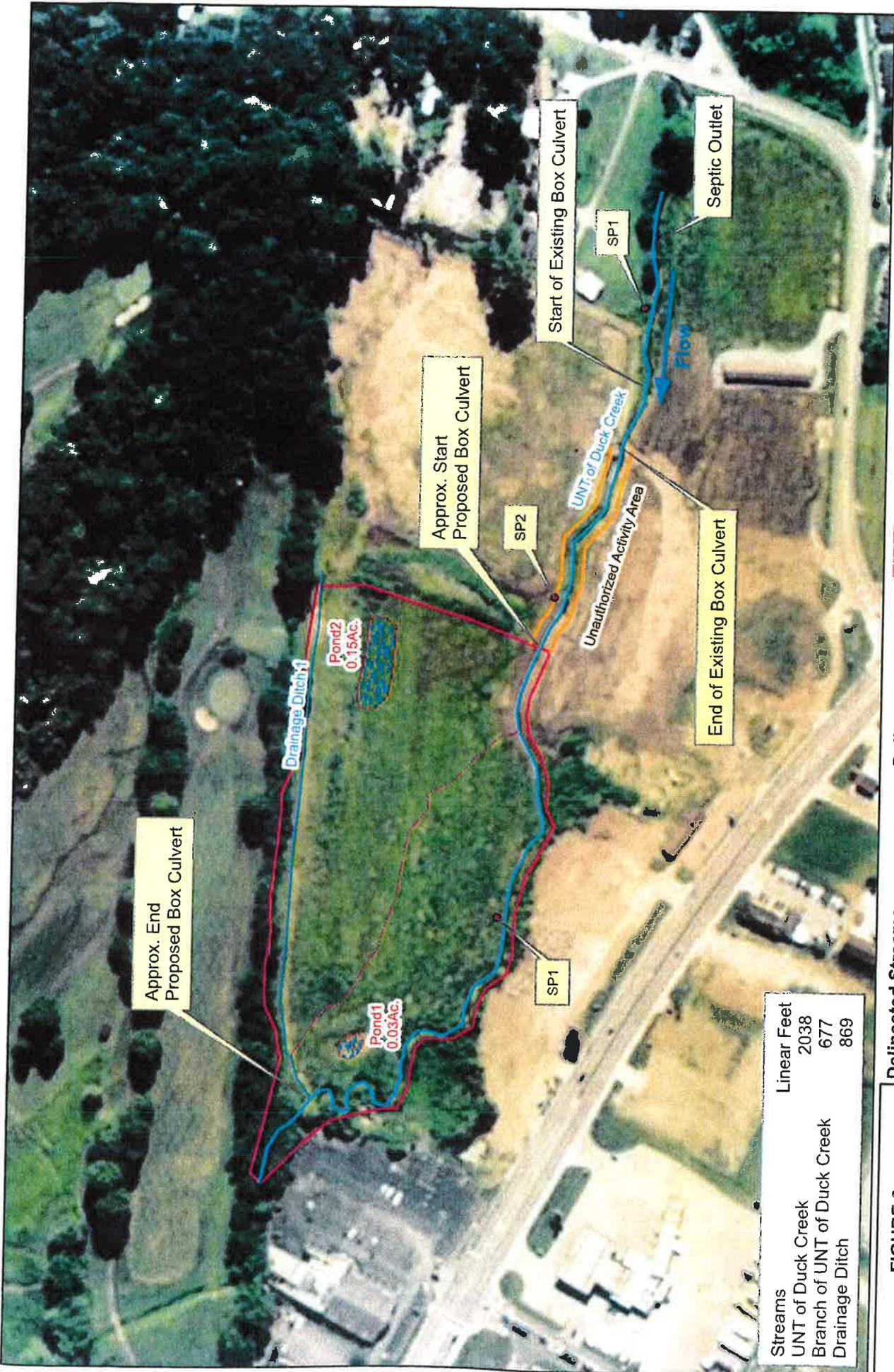
OSM – Ohio State University Museum, OUVC-Ohio University Vertebrate Collection, CMC- Cincinnati Museum Center

APPENDIX D
OHIO EPA FORMS

DELINEATION MAP

PRIMARY HEADWATER HABITAT EVALUATION FORMS

QUALITATIVE HABITAT EVALUATION INDEX AND USE ASSESSMENT FIELD SHEET



Streams	Linear Feet
UNT of Duck Creek	2038
Branch of UNT of Duck Creek	677
Drainage Ditch	869

FIGURE 3
DELINEATION MAP
FIRST COLONY
PICKERING
WASHINGTON COUNTY,
OHIO
 DATE: DECEMBER 17, 2012

Delineated Streams

- Ephemeral
- Intermittent
- Perennial
- Branch of UNT of Duck Creek

Delineated Wetlands

- Area of Interest
- Pond
- Unauthorized Activity Area





Primary Headwater Habitat Evaluation Form

63

HHEI Score (sum of metrics 1, 2, 3) :

SITE NAME/LOCATION UNT Duck Creek US Existing Box Culvert

SITE NUMBER SP 1 RIVER BASIN Ohio DRAINAGE AREA (mi²) 0.98

LENGTH OF STREAM REACH (ft) 200 LAT. 39.40546 LONG. -81.41067 RIVER CODE _____ RIVER MILE _____

DATE 11/21/12 SCORER B. Burdette COMMENTS _____

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: NONE / NATURAL CHANNEL RECOVERED RECOVERING RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.)

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> BDR SLABS [16 pts]	0%	<input type="checkbox"/> SILT [3 pt]	10%
<input type="checkbox"/> BOULDER (>256 mm) [16 pts]	0%	<input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	5%
<input type="checkbox"/> BEDROCK [16 pt]	0%	<input type="checkbox"/> FINE DETRITUS [3 pts]	0%
<input type="checkbox"/> COBBLE (65-256 mm) [12 pts]	10%	<input type="checkbox"/> CLAY or HARDPAN [0 pt]	0%
<input checked="" type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	65%	<input type="checkbox"/> MUCK [0 pts]	0%
<input type="checkbox"/> SAND (<2 mm) [6 pts]	10%	<input type="checkbox"/> ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock 10.00% (A) (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: 18 TOTAL NUMBER OF SUBSTRATE TYPES: 5

2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):

<input checked="" type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 5 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS _____ MAXIMUM POOL DEPTH (centimeters): 72

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input type="checkbox"/> < 1.0 m (<= 3' 3") [5 pts]
<input checked="" type="checkbox"/> > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]	

COMMENTS _____ AVERAGE BANKFULL WIDTH (meters): 1.20

HHEI Metric Points

Substrate Max = 40

23

A + B

Pool Depth Max = 30

20

Bankfull Width Max=30

20

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ☆NOTE: River Left (L) and Right (R) as looking downstream ☆

RIPARIAN WIDTH		FLOODPLAIN QUALITY	
L	R	L	R
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Per Bank) Wide >10m		(Most Predominant per Bank) Mature Forest, Wetland	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moderate 5-10m		Immature Forest, Shrub or Old Field	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Narrow <5m		Residential, Park, New Field	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
None		Fenced Pasture	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Mining or Construction	

COMMENTS Lawn on RDB; very limited riparian area.

FLOW REGIME (At Time of Evaluation) (Check ONLY one box):

<input checked="" type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (Intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (Interstitial)	<input type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS _____

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

<input type="checkbox"/> None	<input checked="" type="checkbox"/> 1.0	<input type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

STREAM GRADIENT ESTIMATE

Flat (0.5 ft/100 ft) Flat to Moderate Moderate (2 ft/100 ft) Moderate to Severe Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):

QHEI PERFORMED? Yes No QHEI Score 50.0 (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

WWH Name: Ohio River Distance from Evaluated Stream < 1 mi
 CWH Name: _____ Distance from Evaluated Stream _____
 EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: Marietta NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____
County: Washington Township / City: Marietta

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: 11/12/12 Quantity: 0.20

Photograph Information: _____

Elevated Turbidity? (Y/N): Canopy (% open): 40%

Were samples collected for water chemistry? (Y/N): (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C) _____ Dissolved Oxygen (mg/l) _____ pH (S.U.) _____ Conductivity (µmhos/cm) _____

Is the sampling reach representative of the stream (Y/N) Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) Voucher? (Y/N) Salamanders Observed? (Y/N) Voucher? (Y/N)
Frogs or Tadpoles Observed? (Y/N) Voucher? (Y/N) Aquatic Macroinvertebrates Observed? (Y/N) Voucher? (Y/N)

Comments Regarding Biology: _____

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: **50**

Stream & Location: UNT Duck Creek US Existy Bx (UL) RM Date: 11/21/06

River Code: SP1 STORET#: _____ Lat/Long: 39.40546 18.81.4077 Office verified location

1] **SUBSTRATE** Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL RIFFLE	OTHER TYPES	POOL RIFFLE	ORIGIN	QUALITY
<input type="checkbox"/> BLDR/SLABS [10]	<input type="checkbox"/>	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/>	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> HEAVY [-2]
<input type="checkbox"/> BOULDER [9]	<input type="checkbox"/>	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/>	<input type="checkbox"/> TILLS [1]	<input checked="" type="checkbox"/> MODERATE [-1]
<input type="checkbox"/> COBBLE [8]	<input type="checkbox"/>	<input type="checkbox"/> MUCK [2]	<input type="checkbox"/>	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> NORMAL [0]
<input checked="" type="checkbox"/> GRAVEL [7]	<u>10</u>	<input type="checkbox"/> SILT [2]	<input type="checkbox"/>	<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> FREE [1]
<input type="checkbox"/> SAND [6]	<u>65</u>	<input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/>	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> EXTENSIVE [-2]
<input type="checkbox"/> BEDROCK [5]	<u>15</u>			<input type="checkbox"/> RIP/RAP [0]	<input checked="" type="checkbox"/> MODERATE [-1]

Check ONE (Or 2 & average)

NUMBER OF BEST TYPES: 4 or more [2] 2 or less [0]

Comments: _____

2] **INSTREAM COVER** Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<input type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	AMOUNT
<input type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	Check ONE (Or 2 & average)
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> EXTENSIVE >75% [11]
<input type="checkbox"/> ROOTMATS [1]			<input checked="" type="checkbox"/> MODERATE 25-75% [7]
			<input type="checkbox"/> SPARSE 5-<25% [3]
			<input type="checkbox"/> NEARLY ABSENT <5% [1]

Comments: _____

3] **CHANNEL MORPHOLOGY** Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input checked="" type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]
<input checked="" type="checkbox"/> LOW [2]	<input checked="" type="checkbox"/> FAIR [3]	<input type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

Comments: _____

4] **BANK EROSION AND RIPARIAN ZONE** Check ONE in each category for EACH BANK (Or 2 per bank & average)

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	CONSERVATION TILLAGE
<input type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]	<input checked="" type="checkbox"/> URBAN OR INDUSTRIAL [0]
<input checked="" type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]	<input type="checkbox"/> MINING / CONSTRUCTION [0]
<input type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	
	<input checked="" type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]	
	<input type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]	

Comments: _____

5] **POOL / GLIDE AND RIFFLE / RUN QUALITY**

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential
Check ONE (ONLY)	Check ONE (Or 2 & average)	Check ALL that apply	Primary Contact
<input type="checkbox"/> > 1m [6]	<input checked="" type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	Secondary Contact
<input checked="" type="checkbox"/> 0.7-1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input checked="" type="checkbox"/> SLOW [1]	(circle one and comment on back)
<input type="checkbox"/> 0.4-0.7m [2]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [0]	<input type="checkbox"/> VERY FAST [1]	
<input type="checkbox"/> 0.2-0.4m [1]		<input type="checkbox"/> FAST [1]	
<input type="checkbox"/> < 0.2m [0]		<input type="checkbox"/> MODERATE [1]	

Comments: _____

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input checked="" type="checkbox"/> BEST AREAS 5-10cm [1]	<input checked="" type="checkbox"/> MAXIMUM < 50cm [1]	<input checked="" type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

Comments: _____

6] **GRADIENT** (4.6 ft/mi) VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]

DRAINAGE AREA (0.94 mi²)

% POOL: 15 % GLIDE: 0

% RUN: 75 % RIFFLE: 10

Comments: _____

A/ SAMPLED REACH

Check ALL that apply

METHOD
 BOAT
 MADE
 L. LINE
 OTHER

STAGE
 1st - sample pass - 2nd
 HIGH
 UP
 NORMAL
 LOW
 DRY

DISTANCE
 0.5 Km
 0.2 Km
 0.15 Km
 0.12 Km
 OTHER

CLARITY
 1st - sample pass - 2nd
 < 20 cm
 20-40 cm
 40-70 cm
 > 70 cm / CTB
 SECHL DEPTH

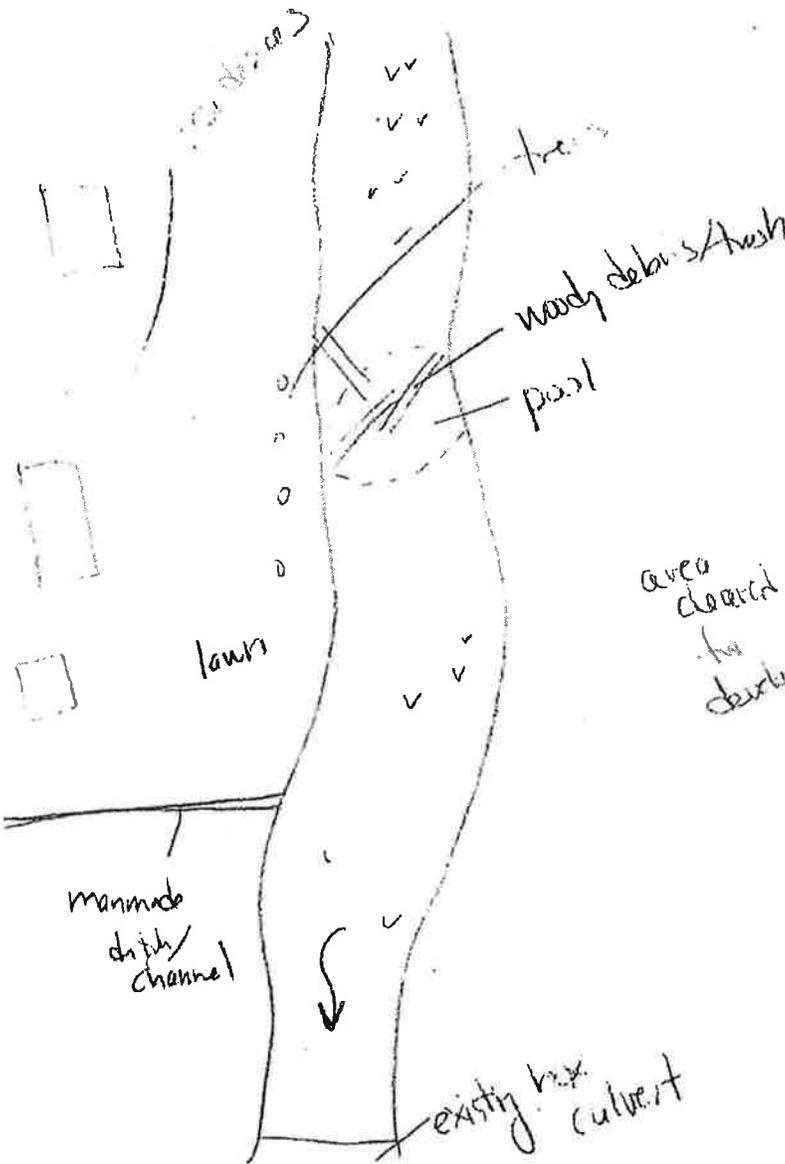
CANOPY
 > 85% - OPEN
 55% - 85%
 30% - 55%
 10% - 30%
 < 10% - CLOSED

C/ RECREATION AREA DEPTH
 > 100m
 > 3R
 POOL

Comment RE: Reach consistency/ is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Access from trail held low taking
 Impact from water bed moving muddy (swamp?) - some sediment.

Stream Drawing:



B/ AESTHETICS
 INVASIVE ALGAE (swamp?)
 INVASIVE MACROPHYTES
 EXCESS TURBIDITY
 DISCOLORATION
 FOAM / SCUM
 FOIL SHEEN
 TRASH / LITTER
 RAUISANCE ODOR (Swamp?)
 SLUDGE DEPOSITS
 CSO/SSO/OUTFALLS

D/ MAINTENANCE
 PUBLIC / PRIVATE / BOTH / NA
 ACTIVE / HISTORIC / BOTH / NA
 YOUNG-SUCCESSION-OLD
 SPRAY / SNAG / REMOVED
 MODIFIED / DIPPED OUT / NA
 LEVEED / ONE SIDED
 RELOCATED / CUTOFFS
 MOVING-BED/ OAD-STABLE
 ARMOURED / SLUMPS
 ISLANDS / SCOURED
 IMPOUNDED / DESICCATED
 FLOOD CONTROL / DRAINAGE

E/ ISSUES
 WWTP / CSO / NPDES / INDUSTRY
 HARDENED / CRACK / DIRTY GRIME
 CONTAMINATED / LANDFILL
 BMPs-CONSTRUCTION-SEDIMENT
 LOGGING / IRRIGATION / COOLING
 BANK / EROSION / SURFACE
 FALSE BANK / MANURE / LAGOON
 WASH H₂O / TILE / H₂O TABLE
 ACID / MINE / QUARRY / FLOW
 NATURAL / WETLAND / STAGNANT
 PARK / GOLF / LAND / HOME
 ATMOSPHERE / DATA PAUCITY

F/ MEASUREMENTS
 width
 depth
 max. depth
 bankfull width
 bankfull x depth
 W/D ratio
 bankfull max. depth
 floodprone x² width
 embrench, ratio
 Legacy Tree:



Primary Headwater Habitat Evaluation Form

48

HHEI Score (sum of metrics 1, 2, 3) :

SITE NAME/LOCATION **UNT Duck Creek DS Existing Box Culvert**

SITE NUMBER **SP 2** RIVER BASIN **Ohio** DRAINAGE AREA (mi²)

LENGTH OF STREAM REACH (ft) **200** LAT **39.40581** LONG **-81.41234** RIVER CODE RIVER MILE

DATE **11/21/12** SCORER **B.Burdette** COMMENTS

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: NONE / NATURAL CHANNEL RECOVERED RECOVERING RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.)

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> BLDR SLABS [16 pts]	0%	<input type="checkbox"/> SILT [3 pt]	15%
<input type="checkbox"/> BOULDER (>256 mm) [16 pts]	0%	<input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	10%
<input type="checkbox"/> BEDROCK [16 pt]	0%	<input type="checkbox"/> FINE DETRITUS [3 pts]	0%
<input type="checkbox"/> COBBLE (65-256 mm) [12 pts]	5%	<input type="checkbox"/> CLAY or HARDPAN [0 pt]	0%
<input checked="" type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	55%	<input type="checkbox"/> MUCK [0 pts]	0%
<input type="checkbox"/> SAND (<2 mm) [6 pts]	15%	<input type="checkbox"/> ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock **5.00%** (A) (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: **18** TOTAL NUMBER OF SUBSTRATE TYPES: **5**

2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):

<input type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 5 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input checked="" type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS: MAXIMUM POOL DEPTH (centimeters): **0**

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input type="checkbox"/> < 1.0 m (<= 3' 3") [5 pts]
<input checked="" type="checkbox"/> > 1.5 m - 3.0 m (> 4' 8" - 9' 8") [20 pts]	

COMMENTS: AVERAGE BANKFULL WIDTH (meters): **1.52**

HHEI Metric Points

Substrate Max = 40

23

A + B

Pool Depth Max = 30

5

Bankfull Width Max=30

20

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY *NOTE: River Left (L) and Right (R) as looking downstream*

RIPARIAN WIDTH		FLOODPLAIN QUALITY	
L	R	L	R
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Per Bank)		(Most Predominant per Bank)	
Wide >10m		Mature Forest, Wetland	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Immature Forest, Shrub or Old Field	<input checked="" type="checkbox"/>
Moderate 5-10m		Residential, Park, New Field	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Fenced Pasture	<input type="checkbox"/>
Narrow <5m		Conservation Tillage	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Urban or Industrial	<input checked="" type="checkbox"/>
None		Open Pasture, Row Crop	<input type="checkbox"/>
		Mining or Construction	<input type="checkbox"/>

COMMENTS: Riparian width narrow; consists only of grassy restored banks/plantings.

FLOW REGIME (At Time of Evaluation) (Check ONLY one box):

<input checked="" type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (interstitial)	<input type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS:

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

<input checked="" type="checkbox"/> None	<input type="checkbox"/> 1.0	<input type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

STREAM GRADIENT ESTIMATE

Flat (0.5 ft/100 ft) Flat to Moderate Moderate (2 ft/100 ft) Moderate to Severe Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This information must also be completed):

QHEI PERFORMED? Yes No QHEI Score 22.0 (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

WWH Name: Ohio River Distance from Evaluated Stream: < 1 mile
 CWH Name: _____ Distance from Evaluated Stream: _____
 EWH Name: _____ Distance from Evaluated Stream: _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: Marietta NRCS Soil Map Page: _____ NRCS Soil Map Stream Order: _____
County: Washington Township / City: Marietta

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: 11/12/12 Quantity: 0.20

Photograph Information: _____

Elevated Turbidity? (Y/N): Canopy (% open): 100%

Were samples collected for water chemistry? (Y/N): (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C): _____ Dissolved Oxygen (mg/l): _____ pH (S.U.): _____ Conductivity (µmhos/cm): _____

Is the sampling reach representative of the stream (Y/N): Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N): Voucher? (Y/N): Salamanders Observed? (Y/N): Voucher? (Y/N):
Frogs or Tadpoles Observed? (Y/N): Voucher? (Y/N): Aquatic Macroinvertebrates Observed? (Y/N): Voucher? (Y/N):

Comments Regarding Biology: _____

No samples collected. Visual observations = few (3-5; approximately 3 inch length) small fish observed.

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →

SP2



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: **22**

Stream & Location: UNT Duck Creek Dist. Existing Box Culvert Date: 11/21/06
 SP2
 River Code: --- STORET #: --- Scorers Full Name & Affiliation: B. Brundette / Poterda
 Lat./Long.: 39.4 WSK 108.1 91234 Office visited location:

1) **SUBSTRATE** Check ONLY two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES		OTHER TYPES		ORIGIN		QUALITY	
<input type="checkbox"/> BLDR / SLABS [10]	<input type="checkbox"/> POOL RIFFLE	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/> POOL RIFFLE	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> SILT	<input type="checkbox"/> HEAVY [-2]	<input type="checkbox"/> MODERATE [-1]
<input type="checkbox"/> BOULDER [9]	<input type="checkbox"/> SAND [6]	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/> SILT [2]	<input type="checkbox"/> TILLS [1]	<input checked="" type="checkbox"/> MODERATE [-1]	<input type="checkbox"/> NORMAL [0]	<input type="checkbox"/> FREE [1]
<input type="checkbox"/> COBBLE [8]	<input type="checkbox"/> BEDROCK [5]	<input type="checkbox"/> MUCK [2]	<input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> EXTENSIVE [-2]	<input type="checkbox"/> MODERATE [-1]
<input checked="" type="checkbox"/> GRAVEL [7]		<input type="checkbox"/> SLUDGE [0]		<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> RIP/RAP [0]	<input type="checkbox"/> MODERATE [-1]	<input type="checkbox"/> NORMAL [0]
				<input type="checkbox"/> SANDSTONE [0]	<input checked="" type="checkbox"/> LACUSTRINE [0]	<input type="checkbox"/> NONE [1]	
				<input type="checkbox"/> RIP/RAP [0]	<input type="checkbox"/> SHALE [-1]		
				<input type="checkbox"/> COAL FINES [-2]			

NUMBER OF BEST TYPES: 4 or more [2] 3 or less [0]

Comments: Score natural substrates; ignore sludge from point-sources

2) **INSTREAM COVER** Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<input type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	<input type="checkbox"/> AMOUNT
<input type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	<input type="checkbox"/> EXTENSIVE >75% [1]
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> MODERATE 25-75% [7]
<input type="checkbox"/> ROOTMATS [1]			<input type="checkbox"/> SPARSE 5-25% [3]
			<input checked="" type="checkbox"/> NEARLY ABSENT <5% [1]

Comments: 1

3) **CHANNEL MORPHOLOGY** Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]
<input type="checkbox"/> LOW [2]	<input type="checkbox"/> FAIR [3]	<input type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]
<input checked="" type="checkbox"/> NONE [1]	<input checked="" type="checkbox"/> POOR [1]	<input checked="" type="checkbox"/> RECENT OR NO RECOVERY [1]	

Comments: This section of stream has been impacted by existing culvert + site development

4) **BANK EROSION AND RIPARIAN ZONE** Check ONE in each category for EACH BANK (Or 2 per bank & average)

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY
<input checked="" type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]
<input type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]
<input type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]
	<input type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]
	<input checked="" type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]

Comments: 3

5) **POOL / GLIDE AND RIFFLE / RUN QUALITY**

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential
Check ONE (ONLY)	Check ONE (Or 2 & average)	Check ALL that apply	Primary Contact
<input type="checkbox"/> > 1m [6]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	Secondary Contact
<input type="checkbox"/> 0.7-1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input checked="" type="checkbox"/> SLOW [1]	(circle one and comment on back)
<input type="checkbox"/> 0.4-0.7m [2]	<input checked="" type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input type="checkbox"/> VERY FAST [1]	
<input type="checkbox"/> 0.2-0.4m [1]		<input type="checkbox"/> FAST [1]	
<input checked="" type="checkbox"/> < 0.2m [0]		<input type="checkbox"/> MODERATE [1]	
		<input type="checkbox"/> INTERSTITIAL [-1]	
		<input type="checkbox"/> INTERMITTENT [-2]	
		<input type="checkbox"/> EDDIES [1]	

Comments: 1

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input type="checkbox"/> BEST AREAS 5-10cm [1]	<input checked="" type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input checked="" type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input checked="" type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

Comments: 1

6) **GRADIENT** (ft./mi) 41.6 VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]

DRAINAGE AREA (sq mi) 0.98

% POOL: 0 % GLIDE: 0 % RUN: 95 % RIFFLE: 5

Comments: 4

104 / 0.24 miles = 41.6 ft/miles

A/ SAMPLED REACH

Check ALL that apply

METHOD

- BOAT
- WADE
- L LINE
- OTHER

STAGE

- 1st-sample past- 2nd
- HIGH
- UP
- NORMAL
- LOW
- DRY

DISTANCE

- 0.5 Km
- 0.2 Km
- 0.15 Km
- 0.12 Km
- OTHER

CLARITY

- 1st-sample past- 2nd
- < 20 cm
- 20-40 cm
- 40-70 cm
- > 70 cm/ CTB
- SECHL DEPTH

CANOPY

- 85%- OPEN
- 55%-85%
- 30%-55%
- 10%-30%
- <10%- CLOSED

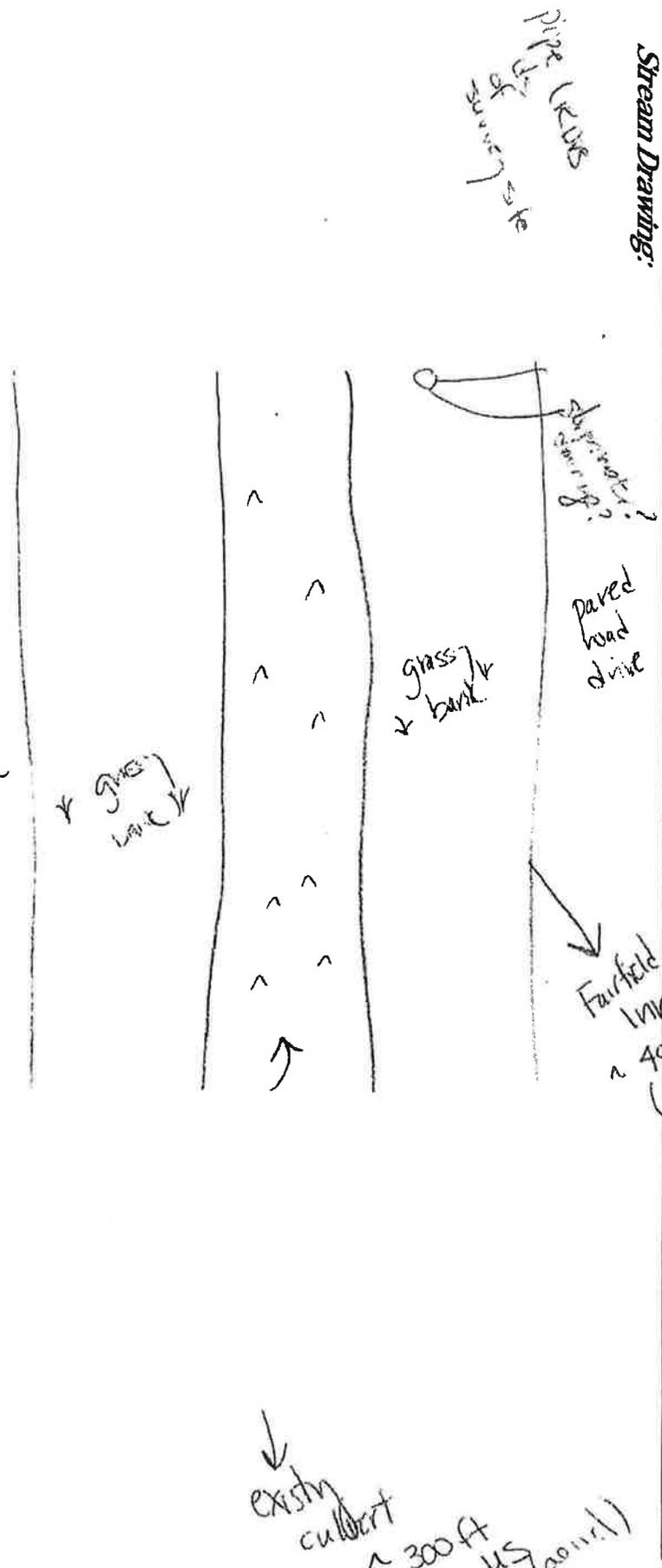
Stream Drawing:

B/AESTHETICS	D/MAINTENANCE	Circle some & COMMENT	E/ISSUES	F/MEASUREMENTS
<input checked="" type="checkbox"/> NAUSANCE ALGAE (HULL) <input type="checkbox"/> INVASIVE MACROPHYTES <input type="checkbox"/> EXCESS TURBIDITY <input type="checkbox"/> DISCOLORATION <input type="checkbox"/> FOAM / SCUM <input type="checkbox"/> OIL / SHEEN <input checked="" type="checkbox"/> TRASH / LITTER <input type="checkbox"/> NAUSANCE ODOR <input type="checkbox"/> SLUDGE DEPOSITS <input type="checkbox"/> CSO/SO2/OUTFALLS	<input type="checkbox"/> PUBLIC / PRIVATE / BOTH / NA <input type="checkbox"/> ACTIVE / HISTORIC / BOTH / NA <input type="checkbox"/> YOUNG-SUCCESSION-OLD <input type="checkbox"/> SPRAY / SNAG / REMOVED <input checked="" type="checkbox"/> MOVED / DIPPED OUT / NA <input type="checkbox"/> LEVEED / ONE SIDED <input type="checkbox"/> RELOCATED / CUTOFFS <input type="checkbox"/> MOVING-BEDLOAD-STABLE <input type="checkbox"/> ARMOURD / SLUMPS <input type="checkbox"/> ISLANDS / SECURED <input type="checkbox"/> IMPOUNDED / DESICCATED <input type="checkbox"/> FLOOD CONTROL / DRAINAGE	Fairfield Inn development construction on site inboard	<input type="checkbox"/> WWTP / CSO / NPDES / INDUSTRY <input type="checkbox"/> HARDENED / URBAN / DIRTGRIME <input type="checkbox"/> CONTAMINATED LANDFILL <input type="checkbox"/> LOGGING / IRRIGATION / COOLING <input type="checkbox"/> BANK / EROSION / SURFACE <input type="checkbox"/> FALSE BANK / MANURE / LAGOON <input type="checkbox"/> WASH H2O / TILE / H2O TABLE <input type="checkbox"/> ACID / MINE / QUARRY / FLOW <input type="checkbox"/> NATURAL / WETLAND / STAGNANT <input type="checkbox"/> PARK / GOLF / LAWN / HOME <input type="checkbox"/> ATMOSPHERE / DATA PAUCITY	<input checked="" type="checkbox"/> max. depth <input checked="" type="checkbox"/> bankfull width <input checked="" type="checkbox"/> bankfull depth <input type="checkbox"/> W/D ratio <input type="checkbox"/> bankfull max. depth <input type="checkbox"/> floodprone x2 width <input type="checkbox"/> entrench. ratio Legacy Tree

Comment RE: Reach consistency is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Access from Fairfield Inn parking.

Impacts from water table nutrient loading, some sediment.



300 ft
 Legacy Tree
 existing culvert



Primary Headwater Habitat Evaluation Form

59

HHEI Score (sum of metrics 1, 2, 3) :

SITE NAME/LOCATION UNT Duck Creek DS Section (Proposed Box Culvert Impact Area)
 SITE NUMBER SP 3 RIVER BASIN Ohio DRAINAGE AREA (mi²) 0.98
 LENGTH OF STREAM REACH (ft) 200 LAT. 39.40601 LONG. -81.41442 RIVER CODE _____ RIVER MILE _____
 DATE 11/21/12 SCORER B. Burdette COMMENTS _____

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: NONE / NATURAL CHANNEL RECOVERED RECOVERING RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.)

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> BLDR SLABS [16 pts]	0%	<input type="checkbox"/> SILT [3 pt]	5%
<input type="checkbox"/> BOULDER (>256 mm) [16 pts]	0%	<input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	3%
<input type="checkbox"/> BEDROCK [16 pt]	0%	<input type="checkbox"/> FINE DETRITUS [3 pts]	3%
<input type="checkbox"/> COBBLE (65-256 mm) [12 pts]	10%	<input type="checkbox"/> CLAY or HARDPAN [0 pt]	0%
<input checked="" type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	70%	<input type="checkbox"/> MUCK [0 pts]	0%
<input type="checkbox"/> SAND (<2 mm) [6 pts]	10%	<input type="checkbox"/> ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock 10.00% (A) (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: 18 TOTAL NUMBER OF SUBSTRATE TYPES: 6

2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):

<input checked="" type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 5 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS _____ MAXIMUM POOL DEPTH (centimeters): 36

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input checked="" type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input type="checkbox"/> < 1.0 m (<= 3' 3") [5 pts]
<input type="checkbox"/> > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]	

COMMENTS _____ AVERAGE BANKFULL WIDTH (meters): 1.21

HHEI Metric Points

Substrate Max = 40
24
A + B

Pool Depth Max = 30
20

Bankfull Width Max=30
15

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ☆NOTE: River Left (L) and Right (R) as looking downstream

RIPARIAN WIDTH		FLOODPLAIN QUALITY	
L	R	L	R
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

FLOW REGIME (At Time of Evaluation) (Check ONLY one box):

<input checked="" type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (Intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (Interstitial)	<input type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS _____

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

<input type="checkbox"/> None	<input checked="" type="checkbox"/> 1.0	<input type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

STREAM GRADIENT ESTIMATE

Flat (0.5 ft/100 ft) Flat to Moderate Moderate (2 ft/100 ft) Moderate to Severe Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This information Must Also be Completed):

QHEI PERFORMED? Yes No QHEI Score 42.0 (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

WWH Name: Ohio River Distance from Evaluated Stream < 1 mile
 CWH Name: _____ Distance from Evaluated Stream _____
 EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: Marietta NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____

County: Washington Township / City: Marietta

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: 11/12/12 Quantity: 0.20

Photograph Information: _____

Elevated Turbidity? (Y/N): Canopy (% open): 50%

Were samples collected for water chemistry? (Y/N): (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C) _____ Dissolved Oxygen (mg/l) _____ pH (S.U.) _____ Conductivity (µmhos/cm) _____

Is the sampling reach representative of the stream (Y/N) Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) Voucher? (Y/N) Salamanders Observed? (Y/N) Voucher? (Y/N)
Frogs or Tadpoles Observed? (Y/N) Voucher? (Y/N) Aquatic Macroinvertebrates Observed? (Y/N) Voucher? (Y/N)

Comments Regarding Biology: _____
No samples collected. Visual Observations = No aquatic fauna.

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →

Appendix F
QHEI and HHEI Forms



Primary Headwater Habitat Evaluation Form

63

HHEI Score (sum of metrics 1, 2, 3) :

SITE NAME/LOCATION UNT Duck Creek US Existing Box Culvert

SITE NUMBER SP 1 RIVER BASIN Ohio DRAINAGE AREA (mi²) 0.98

LENGTH OF STREAM REACH (ft) 200 LAT. 39.40546 LONG. -81.41067 RIVER CODE _____ RIVER MILE _____

DATE 11/21/12 SCORER B. Burdette COMMENTS _____

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: NONE / NATURAL CHANNEL RECOVERED RECOVERING RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.)

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> BLDR SLABS [16 pts]	0%	<input type="checkbox"/> SILT [3 pt]	10%
<input type="checkbox"/> BOULDER (>256 mm) [16 pts]	0%	<input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	5%
<input type="checkbox"/> BEDROCK [16 pt]	0%	<input type="checkbox"/> FINE DETRITUS [3 pts]	0%
<input type="checkbox"/> COBBLE (85-256 mm) [12 pts]	10%	<input type="checkbox"/> CLAY or HARDPAN [0 pt]	0%
<input checked="" type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	85%	<input type="checkbox"/> MUCK [0 pts]	0%
<input type="checkbox"/> SAND (<2 mm) [6 pts]	10%	<input type="checkbox"/> ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock 10.00% (A) (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: 18 TOTAL NUMBER OF SUBSTRATE TYPES: 5

2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):

<input checked="" type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 5 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS _____ MAXIMUM POOL DEPTH (centimeters): 72

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input type="checkbox"/> < 1.0 m (<= 3' 3") [5 pts]
<input checked="" type="checkbox"/> > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]	

COMMENTS _____ AVERAGE BANKFULL WIDTH (meters): 1.20

HHEI Metric Points

Substrate Max = 40
23
A + B

Pool Depth Max = 30
20

Bankfull Width Max = 30
20

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY *NOTE: River Left (L) and Right (R) as looking downstream *

RIPARIAN WIDTH		FLOODPLAIN QUALITY	
L	R	L	R
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Per Bank) Wide >10m		(Most Predominant per Bank) Mature Forest, Wetland	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moderate 5-10m		Immature Forest, Shrub or Old Field	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Narrow <5m		Residential, Park, New Field	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
None		Fenced Pasture	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
COMMENTS <u>Limited on RDB; very limited riparian area.</u>		Conservation Tillage	
		<input checked="" type="checkbox"/> Urban or Industrial	
		<input type="checkbox"/> Open Pasture, Row Crop	
		<input type="checkbox"/> Mining or Construction	

FLOW REGIME (At Time of Evaluation) (Check ONLY one box):

<input checked="" type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (Intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (Interstitial)	<input type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS _____

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

<input type="checkbox"/> None	<input checked="" type="checkbox"/> 1.0	<input type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

STREAM GRADIENT ESTIMATE

Flat (0.5 ft/100 ft) Flat to Moderate Moderate (2 ft/100 ft) Moderate to Severe Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):

QHEI PERFORMED? Yes No QHEI Score 50.0 (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

WWH Name: Ohio River Distance from Evaluated Stream < 1 mi.
 CWH Name: _____ Distance from Evaluated Stream _____
 EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: Marietta NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____
County: Washington Township / City: Marietta

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: 11/12/12 Quantity: 0.20

Photograph Information: _____

Elevated Turbidity? (Y/N): Canopy (% open): 40%

Were samples collected for water chemistry? (Y/N): (Note lab sample no. or Id. and attach results) Lab Number: _____

Field Measures: Temp (°C) _____ Dissolved Oxygen (mg/l) _____ pH (S.U.) _____ Conductivity (µmhos/cm) _____

Is the sampling reach representative of the stream (Y/N): Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) Voucher? (Y/N) Salamanders Observed? (Y/N) Voucher? (Y/N)
Frogs or Tadpoles Observed? (Y/N) Voucher? (Y/N) Aquatic Macroinvertebrates Observed? (Y/N) Voucher? (Y/N)

Comments Regarding Biology: _____

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: **50**

SPI

Stream & Location: UNT Duck Creek US Existing Box culvert Date: 11/21/12
 River Code: 81 STORET #: _____ Lat./Long.: 39.40546 18.81.41047 Office verified location
 Scorers Full Name & Affiliation: B. Brubaker / Prof.

1) **SUBSTRATE** Check ONLY two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL RIFFLE	OTHER TYPES	POOL RIFFLE	ORIGIN	QUALITY
<input type="checkbox"/> BLDR/SLABS [10]	<input type="checkbox"/>	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/>	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> HEAVY [-2]
<input type="checkbox"/> BOULDER [9]	<input type="checkbox"/>	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/>	<input type="checkbox"/> TILLS [1]	<input checked="" type="checkbox"/> MODERATE [-1]
<input type="checkbox"/> COBBLE [8]	<u>10</u>	<input type="checkbox"/> MUCK [2]	<u>5</u>	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> NORMAL [0]
<input checked="" type="checkbox"/> GRAVEL [7]	<u>65</u>	<input type="checkbox"/> SILT [2]	<u>10</u>	<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> FREE [1]
<input type="checkbox"/> SAND [6]	<u>10</u>	<input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/>	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> EXTENSIVE [-2]
<input type="checkbox"/> BEDROCK [5]	<input type="checkbox"/>			<input type="checkbox"/> RIP/RAP [0]	<input checked="" type="checkbox"/> MODERATE [-1]

NUMBER OF BEST TYPES: 4 or more [2] 3 or less [0]

Check ONE (Or 2 & average)

SILT MODERATE [-1] NONE [1]

EMBEDDEDNESS MODERATE [-1] NONE [1]

Substrate Maximum **7**

Comments _____

2) **INSTREAM COVER** Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<input type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	AMOUNT
<input type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	Check ONE (Or 2 & average)
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> EXTENSIVE >75% [11]
<input type="checkbox"/> ROOTMATS [1]			<input checked="" type="checkbox"/> MODERATE 25-75% [7]
			<input type="checkbox"/> SPARSE 5-<25% [3]
			<input type="checkbox"/> NEARLY ABSENT <5% [1]

Cover Maximum **5**

Comments _____

3) **CHANNEL MORPHOLOGY** Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input checked="" type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]
<input checked="" type="checkbox"/> LOW [2]	<input checked="" type="checkbox"/> FAIR [3]	<input type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

Channel Maximum **12**

Comments _____

4) **BANK EROSION AND RIPARIAN ZONE** Check ONE in each category for EACH BANK (Or 2 per bank & average)

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	CONSERVATION TILLAGE
<input type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]	<input checked="" type="checkbox"/> URBAN OR INDUSTRIAL [0]
<input checked="" type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]	<input type="checkbox"/> MINING / CONSTRUCTION [0]
<input type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	
	<input checked="" type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]	
	<input type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum **4**

Comments _____

5) **POOL / GLIDE AND RIFFLE / RUN QUALITY**

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential
Check ONE (ONLY)	Check ONE (Or 2 & average)	Check ALL that apply	Primary Contact
<input type="checkbox"/> > 1m [6]	<input checked="" type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	Secondary Contact
<input checked="" type="checkbox"/> 0.7-<1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input checked="" type="checkbox"/> SLOW [1]	(circle one and comment on back)
<input type="checkbox"/> 0.4-<0.7m [2]	<input type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input type="checkbox"/> VERY FAST [1]	
<input type="checkbox"/> 0.2-<0.4m [1]		<input type="checkbox"/> FAST [1]	
<input type="checkbox"/> < 0.2m [0]		<input type="checkbox"/> INTERSTITIAL [-1]	
		<input type="checkbox"/> INTERMITTENT [-2]	
		<input type="checkbox"/> MODERATE [1]	
		<input type="checkbox"/> EDDIES [1]	

Indicate for reach - pools and riffles.

Pool / Current Maximum **7**

Comments _____

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

Check ONE (Or 2 & average)

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input checked="" type="checkbox"/> BEST AREAS 5-10cm [1]	<input checked="" type="checkbox"/> MAXIMUM < 50cm [1]	<input checked="" type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

Riffle / Run Maximum **3**

Comments _____

6) **GRADIENT** (4.6 f/mi) VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]

DRAINAGE AREA (0.98 mi²)

% POOL: **15** % GLIDE: **0**

% RUN: **75** % RIFFLE: **10**

Gradient Maximum **4**

Comments _____

A/ SAMPLED REACH

Comment RE: Reach consistency/Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Access from Fair held this park
 Impact from water bed (sewer?) - some sediment

Check ALL that apply

METHOD
 BOAT
 MADE
 L LINE
 OTHER

STAGE
 1st sample pass- 2nd
 HIGH
 UP
 NORMAL
 LOW
 DRY

DISTANCE
 0.5 Km
 0.2 Km
 0.15 Km
 0.12 Km
 OTHER

CLARITY
 1st sample pass- 2nd
 < 20 cm
 20-40 cm
 40-70 cm
 > 70 cm/ CTB
 SECCHI DEPTH

B/AESTHETICS
 NUISANCE ALGAE (algae)
 INVASIVE MACROPHYTES
 EXCESS TURBIDITY
 DISCOLORATION
 FOAM / SCUM
 SOIL SHEEN
 TRASH / LITTER
 NUISANCE ODOR (sewer?)
 SLUDGE DEPOSITS
 CSO/SSO/OUTFALLS

D/MAINTENANCE
 PUBLIC / PRIVATE / BOTH / NA
 ACTIVE / HISTORIC / BOTH / NA
 YOUNG-SUCCESSION-OLD
 SPRAY / SNAAG / REMOVED
 MODIFIED / DIPPED OUT / NA
 LEVEED / ONE SIDED
 RELOCATED / CUT-OFFS
 MOVING-BEDLOAD-STABLE
 ARMORED / SLUMPS
 ISLANDS / SCoured
 IMPOUNDED / DESICATED
 FLOOD CONTROL / DRAINAGE

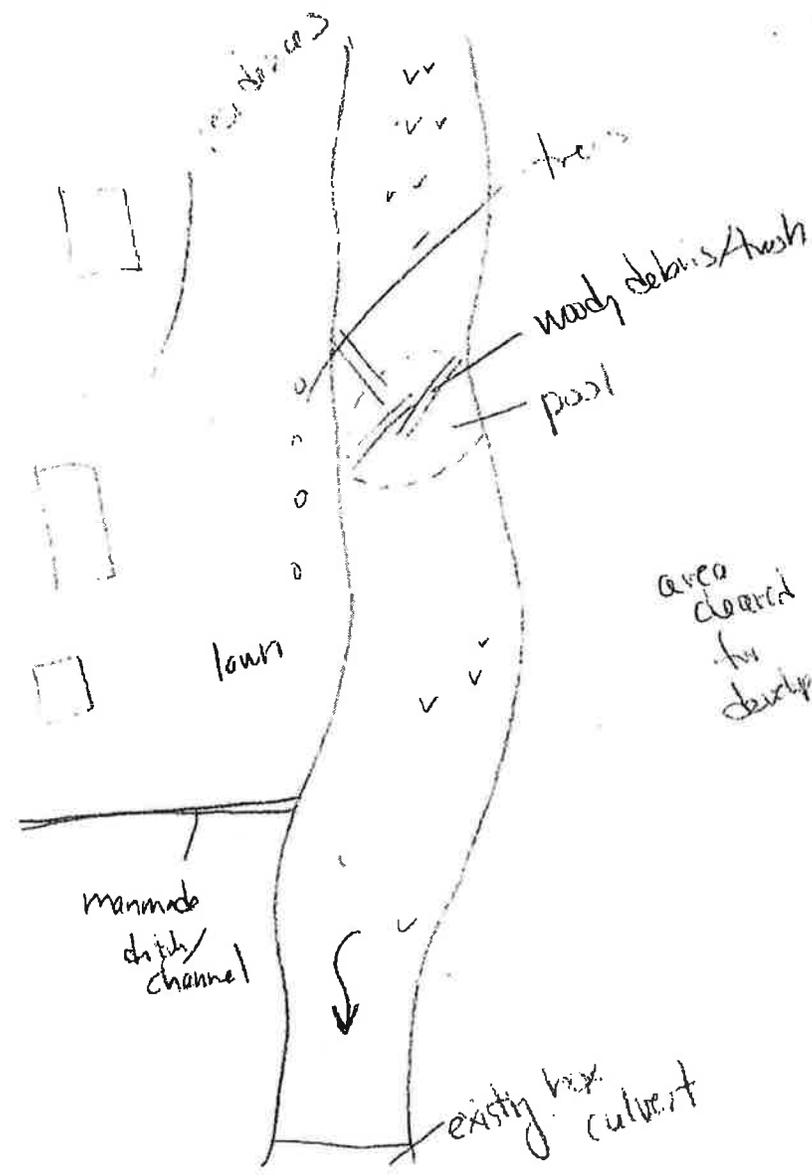
E/ISSUES
 WWTP / CSO / NPDES / INDUSTRY
 HARDENED / REBAR / DIRT & GRIME
 CONTAMINATED / LANDFILL
 BMPs-CONSTRUCTION-SEDIMENT
 LOGGING / IRRIGATION / COOLING
 BANK / EROSION / SURFACE
 FALSE BANK / MANURE / LAGOON
 WASH H₂O / TILE / H₂O TABLE
 ACID / MINE / QUARRY / FLOW
 NATURAL / WETLAND / STAGNANT
 PARK / GOLF / LANDFILL / ONE
 ATMOSPHERE / DATA PAUCITY

F/MEASUREMENTS
 width
 depth
 max. depth
 bankfull width
 bankfull x depth
 W/D ratio
 bankfull max. depth
 floodprone x² width
 oxbow reach ratio
 Legacy Tree:

C/ RECREATION Area Depth
 > 85% - OPEN
 55% - 85%
 30% - 55%
 10% - 30%
 < 10% - CLOSED

POOL: > 100m² > 5m

Stream Drawing:





Primary Headwater Habitat Evaluation Form

48

HHEI Score (sum of metrics 1, 2, 3) :

SITE NAME/LOCATION UNT Duck Creek DS Existing Box Culvert

SITE NUMBER SP 2

RIVER BASIN Ohio

DRAINAGE AREA (m²)

LENGTH OF STREAM REACH (ft) 200

LAT. 39.40581

LONG. -81.41234

RIVER CODE:

RIVER MILE

DATE 11/21/12

SCORER B. Burdette

COMMENTS

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS:

NONE / NATURAL CHANNEL RECOVERED RECOVERING RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 6). Final metric score is sum of boxes A & B.

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> BLDR SLABS [16 pts]	0%	<input type="checkbox"/> SILT [3 pt]	15%
<input type="checkbox"/> BOULDER (>256 mm) [16 pts]	0%	<input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	10%
<input type="checkbox"/> BEDROCK [16 pt]	0%	<input type="checkbox"/> FINE DETRITUS [3 pts]	0%
<input type="checkbox"/> COBBLE (66-256 mm) [12 pts]	5%	<input type="checkbox"/> CLAY or HARDPAN [0 pt]	0%
<input checked="" type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	55%	<input type="checkbox"/> MUCK [0 pts]	0%
<input type="checkbox"/> SAND (<2 mm) [6 pts]	15%	<input type="checkbox"/> ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock **5.00%** (A) (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: **18** TOTAL NUMBER OF SUBSTRATE TYPES: **5**

2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):

<input type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 6 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input checked="" type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS: _____ MAXIMUM POOL DEPTH (centimeters): **0**

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [16 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input checked="" type="checkbox"/> ≤ 1.0 m (≤ 3' 3") [5 pts]
<input checked="" type="checkbox"/> > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]	

COMMENTS: _____ AVERAGE BANKFULL WIDTH (meters): **1.52**

HHEI Metric Points

Substrate Max = 40

23

A + B

Pool Depth Max = 30

5

Bankfull Width Max = 30

20

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ☆NOTE: River Left (L) and Right (R) as looking downstream☆

RIPARIAN WIDTH		FLOODPLAIN QUALITY			
L	R	L	R	L	R
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wide >10m		Mature Forest, Wetland		Conservation Tillage	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Moderate 5-10m		Immature Forest, Shrub or Old Field		Urban or Industrial	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Narrow <5m		Residential, Park, New Field		Open Pasture, Row Crop	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
None		Fenced Pasture		Mining or Construction	

COMMENTS: Riparian width narrow; consists only of grassy restored banks/plantings.

FLOW REGIME (At Time of Evaluation) (Check ONLY one box):

<input checked="" type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (Intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (Interstitial)	<input type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS: _____

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

<input checked="" type="checkbox"/> None	<input type="checkbox"/> 1.0	<input type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

STREAM GRADIENT ESTIMATE

Flat (0.5 ft/100 ft) Flat to Moderate Moderate (2 ft/100 ft) Moderate to Severe Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This information must also be completed):

QHEI PERFORMED? Yes No QHEI Score 22.0 (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

WWH Name: Ohio River Distance from Evaluated Stream: < 1 mile
 CWH Name: _____ Distance from Evaluated Stream: _____
 EWH Name: _____ Distance from Evaluated Stream: _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: Marietta NRCS Soil Map Page: _____ NRCS Soil Map Stream Order: _____
County: Washington Township / City: Marietta

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: 11/12/12 Quantity: 0.20

Photograph Information: _____

Elevated Turbidity? (Y/N): N Canopy (% open): 100%

Were samples collected for water chemistry? (Y/N): N (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C): _____ Dissolved Oxygen (mg/l): _____ pH (S.U.): _____ Conductivity (µmhos/cm): _____

Is the sampling reach representative of the stream (Y/N): Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): N (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N): N Voucher? (Y/N): N Salamanders Observed? (Y/N): N Voucher? (Y/N): N
Frogs or Tadpoles Observed? (Y/N): N Voucher? (Y/N): N Aquatic Macroinvertebrates Observed? (Y/N): N Voucher? (Y/N): N

Comments Regarding Biology: No samples collected. Visual observations = few (3- 5; approximately 3 inch length) small fish observed.

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →

A) SAMPLED REACH

Check ALL that apply

METHOD

BOAT

SWADE

L. LINE

OTHER

STAGE

1st - sample pass - 2nd

HIGH

UP

NORMAL

LOW

DRY

DISTANCE

0.5 Km

0.2 Km

0.15 Km

0.12 Km

OTHER

60.5/6 meters

CLARITY

1st - sample pass - 2nd

< 20 cm

20-40 cm

40-70 cm

> 70 cm / CTB

SECCHI DEPTH

B) AESTHETICS

NUISANCE ALGAE (HEAVY)

INVASIVE MACROPHYTES

EXCESS TURBIDITY

DISCOLORATION

FOAM / SCUM

OIL / SHEEN

TRASH / LITTER

NUISANCE ODOR

SLUDGE DEPOSITS

CSO's/SSO's/OUTFALLS

AREA DEPTH

POOL - > 100m² > 3ft

D) MAINTENANCE

PUBLIC / PRIVATE / BOTH / NA

ACTIVE / HISTORIC / BOTH / NA

YOUNG SUCCESSION-OLD

SPRAY / SNAG / REMOVED

MOVED / DIPPED OUT / NA

LEVEED / ONE SIDED

RELOCATED / CUTOFFS

MOVING-BED / LOAD-STABLE

ARMORED / SLUMPS

ISLANDS / SCoured

IMPROUNDED / DESICCATED

FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

WWT/P / CSO / NPDES / INDUSTRY

HARDENED / ~~WETLAND~~ / DIRT/GRIME

CONTAMINATED / LANDFILL

BUILT-CONSTRUCTION-SEDIMENT

LOGGING / IRRIGATION / COOLING

BANK / EROSION / SURFACE

FALSE BANK / MANURE / LAGOON

WASH H₂O / TILE / H₂O TABLE

ACID / MINE / QUARRY / FLOW

NATURAL / WETLAND / STAGNANT

PARK / GOLF / LAWN / HOME

ATMOSPHERE / DATA PAUCITY

E) ISSUES

WWT/P / CSO / NPDES / INDUSTRY

HARDENED / ~~WETLAND~~ / DIRT/GRIME

CONTAMINATED / LANDFILL

BUILT-CONSTRUCTION-SEDIMENT

LOGGING / IRRIGATION / COOLING

BANK / EROSION / SURFACE

FALSE BANK / MANURE / LAGOON

WASH H₂O / TILE / H₂O TABLE

ACID / MINE / QUARRY / FLOW

NATURAL / WETLAND / STAGNANT

PARK / GOLF / LAWN / HOME

ATMOSPHERE / DATA PAUCITY

F) MEASUREMENTS

width

depth

max. depth

bankfull width

bankfull depth

W/D ratio

bankfull max. depth

floodprone x² width

entrench. ratio

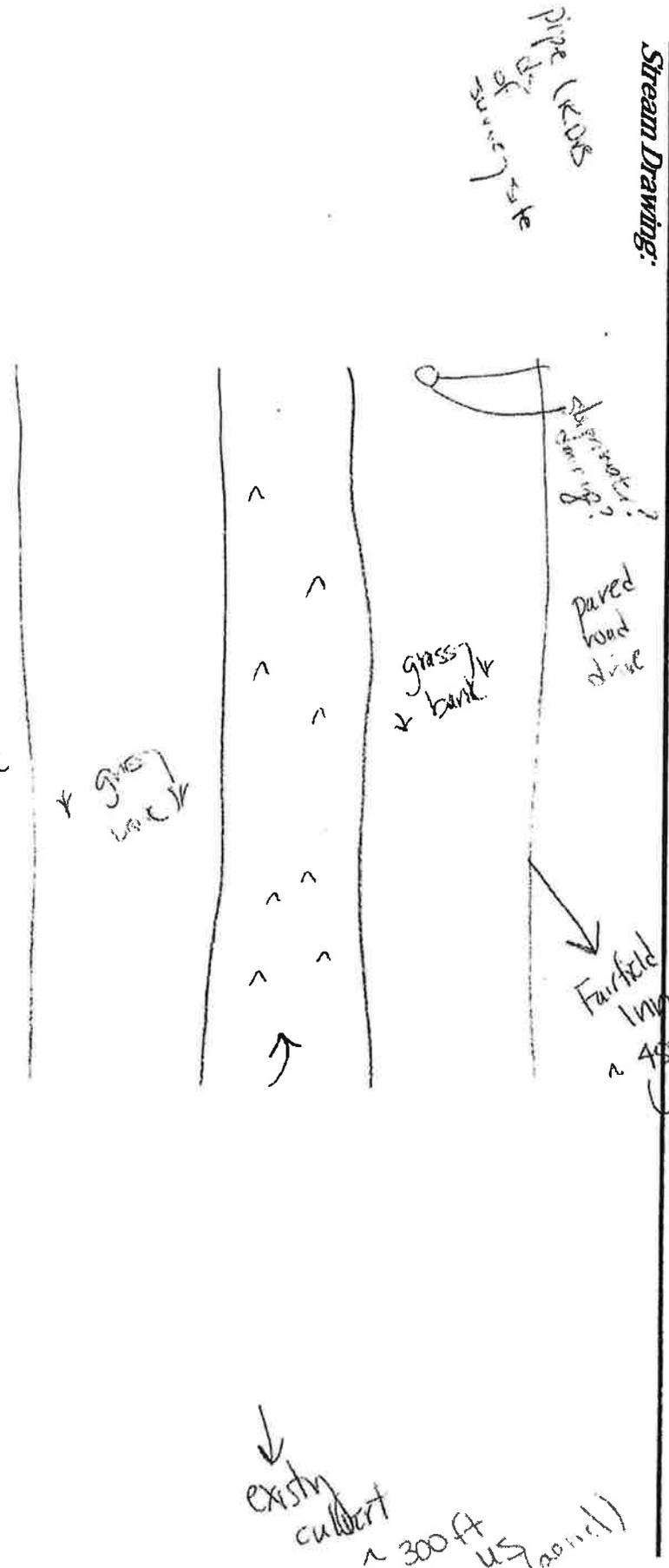
Legacy Tree:

Comment RE: Reach consistency/is reach typical of stream?, Recreation/Observed - Inferred, Other/Sampling observations, Concerns, Access directions, etc.

Access from Fairfield in fall.

Impacts from waterbed outside loading zone sediment.

Stream Drawing:





Primary Headwater Habitat Evaluation Form

HHEI Score (sum of metrics 1, 2, 3) : **59**

SITE NAME/LOCATION UNT Duck Creek DS Section (Proposed Box Culvert Impact Area)
 SITE NUMBER SP 3 RIVER BASIN Ohio DRAINAGE AREA (mi²) 0.98
 LENGTH OF STREAM REACH (ft) 200 LAT. 39.40601 LONG. -81.41442 RIVER CODE _____ RIVER MILE _____
 DATE 11/21/12 SCORER B.Burdette COMMENTS _____

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: NONE / NATURAL CHANNEL RECOVERED RECOVERING RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.)

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> BLDR SLABS [16 pts]	0%	<input type="checkbox"/> SILT [3 pt]	5%
<input type="checkbox"/> BOULDER (>256 mm) [16 pts]	0%	<input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	3%
<input type="checkbox"/> BEDROCK [16 pt]	0%	<input type="checkbox"/> FINE DETRITUS [3 pts]	3%
<input type="checkbox"/> COBBLE (65-256 mm) [12 pts]	10%	<input type="checkbox"/> CLAY or HARDPAN [0 pt]	0%
<input checked="" type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	70%	<input type="checkbox"/> MUCK [0 pts]	0%
<input type="checkbox"/> SAND (<2 mm) [8 pts]	10%	<input type="checkbox"/> ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock 10.00% (A) (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: **18** TOTAL NUMBER OF SUBSTRATE TYPES: **6**

2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):

<input checked="" type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 5 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS _____ MAXIMUM POOL DEPTH (centimeters): **36**

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input checked="" type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input type="checkbox"/> < 1.0 m (<= 3' 3") [5 pts]
<input type="checkbox"/> > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]	

COMMENTS _____ AVERAGE BANKFULL WIDTH (meters): **1.21**

HHEI Metric Points

Substrate Max = 40

24

A + B

Pool Depth Max = 30

20

Bankfull Width Max=30

15

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY

☆NOTE: River Left (L) and Right (R) as looking downstream

RIPARIAN WIDTH		FLOODPLAIN QUALITY			
L	R	L	R	L	R
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Per Bank)		(Most Predominant per Bank)		Conservation Tillage	
Wide >10m		Mature Forest, Wetland		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Immature Forest, Shrub or Old Field		Urban or Industrial	
Moderate 5-10m		Residential, Park, New Field		<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Fenced Pasture		Open Pasture, Row Crop	
Narrow <5m				<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>			Mining or Construction	
None					

FLOW REGIME (At Time of Evaluation) (Check ONLY one box):

<input checked="" type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (Intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (Interstitial)	<input type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS _____

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

<input type="checkbox"/> None	<input type="checkbox"/> 1.0	<input type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input checked="" type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

STREAM GRADIENT ESTIMATE

<input type="checkbox"/> Flat (0.5 ft/100 ft)	<input checked="" type="checkbox"/> Flat to Moderate	<input type="checkbox"/> Moderate (2 ft/100 ft)	<input type="checkbox"/> Moderate to Severe	<input type="checkbox"/> Severe (10 ft/100 ft)
---	--	---	---	--

ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):

QHEI PERFORMED? Yes No QHEI Score 42.0 (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

WWH Name: Ohio River Distance from Evaluated Stream < 1 mile
 CWH Name: _____ Distance from Evaluated Stream _____
 EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: Marietta NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____
County: Washington Township / City: Marietta

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: 11/12/12 Quantity: 0.20

Photograph Information: _____

Elevated Turbidity? (Y/N): N Canopy (% open): 50%

Were samples collected for water chemistry? (Y/N): N (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C) _____ Dissolved Oxygen (mg/l) _____ pH (S.U.) _____ Conductivity (µmhos/cm) _____

Is the sampling reach representative of the stream (Y/N) Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): N (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) N Voucher? (Y/N) N Salamanders Observed? (Y/N) N Voucher? (Y/N) N
Frogs or Tadpoles Observed? (Y/N) N Voucher? (Y/N) N Aquatic Macroinvertebrates Observed? (Y/N) N Voucher? (Y/N) N

Comments Regarding Biology: No samples collected. Visual Observations = No aquatic fauna.

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: **42**

SP3
Poor

Stream & Location: UNT Duck Creek DSS Section (Proposed Box Culvert) Date: 11/21/12

River Code: SP-3 STORET #: Lat./Long.: 39.4001 18.81417 Office verified location:

1) **SUBSTRATE** Check ONLY two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL RIFFLE	OTHER TYPES	POOL RIFFLE	ORIGIN	QUALITY (0)
<input type="checkbox"/> BLDR/SLABS [10]	<input type="checkbox"/> POOL	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/> RIFFLE	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> HEAVY [-2]
<input type="checkbox"/> BOULDER [9]	<input type="checkbox"/> RIFFLE	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/> POOL	<input type="checkbox"/> TILLS [1]	<input checked="" type="checkbox"/> MODERATE [-1]
<input type="checkbox"/> COBBLE [8]	<u>10</u>	<input type="checkbox"/> MUCK [2]	<input type="checkbox"/> RIFFLE	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> NORMAL [0]
<input checked="" type="checkbox"/> GRAVEL [7]	<u>30</u>	<input type="checkbox"/> SILT [2]	<input type="checkbox"/> POOL	<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> FREE [1]
<input type="checkbox"/> SAND [6]	<u>10</u>	<input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/> RIFFLE	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> EXTENSIVE [-2]
<input type="checkbox"/> BEDROCK [5]				<input type="checkbox"/> RIP/RAP [0]	<input checked="" type="checkbox"/> MODERATE [-1]

NUMBER OF BEST TYPES: 4 or more [2] 3 or less [0]

Comments:

2) **INSTREAM COVER** Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<input type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	AMOUNT
<input type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	<input type="checkbox"/> EXTENSIVE >75% [11]
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> MODERATE 25-75% [7]
<input type="checkbox"/> ROOTMATS [1]			<input checked="" type="checkbox"/> SPARSE 5-25% [3]
			<input type="checkbox"/> NEARLY ABSENT <5% [1]

Comments: undercut banks rootwads not functional (art of water)

3) **CHANNEL MORPHOLOGY** Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input checked="" type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]
<input checked="" type="checkbox"/> LOW [2]	<input checked="" type="checkbox"/> FAIR [3]	<input type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

Comments:

4) **BANK EROSION AND RIPARIAN ZONE** Check ONE in each category for EACH BANK (Or 2 per bank & average)

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	CONSERVATION TILLAGE
<input type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]	<input checked="" type="checkbox"/> URBAN OR INDUSTRIAL [0]
<input checked="" type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]	<input type="checkbox"/> MINING / CONSTRUCTION [0]
<input type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	
	<input checked="" type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]	
	<input type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]	

Comments:

5) **POOL / GLIDE AND RIFFLE / RUN QUALITY**

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential
<input type="checkbox"/> > 1m [6]	<input checked="" type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	Primary Contact
<input type="checkbox"/> 0.7-1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input type="checkbox"/> VERY FAST [1]	Secondary Contact
<input type="checkbox"/> 0.4-0.7m [2]	<input type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input type="checkbox"/> FAST [1]	(circle one and comment on back)
<input checked="" type="checkbox"/> 0.2-0.4m [1]		<input type="checkbox"/> MODERATE [1]	
<input type="checkbox"/> < 0.2m [0]		<input type="checkbox"/> INTERSTITIAL [-1]	
		<input type="checkbox"/> INTERMITTENT [-2]	
		<input type="checkbox"/> EDDIES [1]	

Comments:

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average)

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input type="checkbox"/> BEST AREAS 5-10cm [1]	<input checked="" type="checkbox"/> MAXIMUM < 50cm [1]	<input checked="" type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

Comments:

6) **GRADIENT** (33 ft/mi) VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6] 8

DRAINAGE AREA (0.98 mi²)

% POOL: 10 % GLIDE: 0 % RUN: 85 % RIFFLE: 5

Comments:

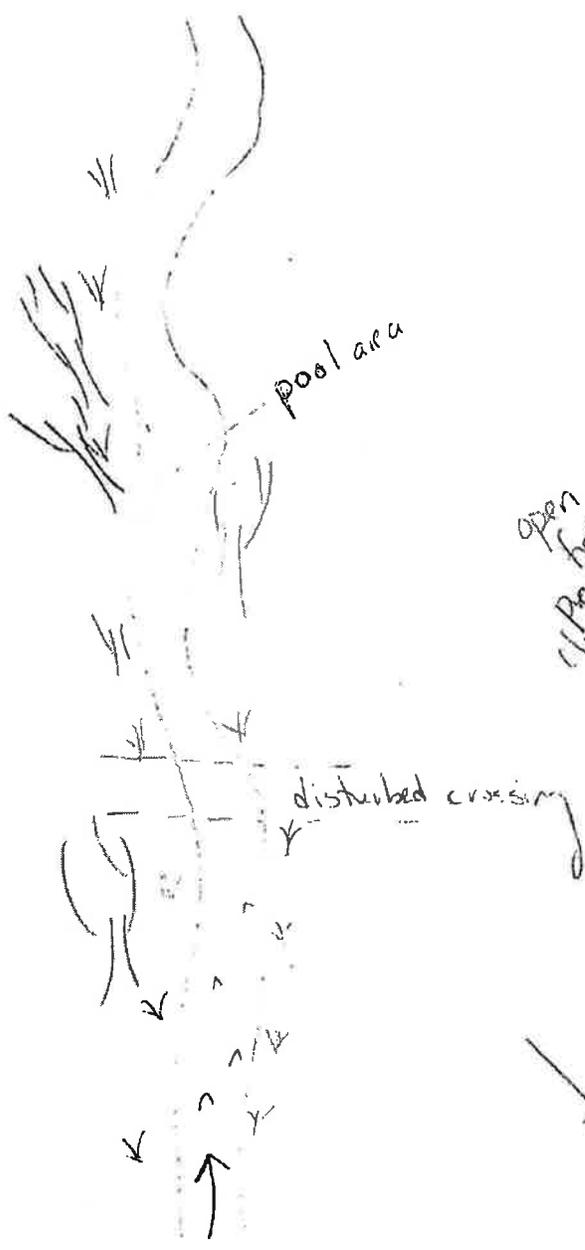
A1/SAMPLED REACH

Check ALL that apply

Comment RE: Reach consistency/ is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.
 Access from Fairfield Inn parking.
 Impacts from watershed; nutrient loading; some sediment

METHOD	<input type="checkbox"/> BOAT <input checked="" type="checkbox"/> WADE <input type="checkbox"/> L. LINE <input type="checkbox"/> OTHER	STAGE	1st -sample pass- 2nd <input type="checkbox"/> HIGH <input type="checkbox"/> UP <input checked="" type="checkbox"/> NORMAL <input type="checkbox"/> LOW <input type="checkbox"/> DRY
DISTANCE	<input type="checkbox"/> 0.5 Km <input type="checkbox"/> 0.2 Km <input type="checkbox"/> 0.15 Km <input type="checkbox"/> 0.12 Km <input checked="" type="checkbox"/> OTHER	CLARITY	1st -sample pass- 2nd <input type="checkbox"/> < 20 cm <input type="checkbox"/> 20-40 cm <input type="checkbox"/> 40-70 cm <input type="checkbox"/> > 70 cm/CTB <input type="checkbox"/> SECCI DEPTH
CANOPY	<input type="checkbox"/> > 85% - OPEN <input type="checkbox"/> 55% - 85% <input checked="" type="checkbox"/> 30% - 55% <input type="checkbox"/> 10% - 30% <input type="checkbox"/> < 10% - CLOSED	B/AESTHETICS	<input checked="" type="checkbox"/> NUISANCE ALGAE <input type="checkbox"/> INVASIVE MACROPHYTES <input type="checkbox"/> EXCESS TURBIDITY <input type="checkbox"/> DISCOLORATION <input type="checkbox"/> FOAM / SCUM <input type="checkbox"/> OIL / SHEEN <input checked="" type="checkbox"/> TRASH / LITTER <input type="checkbox"/> NUISANCE ODOR <input type="checkbox"/> SLUDGE DEPOSITS <input type="checkbox"/> CSO/SSO/OUTFALLS
C/ RECREATION	AREA DEPTH POOL: <input type="checkbox"/> > 100m <input type="checkbox"/> > 3ft	D/ MAINTENANCE	<input type="checkbox"/> PUBLIC / PRIVATE / BOTH / NA <input type="checkbox"/> ACTIVE / HISTORIC / BOTH / NA <input type="checkbox"/> YOUNG-SUCCESSION-OLD <input type="checkbox"/> SPRAY / SNAG / REMOVED <input type="checkbox"/> MODIFIED / DIPPED OUT / NA <input type="checkbox"/> LEVEED / ONE SIDED <input type="checkbox"/> RELOCATED / CUTOFFS <input type="checkbox"/> MOVING-BED/LOAD-STABLE <input type="checkbox"/> ARMOURED / SLUMPS <input type="checkbox"/> ISLANDS / SCOURED <input type="checkbox"/> IMP-OUNDED / DESICCATED <input type="checkbox"/> FLOOD CONTROL / DRAINAGE
		E/ ISSUES	F/ MEASUREMENTS
		WWT/P / GSO / NPDES / INDUSTRY HARDENED / (UREA) / DIRT & GRIME CONTAMINATED / LANDFILL BMP - CONSTRUCTION- SEDIMENT LOGGING / IRRIGATION / COOLING BANK EROSION / SURFACE FALSE BANK / MANURE / LAGOON WASH H ₂ O / TILE / H ₂ O TABLE ACID / MINE / QUARRY / FLOW NATURAL / WETLAND / STAGNANT PARK / GOLF / LAWN / HOME ATMOSPHERE / DATA PAUCITY	<input type="checkbox"/> width <input checked="" type="checkbox"/> depth max. depth <input checked="" type="checkbox"/> bankfull width bankfull/ <input checked="" type="checkbox"/> depth W/D ratio bankfull max. depth floodprone <input checked="" type="checkbox"/> width entrench. ratio Legacy Tree:

Stream Drawing:



open channel
development

development
Fairfield Inn
2 900ft
(canal)

existing
2 800ft
(canal)

Exit

APPENDIX E
SITE PHOTOGRAPHS
SITE PHOTOGRAPH INDEX MAP
SITE PHOTOGRAPHS



Rev.	Date	By	Description
0			

Drawing Description
 LARRY LANG EXCAVATING, INC.
 MARSHALL GIBB
 FIRST COLONY CENTER PHASE II
 SITE PHOTOGRAPHS INDEX MAP

Project: 2120001
Drawn By: AMZ
Checked By: AMZ
Scale: AS SHOWN
Revision: 0
Drawing Number: INDEX

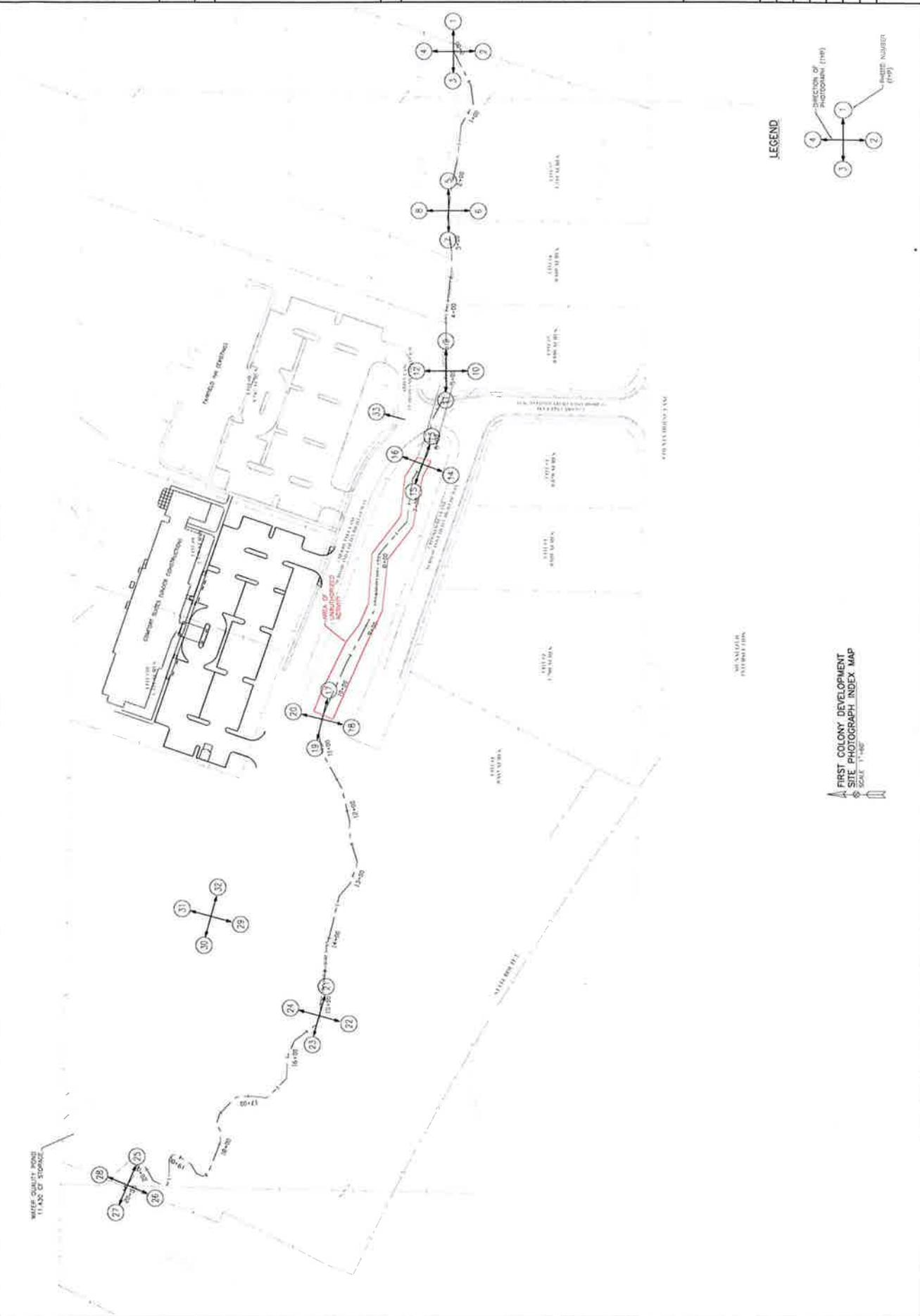




PHOTO #1



PHOTO #2



PHOTO #3



PHOTO #4



PHOTO #5



PHOTO #6



PHOTO #7



PHOTO #8



PHOTO #9



PHOTO #10



PHOTO #11



PHOTO #12



PHOTO #13



PHOTO #14



PHOTO #15



PHOTO #16



PHOTO #17



PHOTO #18



PHOTO #19



PHOTO #20



PHOTO #21



PHOTO #22



PHOTO #23



PHOTO #24



PHOTO #25



PHOTO #26



PHOTO #27



PHOTO #28



PHOTO #29



PHOTO #30



PHOTO #31



PHOTO #32



PHOTO #33

APPENDIX F

STORM WATER POLLUTION PREVENTION PLAN

Stormwater Pollution Prevention Plan

for:

First Colony Phase 2
Larry Lang Excavating, Inc.
19371 St. Rt. 60
Beverly, OH 45715
740-984-4750

Operator(s):

Larry Lang Excavating, Inc.
19371 St. Rt. 60
Beverly, OH 45715
740-984-4750
doubledozer@myway.com

SWPPP Preparer:

Pickering Associates
Amy M. Zwick, P.S., P.E.
11283 Emerson Avenue
Parkersburg WV 26104
304-464-5305
Fax: 304-464-4428

SWPPP Preparation Date:

08/01/2012

Estimated Project Dates:

Project Start Date: 08/06/2012
Project Completion Date: 08/01/2014

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SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information

Project/Site Name: First Colony Phase 2

Project Street/Location: County House Lane/ State Route 7

City: Marietta State: OH ZIP Code: 45750

County or Similar Subdivision: Washington

Latitude/Longitude (Use **one** of three possible formats, and specify method)

Latitude:

1. 39 °24 '20.17" N (degrees, minutes, seconds)

Longitude:

1. 81 °24 '40.78" W (degrees, minutes, seconds)

Method for determining latitude/longitude:

USGS topographic map (specify scale: _____) EPA Web site GPS

Other (please specify): _____

Is the project located in Indian country? Yes No

If yes, name of Reservation, or if not part of a Reservation, indicate "not applicable." _____

Is this project considered a federal facility? Yes No

NPDES project or permit tracking number: _____

Site Description:

The site encompasses approximately 9.906 acres in Washington County and is the area for Phase 2 of First Colony Development in Marietta, Ohio. The purpose of this plan is to provide stormwater control measures for Phase 2 of the site development.

1.2 Contact Information/Responsible Parties

Operator(s):

Insert Company or Organization Name: Larry Lang Excavating, Inc.

Insert Name: Larry Lang

Insert Address: 19371 St. Rt. 60

Insert City, State, Zip Code: Beverly, OH 45715

Insert Telephone Number: 740-984-4750

Insert Fax/Email: doubledozer@myway.com

Project Manager(s) or Site Supervisor(s):

Insert Company or Organization Name: Larry Lang Excavating, Inc.

Insert Name: Mike Gulliver

Insert Address: 19371 St. Rt. 60

Insert City, State, Zip Code: Beverly, OH 45715

Insert Telephone Number: 740-896-3248

Insert Fax/Email:

SWPPP Contact(s):

Insert Company or Organization Name: Pickering Associates

Insert Name: Amy M. Zwick, P.S., P.E.

Insert Address: 11283 Emerson Avenue

Insert City, State, Zip Code: Parkersburg WV 26104

Insert Telephone Number: 304-464-5305

Insert Fax/Email: 304-464-4428

This SWPPP was Prepared by:

Pickering Associates

Insert Name: Amy M. Zwick, P.S., P.E.

Insert Address: 11283 Emerson Avenue

Insert City, State, Zip Code: Parkersburg, WV 26104

Insert Telephone Number: 304-464-5305

Insert Fax/Email: 304-464-4428

Emergency 24-Hour Contact:

Insert Company or Organization Name: Larry Lang Excavating, Inc.

Insert Name: Larry Lang

Insert Telephone Number: 740-984-4750

1.3 Sequence of Construction Activity

Description of Construction Activity:

Sediment and erosion control measures will be installed as shown on the construction drawings. The majority of the site will be protected with silt fence and diversion ditches.

Sequence of Construction Activity:

- INSTALL INLET PROTECTION AT EXISTING CATCH BASINS. PROVIDE PERIMETER FILTER FABRIC FENCE PRIOR TO GRADING. (1/2 DAY)
- PROVIDE TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES AS REQUIRED DURING CONSTRUCTION. (1/2 DAY)
- CONSTRUCT CONSTRUCTION ENTRANCE (1/2 DAY)
- CONSTRUCT EXCAVATION AND EMBANKMENT ASSOCIATED WITH PROPOSED GRADES (CHANNEL AND MANAGE STORM WATER AS SOON AS POSSIBLE VIA SEDIMENT AND EROSION CONTROL DEVICES. (2 MONTHS)*
- PERFORM SITE GRADING (1 MONTH)
- CONSTRUCT REMAINING EXCAVATION AND EMBANKMENT AS REQUIRED BY THE FINISHED GRADES AND SUBGRADES. (2 WEEKS)
- APPLY TEMPORARY AND PERMANENT SEEDING AND MULCHING TO DISTURBED AREAS AS REQUIRED. SEEDING AND MULCHING SHALL BE SCHEDULED TO MINIMIZE THE DURATION OF EXPOSURE. (THROUGHOUT PROJECT)
- CONSTRUCT CONCRETE CURBING. (1 WEEK)
- CONSTRUCT AGGREGATE BASE (1 WEEK)
- CONSTRUCT CONCRETE/HMA BASE PAVEMENT. (2 DAYS)
- REMOVE TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES AND CONSTRUCTION AS CONTRIBUTING AREAS ARE STABILIZED.

*BOX CULVERT AND FILL TO THE NORTH SHALL BE CONSTRUCTED PRIOR TO RELOCATING THE EXISTING STREAM. DO NOT DISTURB EXISTING STREAM UNTIL THEN. AFTER CULVERT IS CONSTRUCTED, STREAM MAY BE DIVERTED AND FILL MAY BE PLACED TO THE SOUTH OF THE CULVERT.

What is the function of the construction activity?

- Residential Commercial Industrial Road Construction Linear Utility
 Other (please specify):

Estimated Project Start Date: 08/06/2012

Estimated Project Completion Date: 08/01/2014

1.4 Construction Site Estimates

The following are estimates of the construction site.

Total project area:	9.906 acres
Construction site area to be disturbed:	9.906 acres
Percentage impervious area before construction:	10%
Runoff coefficient before construction:	0.36
Percentage impervious area after construction:	75%
Runoff coefficient after construction	0.75

1.5 Receiving Waters

Description of receiving waters: Unnamed Tributary to Duck Creek.

Description of storm sewer systems: Existing storm sewer system consists of catch basins/manholes and pipe located along the South portion of the project site to collect stormwater. Proposed storm sewer system will consist of catch basins, manholes and pipe located along proposed roadways and throughout the site to collect stormwater and discharge into a proposed box culvert. A water quality pond will serve as a permanent detention basin for a portion of the Phase 2 developed area.

Description of impaired waters or waters subject to TMDLs: N/A

1.6 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

No tanks or drums containing potential contaminants are expected to be stored at this site. Should the need arise, tanks and drums shall have secondary containment and will be filled or moved only under the supervision of site personnel. Equipment maintenance activities will be kept to a minimum and drip pads will be utilized during these times. Spent fluids will be collected and properly disposed of off-site. Spills resulting of equipment failure will be immediately contained with soil, sand, or other materials to prevent migration. The contaminated material/soils will be removed immediately and properly disposed of. Any spills or accidental discharges will be reported to the site owner immediately for further inspection. The owner will determine if the spill was a reportable quantity and will immediately report any qualify spills to the following contact:

Emergency Response Spill Alert System
Ohio Spill Notification Line
(800)-282-9378
National Response Center
(800)-424-8802

1.7 Endangered Species Certification

Are endangered or threatened species and critical habitats expected to be on or near the project area?

Yes No

1.8 Historic Preservation

Are there any historic sites expected to be on or near the construction site?

Yes No

Determination shall be made by the contractor in accordance with the applicable laws.

SECTION 2: EROSION AND SEDIMENT CONTROL BMPS

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

Signs and/or fences shall be installed along the perimeter of areas that are not to be disturbed during construction activity. The construction limits shall be clearly defined via signs/fences and shall be protected throughout the construction process. All topsoil removed during construction activities shall be stockpiled on site for re-use once final grade has been achieved. Stock piles shall be seeded and mulched in accordance with the construction drawings. Stockpiles shall also be protected from erosion via silt fence.

2.2 Control Stormwater Flowing onto and through the Project

BMP Description: Inlet Protection

<i>Installation Schedule:</i>	Prior to Earthwork activities, prior to demolition
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

BMP Description: Rocked Outlet Protection

<i>Installation Schedule:</i>	After installation of new pipe
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

BMP Description: Sediment Trap

<i>Installation Schedule:</i>	Prior to Earthwork activities, prior to demolition
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

BMP Description: Sediment Basin

<i>Installation Schedule:</i>	Prior to Earthwork activities, prior to demolition
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

2.3 Stabilize Soils

BMP Description: Seeding and Mulching

<input checked="" type="checkbox"/> <i>Permanent</i>	<input checked="" type="checkbox"/> <i>Temporary</i>
<i>Installation Schedule:</i>	See drawing C0.1 for additional info.
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

BMP Description: Construction Entrance

<input checked="" type="checkbox"/> <i>Permanent</i>	<input checked="" type="checkbox"/> <i>Temporary</i>
<i>Installation Schedule:</i>	See drawing C0.1 for additional info.
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

2.4 Establish Perimeter Controls and Sediment Barriers

BMP Description: Silt Fence

<i>Installation Schedule:</i>	Beginning of work and throughout project
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

BMP Description: Diversion Ditch

<i>Installation Schedule:</i>	Beginning of work and throughout project
<i>Maintenance and Inspection:</i>	Once every 7 days and within 24 hours after any storm event greater than 0.5 inches in a 24 hour period
<i>Responsible Staff:</i>	Contractor

SECTION 3: GOOD HOUSEKEEPING

The site shall be maintained in a clean, orderly fashion at all times. Construction drawings shall be referenced for additional information.

SECTION 4: INSPECTIONS

4.1 Inspections

1. **Inspection Personnel:** Contractor shall inspect all sediment and erosion control measures. The owner will perform periodic inspections and review inspection forms from the contractor.

2. **Inspection Schedule and Procedures:**

All erosion and sediment controls shall be inspected at a minimum once every 7 days and within 24 hours of any storm event greater than 0.5 inches per 24 hour period.

SECTION 5: RECORDKEEPING AND TRAINING

5.1 Recordkeeping

The records will document general site conditions at the time of inspection as well as documentation of maintenance activities (cleaning of sediment traps, silt fence repair, etc). Spills, leaks or other incidents will also be recorded. All records will be kept by the owner for a period of 1 year after the permit expires.

5.1 Training

Personnel at all levels of responsibility on the site will be informed of the components and goals of the SWPPP. Training shall address such topics as spill response, good housekeeping techniques, and inspections. The training forms are attached in the appendix.

SECTION 8: CERTIFICATION AND NOTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____ Title: _____

Signature: _____ Date: _____

SWPPP APPENDICES

Attach the following documentation to the SWPPP:

Appendix A – General Location Map

Appendix B – Site Maps

Appendix C – Construction General Permit

Appendix D – Inspection Reports

Appendix E – Corrective Action Log

Appendix F – SWPPP Amendment Log (or in Part 6.2)

Appendix G – Subcontractor Certifications/Agreements

Appendix H – Grading and Stabilization Activities Log

Appendix I – Training Log

Appendix J – Delegation of Authority

Appendix K – Site Inspection Sheet

Appendix L – Standard Specifications/Details

Appendix A

Appendix B

Appendix C

Appendix D

Appendix G – Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the BMPs and practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

Signature: _____

Title: _____

Date: _____

Appendix I – SWPPP Training Log

Stormwater Pollution Prevention Training Log

Project Name: _____

Project Location: _____

Instructor's Name(s): _____

Instructor's Title(s): _____

Course Location: _____ Date: _____

Course Length (hours): _____

Stormwater Training Topic: *(check as appropriate)*

- Erosion Control BMPs Emergency Procedures
 Sediment Control BMPs Good Housekeeping BMPs
 Non-Stormwater BMPs

Specific Training Objective: _____

Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Appendix J – Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the _____ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

_____ (name of person or position)
_____ (company)
_____ (address)
_____ (city, state, zip)
_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in _____ (Reference State Permit), and that the designee above meets the definition of a “duly authorized representative” as set forth in _____ (Reference State Permit).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Company: _____

Title: _____

Signature: _____

Date: _____

Appendix K – Site Inspection Sheet

Inspector:

Date:

Yes	No	Inspection Item
		Engineering controls, including silt fences, sediment retention structures and ditches are in good condition.
		Sediment ditches and retention structures are free of accumulated sediment.
		There are no wastes stored on site and the site is free of litter.
		Any spills or leaks since the last inspection have been properly cleaned.
		Site map and plan are representative of the current site conditions.
		There were no non-storm discharges observed.

IF you answered no to any of the above questions, provide an explanation:

Provide a description of the action(s) taken or planed:

7.4 Construction Entrance



Description

A construction entrance is a stabilized pad of stone underlain with a geotextile and is used to reduce the amount of mud tracked off-site with construction traffic. Located at points of ingress/egress, the practice is used to reduce the amount of mud tracked off-site with construction traffic.

Conditions Where Practice Applies

A construction entrance is applicable where:

- Construction traffic leaves active construction areas and enters public roadways or areas unchecked by effective sediment controls;
- Areas where frequent vehicle and equipment access is expected and likely to contribute sediment to runoff, such as at the entrance to individual building lots.

Planning Considerations

Construction entrances address areas that contribute significant amounts of mud to runoff by providing a stable area for traffic. Although they allow some mud to be removed from construction vehicle tires before they enter a public roads, they should not be the only practice relied upon to manage off-site tracking. Since most mud is flung from tires as they reach higher speeds, restricting traffic to stabilized construction roads, entrances and away from muddy areas is necessary.

If a construction entrance is not sufficient to remove the majority of mud from wheels or there is an especially sensitive traffic situation on adjacent roads, wheel wash areas may be necessary. This requires an extended width pad to avoid conflicts with traffic, a supply of wash water and sufficient drainage to assure runoff is captured in a sediment pond or trap.

Proper installation of a construction entrance requires a geotextile and proper drainage to insure construction site runoff does not leave the site. The use of geotextile under the stone helps to prevent potholes from developing and will save the amount of stone needed during the life of the practice. Proper drainage may include culverts to direct water under the roadway or water bars to direct muddy water off the roadway toward sediment traps or ponds.

Design Criteria

The area of the entrance must be cleared of all vegetation, roots, and other objectionable material. Geotextile will then be placed the full width and length of the entrance.

Stone shall be placed to a depth of at least 6 inches. Roads subject to heavy duty loads should be increased to a minimum of 10 inches. Surface water shall be conveyed under the entrance, through culverts, or diverted via a water bars or mountable berms (minimum 5:1 slopes) so as to convey sediment laden runoff to sediment control practices or to allow clean water to pass by the entrance.

The stabilized construction entrance shall meet the specifications that follow.

Maintenance

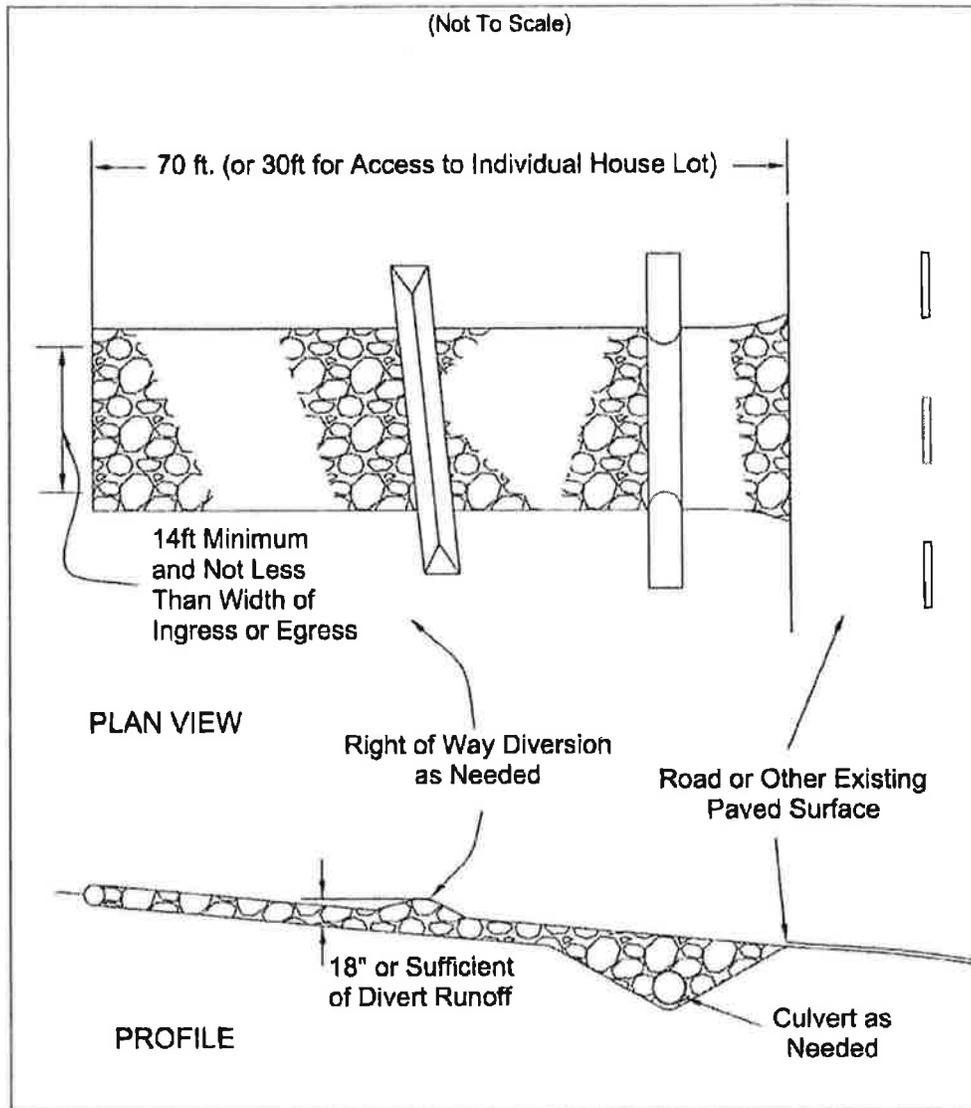
The entrance shall be maintained in a condition that will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with additional stone or the washing and reworking of existing stone as conditions demand and repair and/or cleanout of any structures used to trap sediment. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

Common Problems / Concerns

Mud is allowed to accumulate and is tracked on to public right-of-ways. The entrance and associated construction roads may need dressing with additional stone.

Soft depression areas develop in entrance area. Stone may not have been underlain with geotextile or insufficient stone base has been provided.

Specifications
for
Construction Entrance



Specifications
for
Construction Entrance

1. Stone Size—ODOT # 2 (1.5-2.5 inch) stone shall be used, or recycled concrete equivalent.
2. Length—The Construction entrance shall be as long as required to stabilize high traffic areas but not less than 70 ft. (exception: apply 30 ft. minimum to single residence lots).
3. Thickness -The stone layer shall be at least 6 inches thick for light duty entrances or at least 10 inches for heavy duty use.
4. Width -The entrance shall be at least 14 feet wide, but not less than the full width at points where ingress or egress occurs.
5. Geotextile -A geotextile shall be laid over the entire area prior to placing stone. It shall be composed of strong rot-proof polymeric fibers and meet the following specifications:
6. Timing—The construction entrance shall be installed as soon as is practicable before major grading activities.
7. Culvert -A pipe or culvert shall be constructed under the entrance if needed to prevent surface water from flowing across the entrance or to prevent runoff from being directed out onto paved surfaces.
8. Water Bar -A water bar shall be constructed as part of the construction entrance if needed to prevent surface runoff from flowing the length of the construction entrance and out onto paved surfaces.
9. Maintenance -Top dressing of additional stone shall be applied as conditions demand. Mud spilled, dropped, washed or tracked onto public roads, or any surface where runoff is not checked by sediment controls, shall be removed immediately. Removal shall be accomplished by scraping or sweeping.
10. Construction entrances shall not be relied upon to remove mud from vehicles and prevent off-site tracking. Vehicles that enter and leave the construction-site shall be restricted from muddy areas.
11. Removal—the entrance shall remain in place until the disturbed area is stabilized or replaced with a permanent roadway or entrance.

Figure 7.4.1

Geotextile Specification for Construction Entrance	
Minimum Tensile Strength	200 lbs.
Minimum Puncture Strength	80 psi.
Minimum Tear Strength	50 lbs.
Minimum Burst Strength	320 psi.
Minimum Elongation	20%
Equivalent Opening Size	EOS < 0.6 mm.
Permittivity	1×10 ⁻³ cm/sec.

4.5 Diversion



Description

A permanent channel constructed across the slope with a supporting ridge on the lower side used to divert excess water from one area for use or safe disposal in other areas.

Conditions Where Practice Applies

This practice applies to sites where:

- A permanent diversion is required to control erosion and runoff on down slope developing areas and construction sites
- Runoff from higher areas is causing off site damage
- Surface and shallow subsurface flow is damaging sloping upland.
- A diversion is required as part of a pollution abatement system to protect off site sensitive areas
- Permanent diversions are suitable on flatter gradients. Steeper gradients may require a rock lining or other means of protection
- For a temporary diversion that is needed to divert excess runoff for a short period of time, see the design considerations for Temporary Diversion, Chapter 5.

Planning Considerations

Water Quality

Besides the primary design objective of providing a stable channel, water quality benefits may also be achieved. Diversions may promote settling and infiltration for small storm events, thereby treating runoff. To provide water quality treatment benefits, see Chapter ___ - Water Quality Swale for planning and design details.

Location

Locations of diversions shall be determined by topography, outlet conditions, land use, soil type, and length of slope. When diversions are used to intercept subsurface flow or seepage, depth and location of seepage should be used to determine location and spacing of diversions.

A subsurface drain should be used as necessary to establish and maintain vegetative cover.

Design Criteria

Runoff

Runoff computation will be based upon the most severe soil and cover conditions that will exist in the area draining into the waterway during the planned life of the structure. Use the NRCS Technical Release 55 (TR 55) or other suitable method shall be used to determine peak rate of runoff.

Capacity

Diversions protecting undeveloped land shall have a capacity to carry the peak rate of runoff from a 10-yr. frequency storm. Where high-hazard conditions exist, higher frequency storms should be chosen to provide protection compatible with conditions. Diversions designed to protect urban areas, buildings and roads, shall have a capacity to carry the peak rate of runoff from a 25-yr. frequency storm with a freeboard of not less than 0.3 feet.

Cross Section

The diversion channel shall be parabolic or trapezoidal. The diversion shall be designed to have stable side slopes (3 horizontal to 1 vertical or flatter are recommended on both sides). The ridge height shall include a minimum of 0.3 ft of freeboard and a minimum settlement factor of 10% in addition to the design flow depth. The ridge shall have a minimum constructed top width of 4 feet at the design elevation. The minimum cross sectional area shall meet the specified dimensions. The top of the constructed ridge shall not be lower at any point than the design elevation plus the specified amount for settlement.

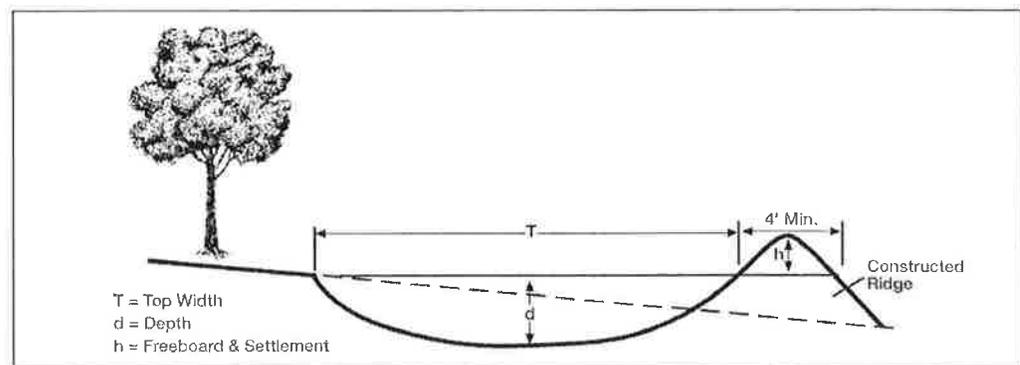


Figure 4.5.1

Grade and velocity

Channel grades shall be as uniform as possible. Special care should be taken in evaluating site conditions for diversions where the grade decreases toward the outlet because of potential sediment deposition problems.

Design Velocity of Vegetative Lining:

Diversions shall be designed so that the velocity of flow expected from a 10-year frequency storm does not exceed the permissible velocity for the type of lining used (see the table below). Manning's Equation or other suitable method should be used to determine design velocity.

Table 4.5.1 Grass Lining Maximum Flow Velocity for a 10-Yr. Frequency Storm

Soil		Maximum Velocity (fps)		
Texture	Type	Seed & Mulch	Seed & Matting	Sod
Sand, Silt, Sandy Loam, Silt Loam	Sand	1.5	3.0	3.5
Silty Clay Loam, Sandy Clay Loam	Firm Loam	2.0	4.0	4.0
Clay	Clay	2.5	4.0	5.0
N/A	Gravel	3.5	5.0	6.0
N/A	Weathering Shale	4.5	5.0	N/A

Note: Soil texture can be generally determined from the soil surveys. If the channel is on fill, the soil should be tested.

Establishing Vegetation

All diversions shall be vegetated or otherwise stabilized, as soon as possible after construction. Stabilization should be done according to the appropriate Standards and Specifications for Vegetative Practices (e.g. Permanent Seeding, Mulching, Matting).

- For design velocities of less than 3.5 fps, seeding and mulching may be used for the establishment of the desired vegetation. Mulch netting should be used to protect the seeding during establishment. It is recommended that when conditions permit, a temporary diversion or other means be used to prevent water from entering the diversion during the establishment of vegetation.
- For design velocities of more than 3.5 fps, the diversion shall be stabilized with seeding protected by erosion control matting or blankets, or with sod. It is recommended that when conditions permit, a temporary diversion or other means be used to prevent water from entering the diversion during the establishment of vegetation.

Sedimentation

Diversions should not be used below high sediment producing areas unless land treatment practices or structural measures that will prevent damage to the diversion are designed and installed prior to installation of the diversion. If some accumulation of sediment cannot be prevented, then the design shall include extra capacity for the sediment. Accumulation of sediment shall be considered in the maintenance plan for this practice.

Outlets

All diversions shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. The outlet may be a grassed waterway / conveyance channel / swale, stable vegetated area, grade stabilization structure, rock lined waterway / outlet, or stable stream. The outlet must convey runoff to a point where outflow will not cause damage. The design elevation of the water surface in the diversion shall not be less than the water surface in the

outlet at the junction when both are operating at design flow.

Maintenance

A maintenance program shall be established to maintain capacity, vegetative cover, and associated structural components such as inlets, outlets, and subsurface drains. Items to consider in the maintenance program include:

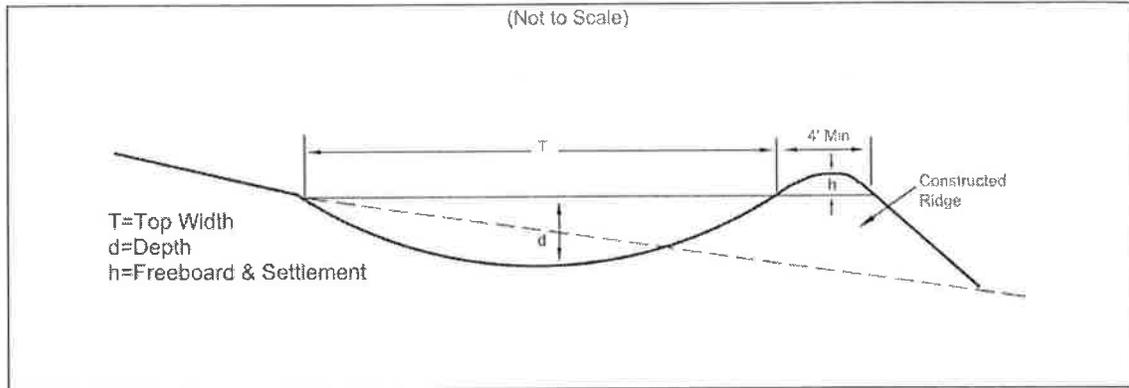
- Determine responsible party to inspect and maintain the diversion after construction
- Protect the diversion from damage by equipment, traffic, or livestock
- Fertilize annually to and maintain a vigorous stand of grass
- Mow the diversion regularly to maintain a healthy and vigorous stand of grass
- Inspect the diversion regularly, especially following heavy rains
- Repair damage to the diversion immediately. Damaged areas will be filled, compacted, and seeded immediately. All broken subsurface drains should be repaired
- Remove sediment deposits to maintain capacity of the diversion. Seed and mulch any bare areas that develop
- Easements should be obtained to ensure the diversion is maintained as constructed

References

Additional guidance for evaluation, planning, and design of diversions is given in:

- NRCS Ohio Practice Standard 362, Diversion.
- NRCS Engineering Field Handbook (EFH) Part 650, Chapter 9 - Diversion
- Agricultural Handbook 667, Stability Design of Grass-lined Open Channels.

Specifications
for
Diversion



1. All trees, brush, stumps, and other unsuitable material shall be removed from the work site.
2. The diversion shall be excavated and shaped to the proper grade and cross section.
3. Fill material used in the construction of the channel shall be well compacted in uniform layers not exceeding 9 inches using the wheel treads or tracks of the construction equipment to prevent unequal settlement.
4. Excess earth shall be graded or disposed of so that it will not restrict flow to the channel or interfere with its functioning.
5. Fertilizing, seeding, and mulching shall conform to the recommendations in the applicable vegetative specifications.
6. Construction shall be sequenced so that the newly constructed channel is stabilized prior to becoming operational. To aid in the establishment of vegetation, surface water may be prevented from entering the newly constructed channel through the establishment period.
7. Gullies that may form in the channel or other erosion damage that occurs before the grass lining becomes established shall be repaired without delay.

7.12 Temporary Rolled Erosion Control Products (Erosion Control Matting)



Description

A Temporary Rolled Erosion Control Product (TRECP) is a degradable manufactured material used to stabilize easily eroded areas while vegetation becomes established. Temporary Rolled Erosion Control Products are degradable products composed of biologically, photochemically or otherwise degradable materials. Temporary RECPs consist of erosion control netting, open weave textiles, and erosion control blankets and mattings. These products reduce soil erosion and assist vegetative growth by providing temporary cover from the erosive action of rainfall and runoff while providing soil-seed contact.

Condition where practice applies:

Temporary rolled erosion control products (matting or blankets) should be used on:

- Areas where erosion potential is high or a failure to establish vegetation is costly such as slopes greater than 3:1, constructed channels or stream banks
- Areas where establishing vegetation is difficult such as southern exposures or areas prone to drying
- Areas of concentrated flow, especially where flows exceeds 3.5 feet per second (e.g near culverts)
- Problem areas with highly erosive soils
- Areas where mulch is difficult to hold in place due to wind or water

Planning Considerations:

Temporary RECPs can be applied to critical or problem areas to enhance the erosion control as vegetation is being established. Although these materials add cost, they insure more immediate stability following construction reducing grading repairs and a faster greening of projects. Permanent non-degradable rolled erosion control products (turf reinforcement mats) are beyond the scope of this practice, but may be useful where design discharges or runoff exert velocities and shear stresses exceeding the ability of mature vegetation to withstand.

Temporary RECPs provide stable and rapid greening for areas conveying stormwater runoff. Care must be taken to choose the type of RECP, which is most appropriate for the specific needs of a project. Designers must take into account the vegetated and unvegetated velocities and sheer stresses in channel applications. With the abundance of soil stabilization products available, it is impossible to cover all the advantages, disadvantages and specifications of all manufactured RECPs. Therefore, as with many erosion control-type products, there is no substitute for a thorough understanding of the manufacturer’s instructions and recommendations and a site visit by a product’s designer or plan reviewer to verify appropriateness.

Temporary RECPs should be used to help establish vegetation on previously disturbed slopes - especially slopes of 3:1 or greater. The materials that compose the RECP will deteriorate over time. If used in permanent conveyance channels, designers should consider the system’s resistance to erosion as it relates to the type of vegetation planted and the existing soil characteristics. As much as possible during establishment of vegetation, soil stabilization blankets should not be subjected to concentrated flows moving at greater than 3.5 feet/second.

Design Criteria

Choose a product that will provide the appropriate time period of protection. Allowable velocity range during vegetation establishment should be 3.5 feet per second or less.

Erosion Control Blankets - shall consist of photodegradable plastic netting or biodegradable natural fiber netting that covers and is entwined in a natural organic or man-made mulching material. The mulching material shall consist of wood fibers, wood excelsior, straw, coconut fiber, or man-made fibers, or a combination of the same. The blanket shall be of consistent thickness with the mulching material/fibers evenly distributed over its entire length. Mulching material/fibers must interlock or entwine to form a dense layer, which not only resists raindrop impact, but also will allow vegetation to penetrate the blanket. The mulching material degradation rate must be consistent with the designers desired slope protection time. Temporary Rolled Erosion Control Products (or erosion control blankets) shall meet the specifications that follow.

Table 7.12.1

Material	Maximum Length Of Protection
Straw	10-12 Months
Straw/Coconut	24 Months
Coconut	36 Months
Excelsior	36 Months

Erosion Control Netting - shall consist of a woven natural fiber or extruded geosynthetic mesh used as a component in the manufacture of RECPs, or separately as a temporary RECP to anchor loose fiber mulches.

Open Weave Textile - shall consist of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.

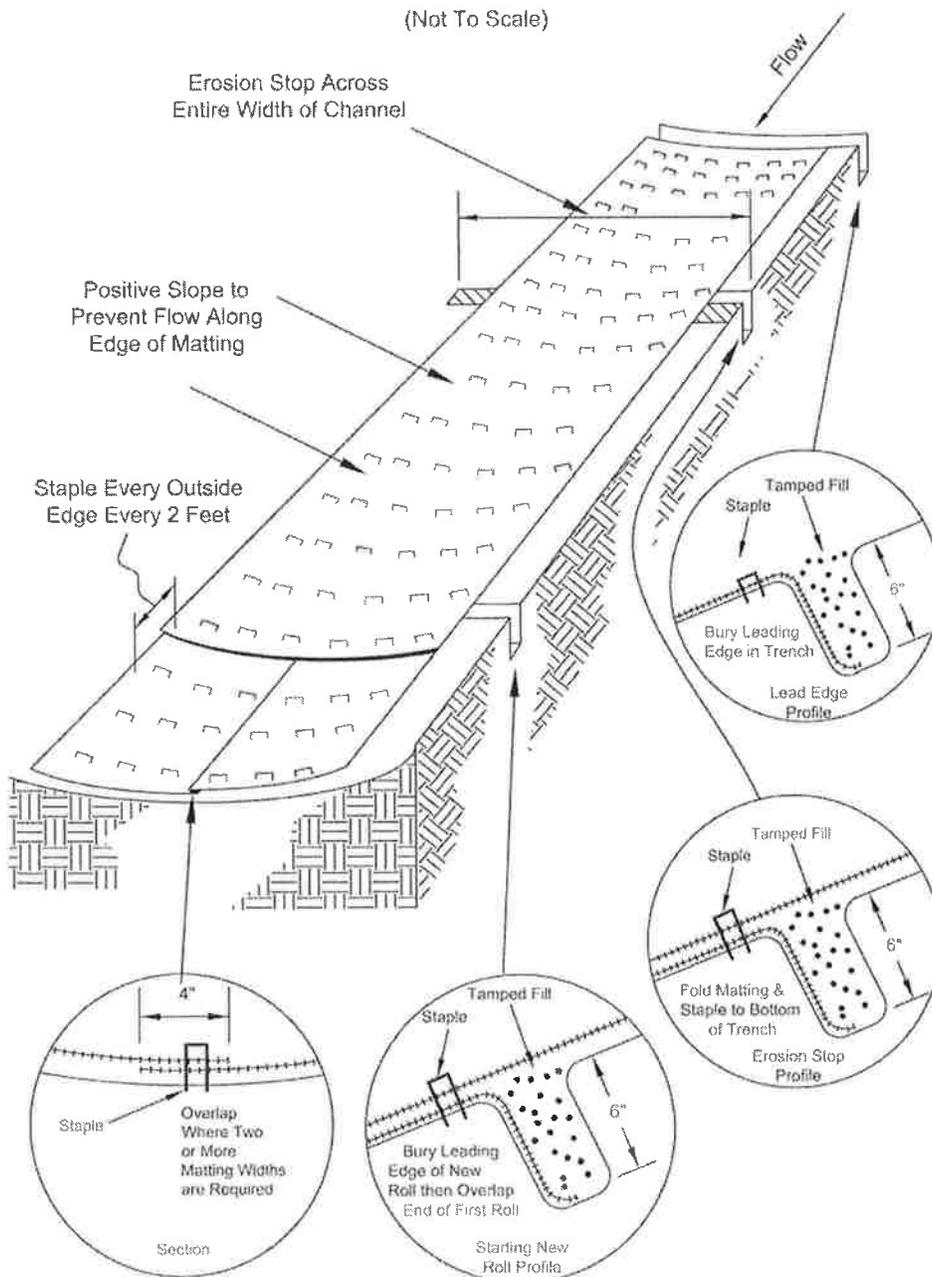
Maintenance:

All RECPs should be inspected regularly after installation, especially after storms to check for erosion or undermining of the product. Make needed repairs immediately, addressing rills or gullies that have developed prior to replacing the RECP. In the case erosion repairs, assure that subsequent runoff across the area is dispersed or adequately spread.

Common Problems/Concerns:

- Manufacturer's selection and installation recommendations not followed. Results in failure of the RECP.
- Poor contact between soil and the RECP. Results in erosion below the RECP and lower seed germination rates, causing failure.
- Proper stapling guidelines not followed. Results in movement or displacement of RECP.
- Erosion check slots are not used. Results in erosion under the RECP, causing failure.
- Unstable slopes that result in RECP or slope failure. Determine cause of slope failure, correct, and reinstall RECP
- In channels, the width of RECP used is not sufficient, this causes water to flow along the sides of RECP causing erosion. Install RECP up side slopes of ditch line as well as the bottom.

Specifications
for
Temporary Rolled Erosion Control Product



Specifications
for

Temporary Rolled Erosion Control Product

1. Channel/Slope Soil Preparation Grade and compact area of installation, preparing seedbed by loosening 2"-3" of topsoil above final grade. Incorporate amendments such as lime and fertilizer into soil. Remove all rocks, clods, vegetation or other debris so that installed RECP will have direct contact with the soil surface.
2. Channel/Slope Seeding Apply seed to soil surface prior to installation. All check slots, anchor trenches, and other disturbed areas must be reseeded. Refer to the Permanent Seeding specification for seeding recommendations.

Slope Installation

3. Excavate top and bottom trenches (12"x6"). Intermittent erosion check slots (6"x6") may be required based on slope length. Excavate top anchor trench 2' x 3' over crest of the slope.
4. If intermittent erosion check slots are required, install RECP in 6"x6" slot at a maximum of 30' centers or the mid point of the slope. RECP should be stapled into trench on 12" centers.
5. Install RECP in top anchor trench, anchor on 12" spacings, backfill and compact soil.
6. Unroll RECP down slope with adjacent rolls overlapped a minimum of 3". Anchor the seam every 18". Lay the RECP loose to maintain direct soil contact, do not pull taught.
7. Overlap roll ends a minimum of 12" with upslope RECP on top for a shingle effect. Begin all new rolls in an erosion check slot if required, double anchor across roll every 12".
8. Install RECP in bottom anchor trench (12"x6"), anchor every 12". Place all other staples throughout slope at 1 to 2.5 per square yard dependant on slope. Refer to manufacturer's anchor guide.

Channel Installation

9. Excavate initial anchor trench (12"x6") across the lower end of the project area.
10. Excavate intermittent check slots (6"x6") across the channel at 30' intervals along the channel.
11. Excavate longitudinal channel anchor slots (4"x4") along both sides of the channel to bury the edges. Whenever possible extend the RECP 2'-3' above the crest of channel side slopes.
12. Install RECP in initial anchor trench (downstream) anchor every 12", backfill and compact soil.
13. Roll out RECP beginning in the center of the channel toward the intermittent check slot. Do not pull taught. Unroll adjacent rolls upstream with a 3" minimum overlap (anchor every 18") and up each channel side slope.
14. At top of channel side slopes install RECP in the longitudinal anchor slots, anchor every 18".
15. Install RECP in intermittent check slots. Lay into trench and secure with anchors every 12", backfill with soil and compact.
16. Overlap roll ends a minimum of 12" with upstream RECP on top for a shingling effect. Begin all new rolls in an intermittent check slot, double anchored every 12".
17. Install upstream end in a terminal anchor trench (12"x6"); anchor every 12", backfill and compact.
18. Complete anchoring throughout channel at 2.5 per square yard using suitable ground anchoring devices (U shaped wire staples, metal geotextile pins, plastic stakes, and triangular wooden stakes). Anchors should be of sufficient length to resist pullout. Longer anchors may be required in loose sandy or gravelly soils.

6.2 Sediment Trap



Description

A sediment trap is a temporary settling pond formed by construction of an embankment and/or excavated basin and having a simple outlet structure that is typically stabilized with geotextile and rip-rap. Sediment traps are constructed to detain sediment-laden runoff from small, disturbed areas for a sufficient period of time to allow the majority of the sediment to settle out. They are established early in the construction process using natural drainage patterns and favorable topography where possible to minimize grading.

Conditions Where Practice Applies

Sediment traps are used:

1. At the outlets of diversions, channels, slope drains, or other runoff conveyances that discharge sediment-laden water.
2. Below disturbed areas where the total contributing drainage area is **5 acres or less**. If the contributing drainage area is greater than 5 acres, the use of a Sediment Basin is recommended.
3. Where access can be maintained for removal and proper disposal of sediment.
4. In drainage swales or areas, where sediment control is needed upstream of a drainage pattern leading to a storm drain inlet.
5. Where the required life of the structure will be 18 months or less.

6. Where failure of the structure will not result in loss of life; or cause damage to buildings, roads, utilities, or other properties.

Note: Sediment traps, that have the entire capacity achieved through excavation, may have larger drainage areas without compromising the stability of the sediment trap.

Planning Considerations

Timing – Sediment traps shall be constructed as a first step in any land-disturbing activity, and shall be made functional before upslope land disturbance takes place. Sediment traps are temporary measures with a typical design life of 6 months to 18 months. One or more traps are often built early in the construction process to capture sediment, prior to construction of a larger structure (e.g., sediment basin or modified detention basin) is constructed. Sediment traps are to be functional during the entire construction process, both before and after new drainage systems are constructed.

Location – Sediment traps usually are placed near the edges of construction sites so to be out of the way of major construction activities.

Diverting Runoff – Temporary diversions at the perimeter of sites are used to direct runoff to sediment traps (see Temporary Diversion Specifications).

Storm-Sewer Diversions – Storm drains may be temporarily redirected through sediment traps during construction. After construction, the temporary pipes are removed and runoff is allowed to flow through the permanent storm drain as originally intended.

Utilities – Give special consideration to sediment trap location and possible interference with construction of proposed drainage ways, utilities and storm drains.

Trapping Efficiency – Improved sediment trapping efficiencies can be achieved by including both a “wet” storage volume and a drawdown or “dry” storage volume that enhances settling and prevents excessive sediment losses during large storm events. In order to maintain effectiveness, sediment must be periodically removed from the trap to maintain the required design volume. Frequent inspection and appropriate maintenance should be provided until the construction site is permanently protected against erosion.

Design Criteria

Capacity - The minimum total design volume for the sediment trap shall consist of two components, the dewatering zone and the sediment storage zone. These zones are shown schematically in Figure 6.2.1. The volume of the dewatering zone shall be calculated for the entire drainage area by the method shown below. The drainage area includes the entire area contributing runoff to the sediment basin, offsite as well as on. The sediment storage volume may be in the form of a permanent pool or wet storage to provide a stable-settling medium, while the dewatered volume shall be in the form of a draw down or dry storage of at least 67 cubic yards per acre which will provide extended settling time during less frequent, larger storm events.

a) Dewatering Zone Volume –

The volume of the dewatering zone shall be a minimum of 1800 cubic feet per acre of drainage (67 yd³/acre) or the minimum stated in the current NPDES construction general permit. The total volume of the dewatering zone shall be measured from the base of the stone outlet structure to the crest of the stone outlet structure.

b) Sediment Storage Zone Volume –

The volume of the sediment storage zone shall be calculated by one of the following methods. The sediment storage zone shall be measured below the elevation of the base of the stone outlet structure.

Method 1: The volume of the sediment storage zone shall be 1000 cu. ft. per disturbed acre within the watershed of the basin; OR

Method 2: The volume of the sediment storage zone shall be the volume necessary to store the sediment yield as calculated with RUSLE or a similar generally accepted erosion prediction model. While the sediment storage volume may extend to the expected time period of the construction project, the minimum estimated time between cleanouts shall be six months.

Sediment shall be removed when it has accumulated to the top of the sediment storage or wet storage zone. This elevation shall be signified by the top of a stake near the center of the trap.

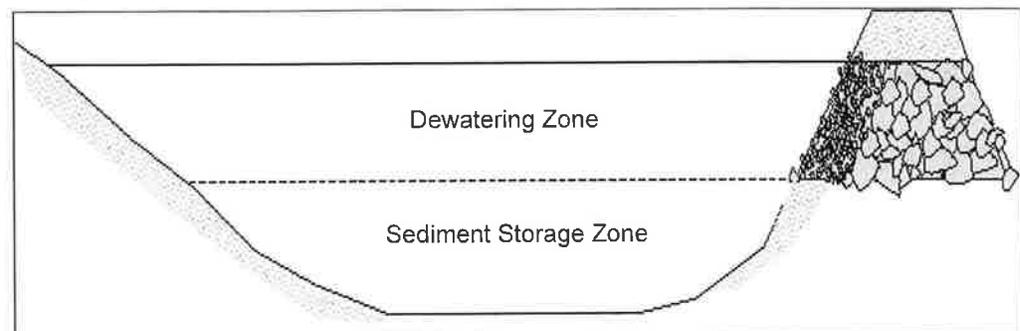


Figure 6.2.1 Capacity of a sediment trap is distributed between dewatering and sediment storage zones.

Embankment – Ensure that embankments for temporary sediment traps do not exceed 5 feet in height measured at the centerline from the original ground surface to the top of the embankment. Construct embankments with a minimum 4 foot top width and 2:1 (H:V) or flatter side slopes.

The design height of the embankment shall be increased by 5% to allow for settlement of the finished embankment. The original ground under the embankment shall be stripped of vegetation and scarified to a depth of 6 inches or more before placement of the fill material. Fill material should be made of clay, free of roots, large rocks, and organic material. Place fill in layers 6 inches thick and then compact using appropriate equipment. Fill material shall not be placed on frozen ground.

The completed embankment shall be seeded in accordance with temporary or permanent vegetation as found in this manual (Temporary Seeding or Permanent Seeding).

Excavation – Where sediment pools are formed or enlarged by excavation, keep side slopes at 2:1 (H: V) or flatter for safety. The maximum depth of excavation within the wet storage area (sediment storage zone) should be 4 feet to facilitate clean out and for site safety considerations.

Outlet Section – Construct the sediment trap outlet using a stone section of embankment located at the low point in the basin. The stone section serves two purposes: 1) the top section serves as a non-erosive spillway outlet for flood flow, and 2) the bottom section provides a means to de-watering the basin between runoff events. A combination of coarse aggregate and riprap shall be used to provide for filtering/detention as well as outlet stability.

Construct the outlet using well-graded stones with a d50 size larger than 6 inches (ODOT Type D). A 1 foot layer of AASHTO # 57 aggregate should be placed on the inside face to reduce drainage flow rate. Geotextile that meets the minimum requirements of ODOT Construction and Material Specification 712.09, Geotextile Fabric Type B, shall be placed at the stone-soil interface to act as a separation and to prevent piping. The geotextile shall be buried or keyed in at the upstream end a minimum of 6 inches. The crest of the stone outlet must be at least 1.5 feet below the top of the embankment to ensure that the flow will travel over the stone and not the embankment. The outlet shall be configured as noted in figure 2.

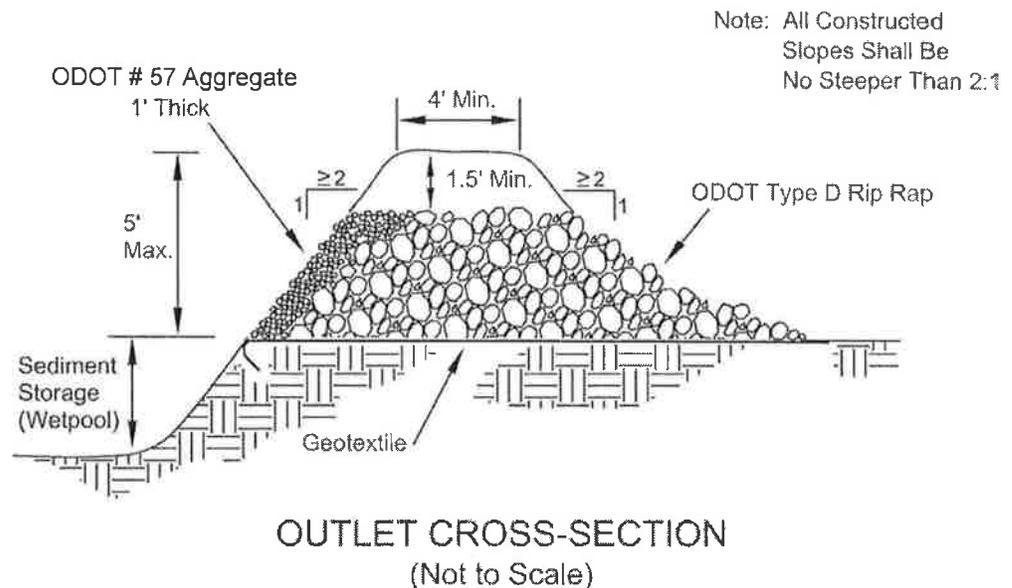


Figure 6.2.2 Outlet configuration

The spillway weir shall be at least 4 feet long and sized to pass the peak discharge of the 10-year, 24-hour storm without failure, overtopping of the basin or significant erosion. A maximum flow depth of 1 foot, a minimum freeboard of 0.5 foot, and maximum side slopes of 2:1 are required. See Table 6.2.1 for weir length associated with drainage area.

Table 6.2.1 Sediment Trap weir length.

Drainage Area (acres)	Weir Length (feet)
1	4.0
2	6.0
3	8.0
4	10.0
5	12.0

Note: alternatively use $Q_{weir} = CLH^{3/2}$
 Where C = Weir coefficient
 L = Weir Length (feet)
 H = Head of 1 foot

Direct spillway discharges to natural, stable areas. Locate outlets so that flow will not damage the embankment. Discharges must be conveyed to a natural waterway via a channel of adequate capacity and stability. Where the channel enters a natural waterway, the discharge shall be less than 1 ½ feet per second or otherwise less than the velocity that will initiate erosion or scour within the receiving waterway. When traps discharge to storm water facilities, the facility must have adequate capacity to receive the discharge from the sediment trap.

Where an emergency spillway is utilized, the primary rock spillway crest should be at least 1.5 feet below the settled top of the embankment with the emergency spillway crest being 0.5 foot below the top of the embankment.

The plans and specifications should show the following requirements:

1. Location of the sediment traps.
2. Size of sediment trap including width, length and depth.
3. Minimum cross section of embankment.
4. Typical cross section through the spillway with geotextile fabric details and rock placement.
5. Location of emergency spillway, if used.
6. Gradation and quality of rock.
7. Plans shall detail how excavated sediment is to be disposed of, such as placement on areas where it will be stabilized or removal to an approved off-site location.

All plans should include the installation and maintenance schedules with the responsible party identified.

Install warning signs, barricades, perimeter fence and other measures around sediment traps as necessary to protect workers, children, equipment, etc.

Operation and Maintenance

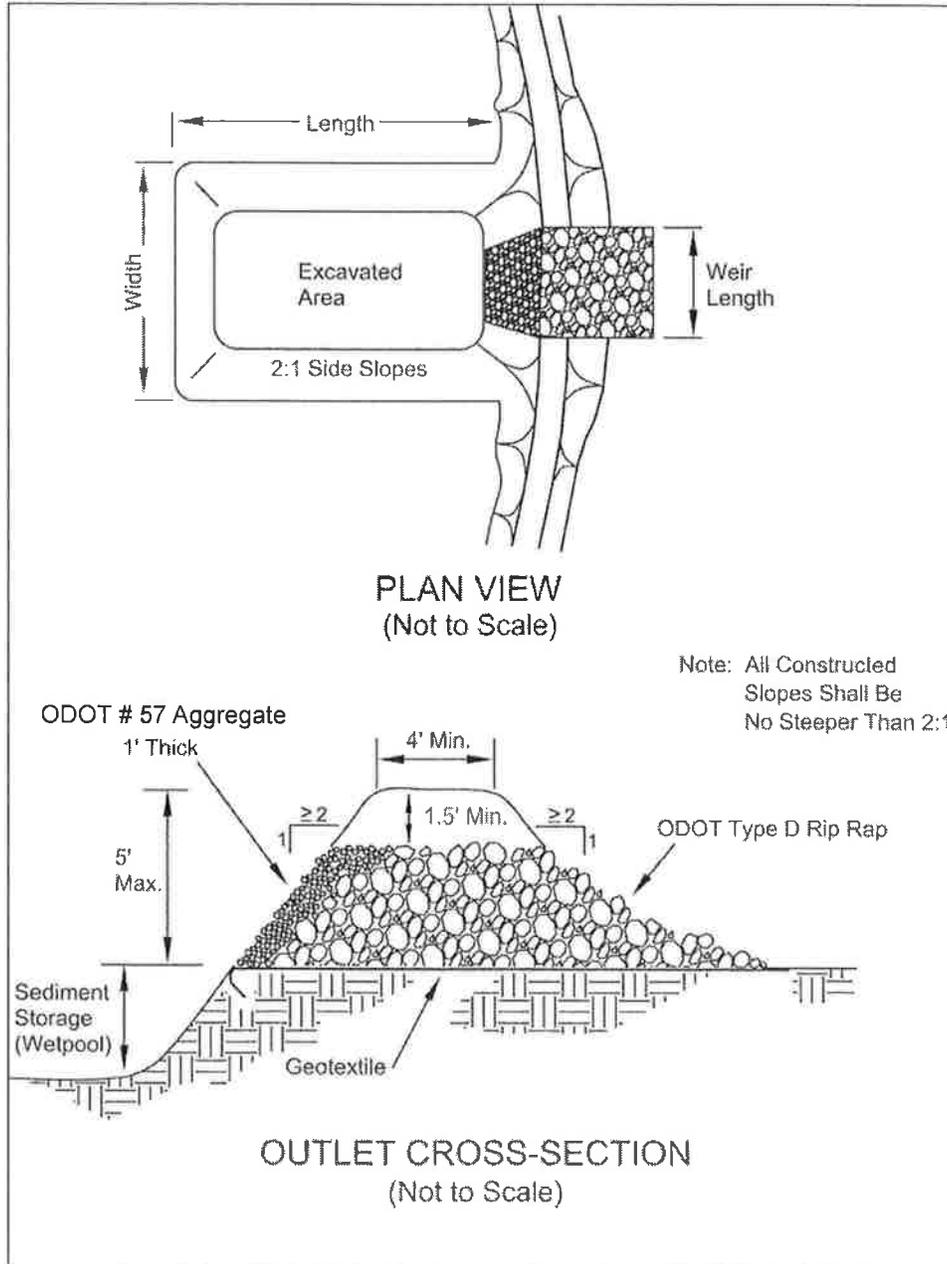
1. The capacity and function of the sediment trap shall be maintained by inspecting on a weekly basis and after each runoff event, and by performing the necessary activities shown below.
2. Establish vegetative cover and fertilize as necessary to maintain a vigorous cover around the sediment trap.
3. Inspect the pool area, embankment and spillway area for burrowing rodents, slope failure, seepage, excess settlement, and displaced stone. The area should be inspected for structural soundness and repaired as needed.
4. Regularly inspect water discharged from trap for excess suspended sediments. Identify and perform necessary repairs to improve water quality. Excessive suspended sediments may require design modifications or treatment with flocculants.
5. Remove woody vegetated growth on the embankment and spillway areas.
6. Remove trash and debris that accumulate in the pond and have potential to block spillways.
7. Dewatering outlets shall be regularly checked to ensure that performance is maintained. Filter stone choked with sediment shall be removed and replaced to restore its flow capacity.
8. Remove sediment and restore the sediment trap to its original dimensions when sediment has accumulated to the top of the sediment storage or wet storage zone. This elevation shall be signified by the top of a stake near the center of the trap. Removing sediment by hand may be necessary adjacent to the outlet section of the embankment to prevent equipment damage. Place the removed sediment and stabilize with vegetation in a designated area where it will not easily erode again. Restore trap to its original dimensions and replace stone as needed on the outlet.
9. After the entire construction project is completed, temporary sediment traps should be dewatered and regraded so as to conform to the contours of the area. All temporary structures should be removed and the area seeded, mulched and stabilized as necessary.

Common Problems/Concerns

Utilizing sediment traps on large drainage areas (greater than 5 acres) where Sediment Basins (see page 2 of this chapter) are appropriate will increase sediment discharged during construction.

Failure to removed trapped sediment will reduce the effectiveness of this practice in capturing sediment.

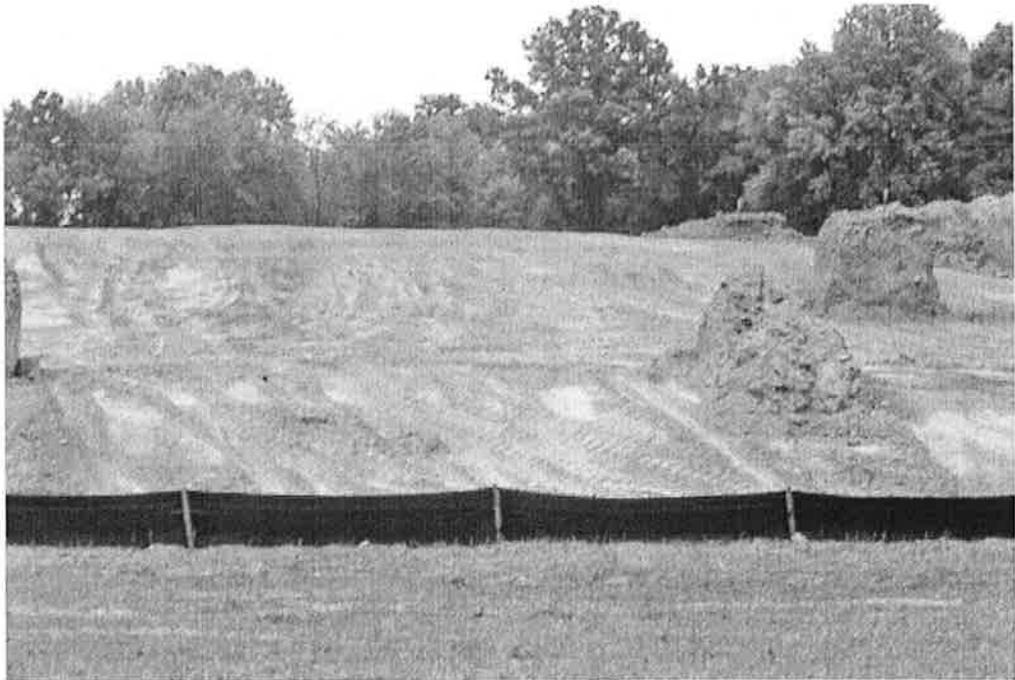
Specifications
for
Sediment Trap



Specifications
for
Sediment Traps

1. Work shall consist of the installation, maintenance and removal of all sediment traps at the locations designated on the drawings.
2. Sediment traps shall be constructed to the dimensions specified on the drawings and operational prior to upslope land disturbance.
3. The area beneath the embankment shall be cleared, grubbed and stripped of vegetation to a minimum depth of six (6) inches. The pool shall be cleared as needed to facilitate sediment cleanout.
4. Fill used for the embankment shall be evaluated to assure its suitability and it must be free of roots or other woody vegetation, large rocks, organics or other objectionable materials. Fill material shall be placed in six (6) inch lifts and shall be compacted by traversing with a sheepfoot or other approved compaction equipment. Fill height shall be increased five (5) percent to allow for structure/foundation settlement. Construction shall not be permitted if either the earthfill or compaction surface is frozen.
5. The maximum height of embankment shall be five (5) feet. All cut and fill slopes shall be 2:1 (H:V) or flatter.
6. A minimum storage volume below the crest of the outlet of 67 yd³. for every acre of contributing drainage area shall be achieved at each location noted on the drawings with additional sediment storage volume provided below this elevation.
7. Temporary seeding shall be established and maintained over the useful life of the practice.
8. The outlet for the sediment trap structure shall be constructed to the dimensions shown on the drawings.
9. The outlet shall be constructed using the materials specified on the drawings. Where geotextile is used, all overlaps shall be a minimum of two (2) feet or as specified by the manufacturer, whichever is greater. All overlaps shall be made with the upper most layer placed last. Geotextile shall be keyed in at least 6" on the upstream side of the outlet.
10. Warning signs and safety fence shall be placed around the traps and maintained over the life of the practice.
11. After all sediment-producing areas have been permanently stabilized, the structure and all associated sediment shall be removed. Stable earth materials shall be placed in the sediment trap area and compacted. The area shall be graded to blend in with adjoining land surfaces and have positive drainage. The area shall be immediately seeded.

6.3 Silt Fence



Description

Silt fence is a sediment-trapping practice utilizing a geotextile fence, topography and sometimes vegetation to cause sediment deposition. Silt fence reduces runoff's ability to transport sediment by ponding runoff and dissipating small rills of concentrated flow into uniform sheet flow. Silt fence is used to prevent sediment-laden sheet runoff from entering into downstream creeks and sewer systems.

Conditions Where Practice applies

Silt fence is used where runoff occurs as sheet flow or where flow through small rills can be converted to sheet flow. Major factors in its use are slope, slope length, and the amount of drainage area from which the fence will capture runoff. Silt fence cannot effectively treat flows in gullies, ditches or channels. For concentrated flow conditions see specifications for temporary diversions, sediment traps and sediment basins.

Planning Considerations

Alternatives: Silt Fence vs. Temporary Diversions and Settling Ponds. While silt fence requires less space and disturbs less area than other control measures there are significant disadvantages to its use. Silt fence is not as effective controlling sediment as routing runoff through a system of diversions and settling ponds. Settling ponds and earth diversions are more durable, easier to construct correctly and significantly more effective at removing sediments from runoff. Additionally earth diversions and settling ponds are less apt to fail during construction and typically require less repair and maintenance.

Proper installation is critical. Experience from ODNR and other field testing has shown that nearly 75 percent of silt fence does not function properly due to poor installation. Proper installation consists of it being installed: (1) on the contour; (2) with sufficient geotextile material buried; (3) with the fence pulled taut and supported on the downstream side by strong posts; (4) and with the fence backfilled and compacted.

Two general methods are used to install silt fence: (1) utilizing traditional method of digging the trench, installation of the fence materials, then backfilling and compaction; or (2) a method using an implement to static slice or narrow plow while installing the geotextile in the slot opening, followed by compaction and installation of posts. The latter methods generally installs silt fence more effectively and efficiently.

Silt fence is most applicable for relatively small areas with flat topography. Silt fence should be used below areas where erosion will occur in the form of sheet and rill erosion. For moderately steep areas, the area draining to the silt fence should be no larger than one quarter acre per 100 feet of fence length, the slope length no longer than 100 feet, and the maximum drainage gradient no steeper than 50 percent (2:1). This practice should be sited so that the entire fence ponds runoff and facilitates settling of suspended solids.

Design Criteria

Proper installation of silt fence requires utilizing the site topography. This is critical because the sediment removal process relies on ponding runoff behind the fence. As a ponding occurs behind the fence, coarser materials are allowed to settle out. Leaving a long, flat slope behind the silt fence maximizes areas for ponding (sediment deposition), and for water to disperse and flow over a much larger surface area of the silt fence. For silt fence to work effectively, runoff must be allowed to maintain sheet flow, to pond and to be released slowly. However, if silt fence is used without regard to a site's topography, it will typically concentrate runoff, increasing the likelihood of blocking and overtopping of the fence, thus reducing or eliminating its effectiveness.

Level Contour – For silt fence to promote deposition, it must be placed on the level contour of the land, so that flows are dissipated into uniform sheet flow that has less energy for transporting sediment. Silt fence should never concentrate runoff, which will result if it is placed up and down slopes rather than on the level contour.

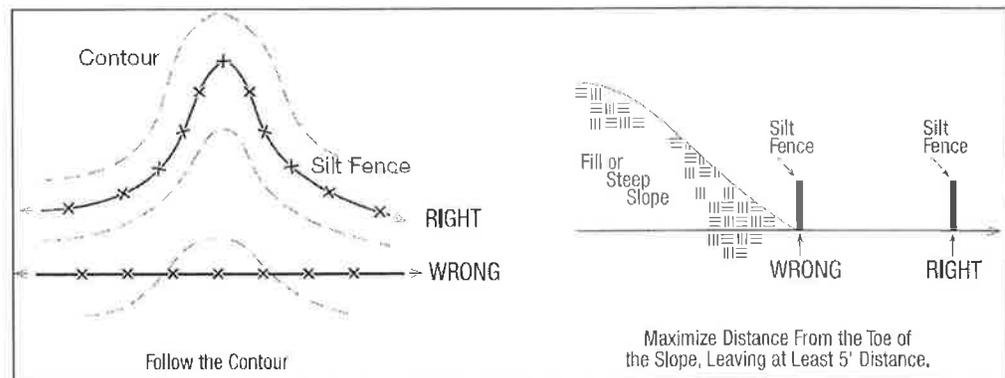


Figure 6.3.1 Silt fence layout

Flat Slopes – Slope has the greatest influence on runoff’s ability to transport sediment, therefore silt fence should be placed several feet away from the toe of a slope if at all possible, to encourage deposition. Silt fence generally should be placed on the flattest area available to increase the shallow ponding of runoff and maximize space available for deposited sediment.

Flow Around Ends – To prevent water ponded by the silt fence from flowing around the ends, each end must be constructed upslope so that the ends are at a higher elevation.

Vegetation – Dense vegetation also has the effect of dissipating flow energies and causing sediment deposition. Sediment-trapping efficiency will be enhanced where a dense stand of vegetation occurs for several feet both behind and in front of a silt fence.

Table 6.3.1 Maximum area contributing area using slope length

Maximum Slope Length Above Silt Fence		
Slope		Slope Length (ft.)
0% - 2%	Flatter than 50:1	250
2% - 10%	50:1 - 10:1	125
10% - 20%	10:1 - 5:1	100
20% - 33%	5:1 - 3:1	75
33% - 50%	3:1 - 2:1	50
> 50%	> 2:1	25

Note: For larger drainage areas, see standards for temporary diversions, sediment traps and sediment basins.

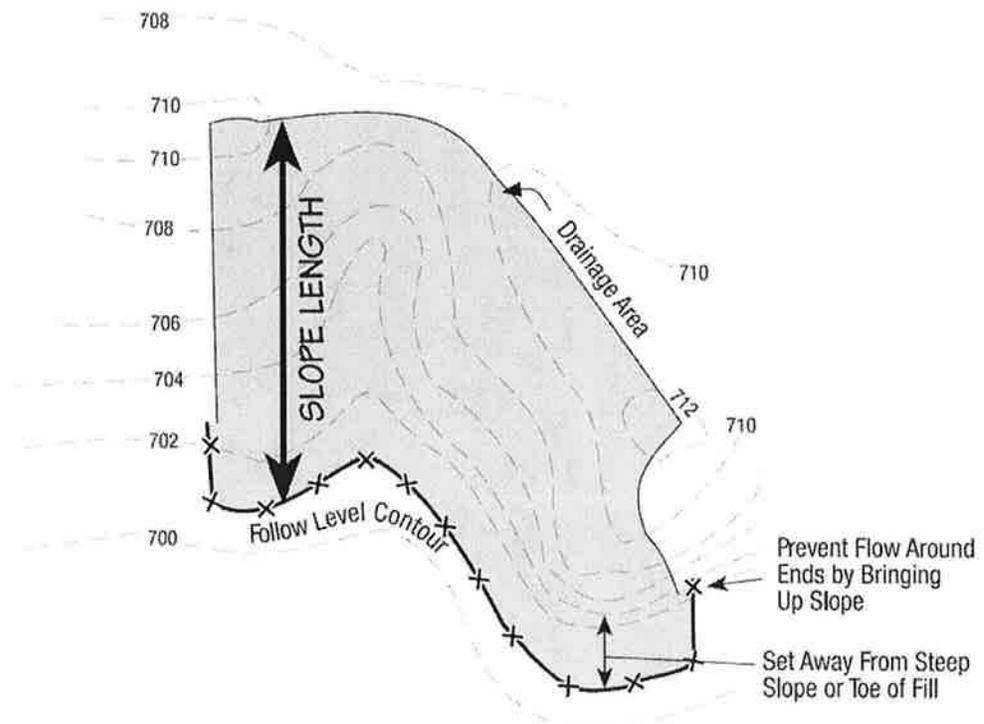


Figure 6.3.2 Silt fence and allowable drainage area

Dispersing Flow – Proper applications of silt fence allow all the intercepted runoff to pass as diffused flow through the geotextile. Runoff should never overtop silt fence, flow around the ends, or in any other way flow as concentrated flow from the practice. If any of these failures occurs, an alternative silt fence layout, or other practices are needed.

In cases where additional support of the fabric is needed, either wire or geogrid fencing may be used as a backing on the fabric. In these instances, the reinforcing material should be attached/erected first, then the fabric installed.

Materials

Fence posts shall be a minimum length of 32 inches long, composed of nominal dimensioned 2-by-2-inch hardwood of sound quality. They shall be free of knots, splits and other visible imperfections which would weaken the posts. Steel posts may be utilized in place of wood provide the geotextile can be adequately secured to the post.

Silt fence geotextile must meet the minimum criteria shown in the table below.

Table 6.3.2

Minimum criteria for Silt Fence Fabric (ODOT, 2002)		
Minimum Tensile Strength	120 lbs. (535 N)	ASTM D 4632
Maximum Elongation at 60 lbs	50%	ASTM D 4632
Minimum Puncture Strength	50 lbs (220 N)	ASTM D 4833
Minimum Tear Strength	40 lbs (180 N)	ASTM D 4533
Apparent Opening Size	≤ 0.84 mm	ASTM D 4751
Minimum Permittivity	$1 \times 10^{-2} \text{ sec.}^{-1}$	ASTM D 4491
UV Exposure Strength Retention	70%	ASTM G 4355

Maintenance

Silt Fence requires regular inspection and maintenance to insure its effectiveness. Silt fences must be inspected after each rainfall and at least daily during prolonged rainfall. Silt fence found damaged or improperly installed shall be replaced or repaired immediately.

Sediment deposits shall be routinely removed when they reach approximately one-half the height of the silt fence.

Common Problems/Concerns

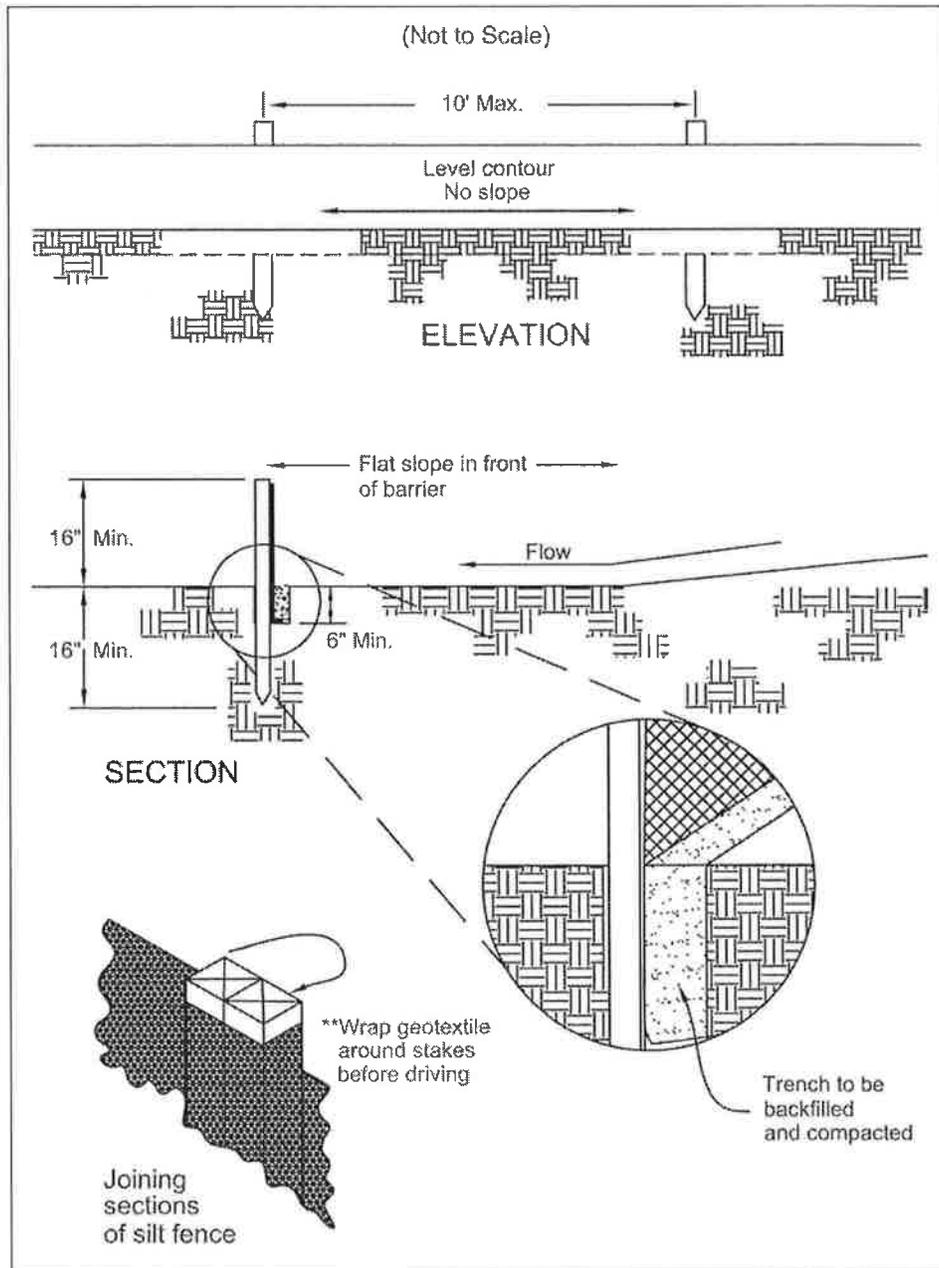
The predominant problems with silt fence regard inadequate installation or location that allows runoff to concentrate, overtop the fence, flow under the fabric or around the fence ends. If this occurs one of the following shall be performed, as appropriate:

- The location and layout of the silt fence shall be changed to conform to the level contour
- The silt fence shall be reinstalled with proper burial, backfill and compaction and support
- Accumulated sediment shall be removed
- Alternative practices shall be installed.

References

Construction and Material Specifications, January 1, 2002. State of Ohio Department of Transportation, P.O. Box 899, Columbus, Ohio 43216-0899, <http://www.dot.state.oh.us/construction/OCA/Specs/2002CMS/Specbook2002/Specbook2002.htm>

Specifications
for
Silt Fence



Specifications
for
Silt Fence

1. Silt fence shall be constructed before upslope land disturbance begins.
2. All silt fence shall be placed as close to the contour as possible so that water will not concentrate at low points in the fence and so that small swales or depressions that may carry small concentrated flows to the silt fence are dissipated along its length.
3. Ends of the silt fences shall be brought upslope slightly so that water ponded by the silt fence will be prevented from flowing around the ends.
4. Silt fence shall be placed on the flattest area available.
5. Where possible, vegetation shall be preserved for 5 feet (or as much as possible) upslope from the silt fence. If vegetation is removed, it shall be reestablished within 7 days from the installation of the silt fence.
6. The height of the silt fence shall be a minimum of 16 inches above the original ground surface.
7. The silt fence shall be placed in an excavated or sliced trench cut a minimum of 6 inches deep. The trench shall be made with a trencher, cable laying machine, slicing machine, or other suitable device that will ensure an adequately uniform trench depth.
8. The silt fence shall be placed with the stakes on the downslope side of the geotextile. A minimum of 8 inches of geotextile must be below the ground surface. Excess material shall lay on the bottom of the 6-inch deep trench. The trench shall be backfilled and compacted on both sides of the fabric.
9. Seams between sections of silt fence shall be spliced together only at a support post with a minimum 6-in. overlap prior to driving into the ground, (see details).
10. Maintenance—Silt fence shall allow runoff to pass only as diffuse flow through the geotextile. If runoff overtops the silt fence, flows under the fabric or around the fence ends, or in any other way allows a concentrated flow discharge, one of the following shall be performed, as appropriate: 1) the layout of the silt fence shall be changed, 2) accumulated sediment shall be removed, or 3) other practices shall be installed.

Sediment deposits shall be routinely removed when the deposit reaches approximately one-half of the height of the silt fence.

Silt fences shall be inspected after each rainfall and at least daily during a prolonged rainfall. The location of existing silt fence shall be reviewed daily to ensure its proper location and effectiveness. If damaged, the silt fence shall be repaired immediately.

Criteria for silt fence materials

1. Fence post – The length shall be a minimum of 32 inches. Wood posts will be 2-by-2-in. nominal dimensioned hardwood of sound quality. They shall be free of knots, splits and other visible imperfections, that will weaken the posts. The maximum spacing between posts shall be 10 ft. Posts shall be driven a minimum 16 inches into the ground, where possible. If not possible, the posts shall be adequately secured to prevent overturning of the fence due to sediment/water loading.
2. Silt fence fabric – See chart below.

Table 6.3.2 Minimum criteria for Silt Fence Fabric (ODOT, 2002)

FABRIC PROPERTIES	VALUES	TEST METHOD
Minimum Tensile Strength	120 lbs. (535 N)	ASTM D 4632
Maximum Elongation at 60 lbs	50%	ASTM D 4632
Minimum Puncture Strength	50 lbs (220 N)	ASTM D 4833
Minimum Tear Strength	40 lbs (180 N)	ASTM D 4533
Apparent Opening Size	≤ 0.84 mm	ASTM D 4751
Minimum Permittivity	1X10 ⁻² sec. ⁻¹	ASTM D 4491
UV Exposure Strength Retention	70%	ASTM G 4355

5.1 Rock Check Dams



Description

Check dams are small rock dams constructed in swales, grassed waterways or diversions. They reduce the velocity of concentrated flows, thereby reducing erosion within the swale or waterway. While this practice often traps some sediment, its trapping efficiency is extremely poor, thus, it should not be used as a primary sediment-trapping practice.

Condition Where Practice Applies

This practice is limited to use in small open channels where it is necessary to slow the velocity of flows in order to prevent erosion. Applications include temporary swales, which, because of their short length of service, are not practical to receive a nonerodible lining or swales, which need protection during the establishment of grass linings. See specifications for Rock Check and Gravel Riffle for larger channels and streams.

This practice is limited to small, open channels with a drainage area less than 10 acres with the object to protect live streams. Examples would be:

1. Ditches or swales that cannot receive a non-erodible lining and still need protection to reduce erosion.
2. The interim period while grassed lining is being established.
3. As an aid (not a substitute) to trap sediment from construction activity.

Planning Considerations

Rock check dams are preferred over straw bale dams for their effectiveness at filtration and minimal maintenance requirements.

Rock check dams shall be placed where standing water or excessive siltation are minimized or where vegetative lining death is insignificant.

Rock check dams should be considered where the ditch or swale will not be mowed after construction is complete.

Design Criteria

See the specification below for design guidelines. For increased sediment control smaller aggregate and or filter fabric on the upstream side may be used. Although it should be noted that increased ponding and the subsequent increase in height of water behind the check dam raises the erosion potential downstream.

Maintenance

Sediment shall be removed from behind check dam once it accumulates to one-half the original height of the check dam.

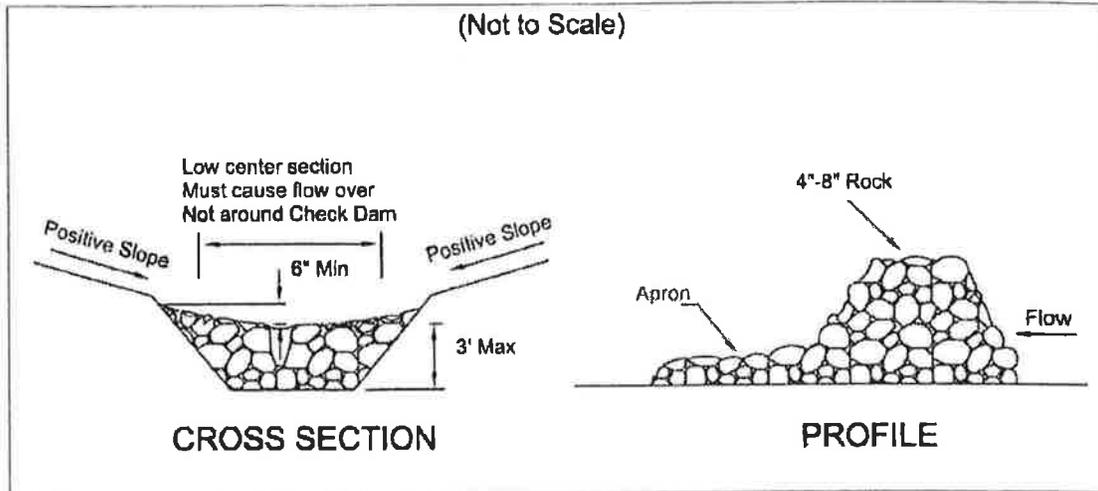
Removal

Removal of the check dam can be performed by hand or mechanical means. Stone and sediment should be removed and the area graded and seeded.

Common Problems/Concerns

If the swale/ ditch is to be mowed, the rocks that remain after the rock check dam is removed may pose a safety or maintenance problem.

Specifications
for
Rock Check Dam



1. The check dam shall be constructed of 4-8 inch diameter stone, placed so that it completely covers the width of the channel. ODOT Type D stone is acceptable, but should be underlain with a gravel filter consisting of ODOT No. 3 or 4 or suitable filter fabric.
2. Maximum height of check dam shall not exceed 3.0 feet.
3. The midpoint of the rock check dam shall be a minimum of 6 inches lower than the sides in order to direct across the center and away from the channel sides.
4. The base of the check dam shall be entrenched approximately 6 inches.
5. Spacing of check dams shall be in a manner such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
6. A Splash Apron shall be constructed where check dams are expected to be in use for an extended period of time, a stone apron shall be constructed immediately downstream of the check dam to prevent flows from undercutting the structure. The apron should be 6 in. thick and its length two times the height of the dam.
7. Stone placement shall be performed either by hand or mechanically as long as the center of check dam is lower than the sides and extends across entire channel.
8. Side slopes shall be a minimum of 2:1.

4.3 Rock Lined Channel



Description

A channel that is shaped or graded and protected with an erosion resistant rock riprap underlain with filter or bedding material used to convey stormwater runoff without allowing channel erosion. Rock channel protection provides for the safe conveyance of runoff from areas of concentrated flow without damage from erosion or flooding, where vegetated waterway / conveyance channel / swales would be inadequate. Rock lined channel may also be necessary to control seepage, piping, and sloughing or slides. The riprap section extends up the side slopes to designed depth. The earth above the rock should be vegetated or otherwise protected.

Conditions Where Practice Applies

This practice applies where the following conditions exist:

- Concentrated runoff will cause erosion unless a liner is provided
- Steep grades, wetness, seepage, prolonged base flow, or piping would cause erosion
- Damage by vehicles or animals will make the establishment or maintenance of vegetation difficult
- Soils are highly erosive or other soil or climatic conditions preclude the use of vegetation
- Velocities are expected that will erode the channel or outlet without protection

Caution should be used when design flow greater than 100 cubic feet per second (cfs) from a 10-yr.-frequency storm is expected. Chapter __ - Stream Channel Restoration, should be referenced for planning and design of larger channels.

Planning Considerations

Permits

A construction permit may be required by the local government. Additionally, the U.S. Army Corps of Engineers and the Ohio Environmental Protection Agency, through Sections 404 and 401, respectively, of the Clean Water Act, may require a permit for rock lined channel / outlet that are located adjacent to a stream. It is best to contact your local Soil and Water Conservation District (SWCD) office to determine what both agencies' permit requirements are for your project.

Water Quality

Rock lined channels and outlet protection provide water quality benefits by providing channel stability, prevention of excessive erosion, and limiting subsequent downstream sedimentation.

Design Criteria

Runoff

Runoff computation will be based upon the most severe soil and cover conditions that will exist in the area draining into the channel during the planned life of the structure. Use the NRCS Technical Release 55 (TR 55) or other suitable method shall be used to determine peak rate of runoff.

Capacity

The design capacity of the rock lined channel shall be adequate to carry the peak rate of runoff from a 10-yr. frequency storm. Where high-hazard conditions exist, higher frequency storms should be chosen to provide protection compatible with conditions. The rock-lined channel must have design capacity as required if it to be used as an outlet for a grassed waterway, diversion, terrace, or other measure. Capacity shall be computed using Manning's Equation with a coefficient of roughness "n" listed in the "rock size" table below.

Rock-lined channels / outlets shall be designed by accepted engineering methods such as the Federal Highway Administration Circular No. 15 or Figure 2-1 (Maximum depth of Flow for Riprap Lined Channels) that can be used to determine rock size using flow depth and velocity obtained from Manning's equation. Procedures are also available in the NRCS Engineering Field Handbook.

Velocity

Table 4.3.1 Maximum Design Velocity

Design Flow Depth	Maximum Velocity
0 - 0.5 ft	25 fps
0.5 - 1.0 ft	15 fps
> 1.0 ft	10 fps

Cross Section Shape

The cross sectional shape of rock lined waterway / outlets shall be parabolic, trapezoidal, or triangular.

- *Parabolic channels* most closely approximate natural flow characteristics at low as well as high flows. Although generally preferred for esthetic reasons, design and construction procedures are more complex.
- *Trapezoidal channels* often are used where the quantity of water to be carried is large and velocities high. The steepest permissible side slopes, horizontal to vertical, shall be 2 to 1.
- *Triangular shaped channels* generally is used where the quantity of water to be handled is relatively small, such as roadside ditches. The steepest permissible side slopes, horizontal to vertical, shall be 2 to 1.

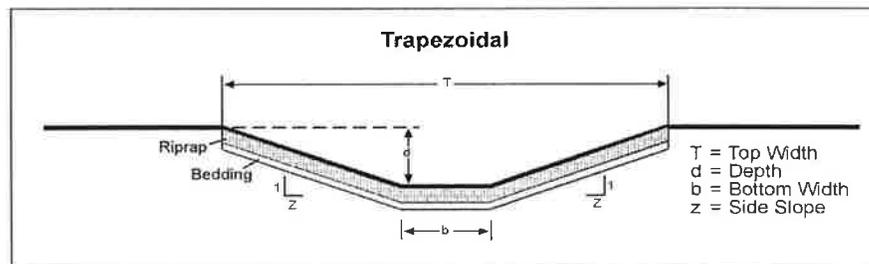


Figure 4.3.1

Rock Lining

The rock-lined channel shall consist of the rock riprap layer and an underlying filter or bedding. Minimum thickness of the rock riprap layer shall be the maximum stone size. Stone used for riprap shall be dense and hard enough to withstand exposure to air, water, freezing and thawing. Figure 4.3.2 gives the maximum depth of flow for riprap lined channels. Rock riprap must have a well-graded distribution and be placed in a to obtain a solid, compact layer of riprap. This may require some hand placing and tamping with construction equipment. Spreading gravel or soil over top of the placed riprap surface will fill the voids by interlocking the riprap together.

Filter or Granular Bedding

Filter or granular bedding must be placed beneath all riprap to prevent the underlying soil from eroding and undermining the riprap, and to collect seepage and base flow. Minimum bedding thickness shall be 4 inches. Use of large size riprap may necessitate the use of a thicker bedding layer or 2 differently sized bedding layers. Care should be taken to select a granular bedding that that is suitable with the subgrade material.

Table 4.3.2 Rock Riprap Size

Type of Rock or Riprap (ODOT)	"n" value	Size of Rock	
		50% by weight	85% by weight
Type D	.036	> 6 in.	3 - 12 in.
Type C	.04	> 12 in.	6 - 18 in.
Type B	.043	> 18 in.	12 - 24 in.
Type A	.045	> 24 in.	18 - 30 in.

Adjustments to Naturalize Rock Lining

In order to more closely reflect the nature of the bed of a natural channel, smaller size graded stone may be used to fill the voids left in typical riprap applications.

Besides channel shape and pattern, typical rock lined channels depart from the flow behavior of natural channels by having too much pore space in the rock. Therefore regular flow is often entirely below the surface. This will be improved by extending the gradation of stone down to the gravel-sized material. This addition will increase velocity and reduce capacity slightly; therefore corresponding adjustments should be made.

Geotextile

Geotextile may be used as a filter to be placed beneath the riprap to prevent piping of the soil where wetness, seepage, or prolonged base flow is the reason for lining the channel with riprap. If design of the rock lined channel results in high velocities and steep grades, granular bedding should be used instead of geotextile. Care should be taken to properly anchor the geotextile to prevent unraveling under flowing water. Geotextile shall be woven or nonwoven monofilament yarn and shall meet Class I criteria in the attached table "Requirements for Geotextile".

Maintenance

A maintenance program shall be established to maintain capacity, vegetative cover above the riprap, and associated structural components such as inlets, outlets, and tile lines. Items to consider in the maintenance program include:

- Determine responsible party to inspect and maintain the channel after construction
- Protect the channel from damage by equipment, traffic, or livestock
- Fertilize the vegetated area annually to and maintain a vigorous stand of grass
- Mow the vegetated area to maintain a healthy and vigorous stand of grass.
- Repair damage to channels immediately. Missing riprap should be replaced as soon as possible. All broken subsurface drains should be repaired. Seed and mulch any bare areas that develop.
- Remove sediment and debris that have accumulated.
- Easements, or other means, should be obtained to ensure the channel is maintained as constructed

References

Additional guidance for evaluation, planning, and design of rock lined channels is given in:

- National Cooperative Highway Research Program Report 108 – Tentative Design Procedure for Riprap – Lined Channels
- NRCS Ohio Practice Standard 468, Lined Waterway Or Outlet
- NRCS Engineering Field Handbook, Chapter 6 - Structures
- NRCS Design Note 24, Guide for Use of Geotextiles

Table 4.3.3 Requirements for Geotextiles

Property	Test method	Woven - Class I	Nonwoven - Class I
Tensile strength (pounds) 1/	ASTM D 4632 grab test	200 minimum in any principal direction	180 minimum
Elongation at failure (percent) 1/	ASTM D 4632 grab test	<50	≥ 50
Puncture (pounds) 1/	ASTM D 4833	90 minimum	80 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum
Apparent opening size (AOS)	ASTM D 4751	As specified, but no smaller than 0.212 mm (#70) 2/	As specified max. #40 2/
Percent open area (percent)	CWO-02215-86	4.0 minimum	-----
Permittivity sec-1	ASTM D 4491	0.10 minimum	0.70 minimum

1/ Minimum average roll value (weakest principal direction).

2/ U.S. standard sieve size.

Note: CWO is a USACE reference.

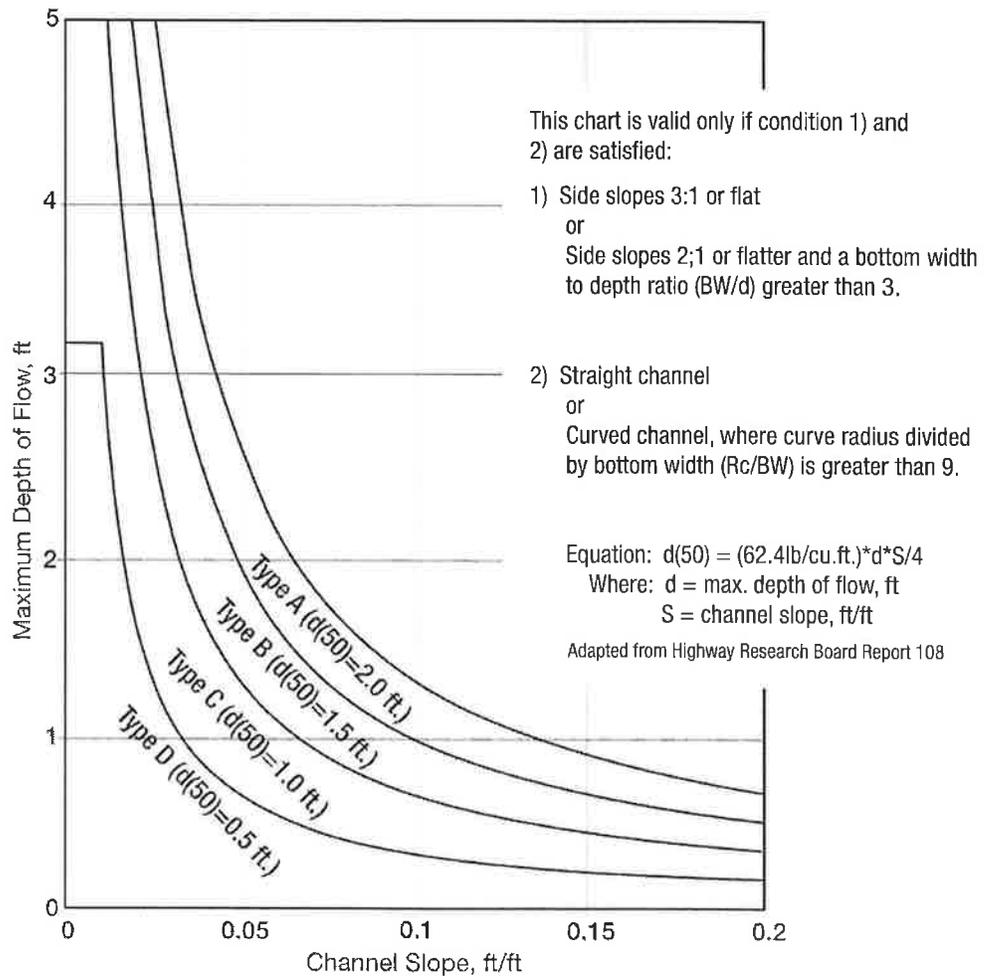
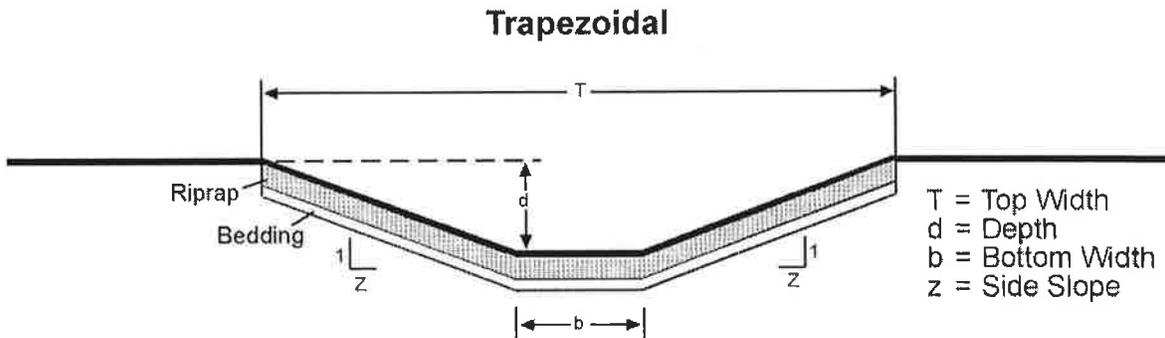


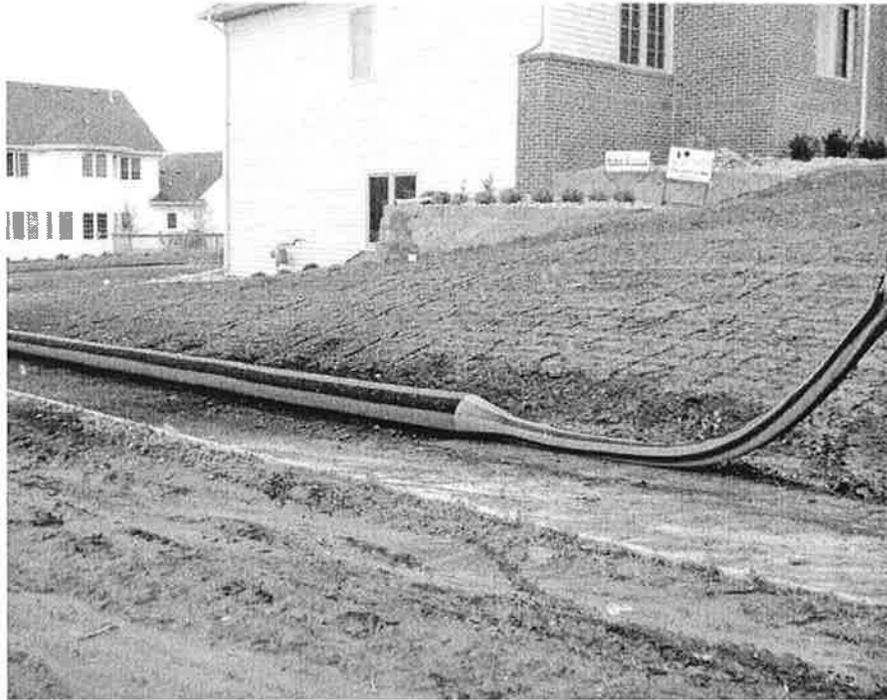
Figure 4.3.2 Maximum Depth of Flow for Riprap Lined Channels

Specifications
for
Rock Lined Channel



1. Subgrade for the filter and riprap shall be prepared to the required lines and grades as shown on the plan. The subgrade shall be cleared of all trees, stumps, roots, sod, loose rock, or other material.
2. Riprap shall conform to the grading limits as shown on the plan.
3. No abrupt deviations from the design grade or horizontal alignment shall be permitted.
4. Geotextile shall be securely anchored according to manufacturers recommendations.
5. Geotextile shall be laid with the long dimension parallel to the direction of flow and shall be laid loosely but without wrinkles and creases. Where joints are necessary, strips shall be placed to provide a 12-in. minimum overlap, with the upstream strip overlapping the downstream strip.
6. Gravel bedding shall be ODOT No. 67's or 57's unless shown differently on the drawings.
7. Riprap may be placed by equipment but shall be placed in a manner to prevent slippage or damage to the geotextile.
8. Riprap shall be placed by a method that does not cause segregation of sizes. Extensive pushing with a dozer causes segregation and shall be avoided by delivering riprap near its final location within the channel.
9. Construction shall be sequenced so that riprap channel protection is placed and functional without delays when the channel becomes operational.
10. All disturbed areas will be vegetated as soon as practical.

6.6 Filter Sock



Description

Filter socks are sediment-trapping devices using compost inserted into a flexible, permeable tube with a pneumatic blower device or equivalent. Filter socks trap sediment by filtering water passing through the berm and allowing water to pond, creating a settling of solids.

Conditions where practice applies

Filter socks are appropriate for limited drainage areas, requiring sediment control where runoff is in the form of sheet flow or in areas that silt fence is normally considered acceptable. The use of filter socks is applicable to slopes up to 2:1 (H:V), around inlets, and in other disturbed areas of construction sites requiring sediment control. Filter socks also may be useful in areas, where migration of aquatic life such as turtles, salamanders and other aquatic life would be impeded by the use of silt fence.

Planning Considerations

Filter socks are sediment barriers, capturing sediment by ponding and filtering water through the device during rain events. They may be a preferred alternative where equipment may drive near or over sediment barriers, as they are not as prone to complete failure as silt fence if this occurs during construction. Driving over filter socks is not recommended; but if it should occur, the filter sock should be inspected immediately, repaired and moved back into place as soon as possible.

Design Criteria

Typically, filter socks can handle the same water flow or slightly more than silt fence. For most applications, standard silt fence is replaced with 12" diameter filter socks. However, proper installation is especially important for them to work effectively.

Materials – Compost/mulch used for filter socks shall be weed free and derived from a well-decomposed source of organic matter. The compost shall be produced using an aerobic composting process meeting CFR 503 regulations, including time and temperature data indicating effective weed seed, pathogen and insect larvae kill. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products are not acceptable.

Materials should meet the following requirements: pH between 5.0-8.0; 100% passing a 2" sieve and a minimum of 70% greater than the 3/8" sieve; moisture content is less than 60%; material shall be relatively free (<1% by dry weight) of inert or foreign man made materials.

Level Contour – Place filter socks on the level contour of the land so that flows are dissipated into uniform sheet flow. Flow coming to filter socks must not be concentrated and the filter sock should lie perpendicular to flows.

Flat Slopes – When possible, place filter socks at a 5' or greater distance away from the toe of the slopes in order for the water coming from the slopes to maximize space available for sediment deposit (see the illustration). When this is not possible due to construction limitations, additional filter socks may be required upslope of the initial filter sock (see the chart below for appropriate slope lengths and spacing).

Flow Around Ends – In order to prevent water flowing around the ends of filter socks, the ends of the filter socks must be constructed pointing upslope so the ends are at a higher elevation.

Vegetation – For permanent areas, seeding filter socks is recommended to establish vegetation directly in the sock and immediately in front and back of the sock at a distance of 5 feet. Vegetating on and around the filter socks will assist in slowing down water for filtration creating a more effective longer-term sediment control.

Drainage Area: Generally filter socks are limited to ¼ to ½ acre drainage area per 100 foot of the sediment barrier. Specific guidance is given in the chart below.

Table 6.6.1 Maximum Slope Length Above Filter Sock and Recommended Diameter

Slope	Ratio (H:V)	8"	12"	18"	24"
0% - 2%	10% - 20%	125	250	300	350
10% - 20%	50:1 - 10:1	100	125	200	250
2% - 10%	10:1 - 5:1	75	100	150	200
20% - 33%	5:1 - 2:1		50	75	100
>50%	>2:1		25	50	75

Note: For larger drainage areas, see standards for temporary diversions, sediment traps and sediment basins.

Dispersing flow – Sheet flow and runoff should not exceed berm height or capacity in most storm events. If overflow of the berm is a possibility, a larger filter sock should be installed or an alternative sediment control should be used.

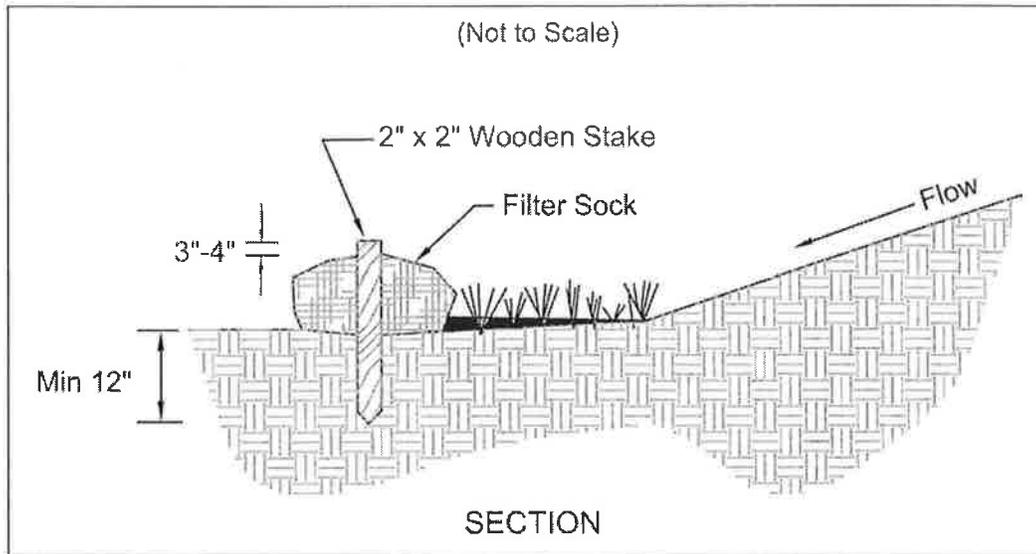
Maintenance – Filter socks should be regularly inspected to make sure they hold their shape, are ponding, and allowing adequate flow through. If ponding becomes excessive, filter socks should be replaced. Used filter socks may be cut and the compost dispersed and seeded to prevent captured sediment from being resuspended.

Removal – When construction is completed on site, the filter socks may be cut and dispersed with a loader, rake, bulldozer or other device to be incorporated into the soil or left on top of the soil for final seeding. The mesh netting material will be disposed of in normal trash container or removed by the contractor.

References

Standard Specification for Compost for Erosion/Sediment Control (Filter Berms) AASHTO Designation: MP-9 <http://www.iaasla.org/NEWS/FILES/AASHTO-Filterberm6.doc>

Specifications
for
Filter Sock



1. Materials – Compost used for filter socks shall be weed, pathogen and insect free and free of any refuse, contaminants or other materials toxic to plant growth. They shall be derived from a well-decomposed source of organic matter and consist of a particles ranging from 3/8" to 2".
2. Filter Socks shall be 3 or 5 mil continuous, tubular, HDPE 3/8" knitted mesh netting material, filled with compost passing the above specifications for compost products.

INSTALLATION:

3. Filter socks will be placed on a level line across slopes, generally parallel to the base of the slope or other affected area. On slopes approaching 2:1, additional socks shall be provided at the top and as needed mid-slope.
4. Filter socks intended to be left as a permanent filter or part of the natural landscape, shall be seeded at the time of installation for establishment of permanent vegetation.

5. Filter Socks are not to be used in concentrated flow situations or in runoff channels.

MAINTENANCE:

6. Routinely inspect filter socks after each significant rain, maintaining filter socks in a functional condition at all times.
7. Remove sediments collected at the base of the filter socks when they reach 1/3 of the exposed height of the practice.
8. Where the filter sock deteriorates or fails, it will be repaired or replaced with a more effective alternative.
9. Removal – Filter socks will be dispersed on site when no longer required in such as way as to facilitate and not obstruct seedings.

7.5 Dust Control



Description

Dust control involves preventing or reducing dust from exposed soils or other sources during land disturbing, demolition and construction activities to reduce the presence of airborne substances which may present health hazards, traffic safety problems or harm animal or plant life.

Conditions Where Practice Applies

In areas subject to surface and air movement of dust where on-site and off-site damage is likely to occur if preventive measures are not taken.

Planning Considerations

Construction activities inevitably result in the exposure and disturbance of soil. Fugitive dust results from both construction activities and as a result of wind erosion over the exposed earth surfaces. Large quantities of dust are typically generated in heavy construction activities, such as road construction and subdivision, commercial or industrial development, which involve disturbing significant areas of the soil surface. Research of construction sites has established an average dust emission rate of 1.2 tons/acre/month for active construction. Earth-moving activities comprise the major source of construction dust emissions, but traffic and general disturbance of the soil also generate significant dust emissions.

Planning for dust control involves limiting the amount of soil disturbance at any one time as a key objective. Therefore, phased clearing and grading operations (minimize disturbance-phasing) and the utilization of other stabilization practices can significantly reduce dust emissions. Undisturbed vegetative buffers (minimum 50-foot widths) left between graded areas and protected areas can also be very helpful in dust control by providing windbreaks and non-erosive areas.

Design Criteria

A number of measures can be utilized to limit dust either during or between construction stages or once construction is complete. Generally the same methods that are used to limit erosion by limiting exposure of soils to rainfall can be used to limit dust including: stabilizing exposed soils with mulch, vegetation or permanent cover. Additional methods particular to dust control include managing vehicles and construction traffic, road treatment and treatment of exposed soil with chemical stabilizers.

Vegetative Cover – The most effective way to prevent dust from exposed soil is to provide a dense cover of vegetation. In areas subject to little or no construction traffic, vegetative stabilization reduces dust drastically. Timely temporary and permanent seedings must be utilized to accomplish this. See TEMPORARY SEEDING & PERMANENT SEEDING.

Mulch - When properly applied, mulch offers a fast, effective means of controlling dust. Mulching is not recommended for areas within heavy traffic pathways. Binders or tackifiers should be used to tack organic mulches. See MULCHING.

Rough Graded Soils – Leaving the soil in a temporary state of rough grade, where clods rather than flattened soils predominate the surface can reduce the amount of dust generated from areas during periods of higher winds. This must be balanced by the need to reach a stage where the soil can be stabilized and may be only be necessary when high winds are predicted.

Watering - This is the most commonly used dust control practice. The site is sprinkled with water until the surface is wet before and during grading and is repeated as needed. It offers fast protection for haul roads and other heavy traffic routes. Watering should be done at a rate that prevents dust but does not cause soil erosion. Wetting agents are also available to increase the effectiveness of watering and must follow manufacturers instructions.

Chemical Stabilizers/Wetting Agents – Many products of this type are available and are usually most effective on typical mineral soils but may not be on predominantly organic soils such as muck. Users are advised to pay attention to the limitations and instructions regarding each product. The following table lists various adhesives and provides corresponding information on mixing and application:

Table 7.5.1 Adhesives for Dust Control

Adhesive	Water Dilution (Adhesive: Water)	Nozzle Type	Application Rate Gallon/Acre
Latex Emulsion	12.5:1	Fine	235
Resin in Water	4:1	Fine	300
Acrylic Emulsion (No-traffic)	7:1	Coarse	450
Acrylic Emulsion (Traffic)	3.5:1	Coarse	350

Stone - Stone can be used to stabilize roads or other areas during construction using crushed stone or coarse gravel. Research has shown the addition of bentonite to limestone roads (not igneous gravel) has shown benefits in reducing dust.

Windbreaks and Barriers – Where dust is a known problem, existing windbreak vegetation should be preserved. Maintaining existing rows of trees or constructing a wind fence, sediment fence, or similar barrier can help to control air currents and blowing soil. Place barriers perpendicular to prevailing air currents at intervals of about 15 times the barrier height.

Calcium Chloride - This chemical may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage. Liquid application of a 35% calcium chloride solution is common. Note: application rates should be strictly in accordance with suppliers' specified rates.

Street Cleaning - Paved areas that have accumulated sediment from construction sites should be cleaned daily, or as needed, utilizing a street sweeper or bucket-type loader or scraper.

Operation and Maintenance

Most dust control measures, such as applications of water or road treatments will require monitoring and repeat applications as needed to accomplish good control.

Common Problems / Concerns

Vegetation is removed from large areas of the construction site and left barren for long periods of time.

Continuous, scheduled monitoring of the construction site conditions is not made.

Specifications
for
Dust Control

1. Vegetative Cover and/mulch – Apply temporary or permanent seeding and mulch to areas that will remain idle for over 21 days. Saving existing trees and large shrubs will also reduce soil and air movement across disturbed areas. See Temporary Seeding; Permanent Seeding; Mulching Practices; and Tree and Natural Area Protection practices.
2. Watering – Spray site with water until the surface is wet before and during grading and repeat as needed, especially on haul roads and other heavy traffic routes. Watering shall be done at a rate that prevents dust but does not cause soil erosion. Wetting agents shall be utilized according to manufacturers instructions.
3. Spray-On Adhesives – Apply adhesive according to the following table or manufacturers' instructions.
4. Stone – Graded roadways and other suitable areas will be stabilized using crushed stone or coarse gravel as soon as practicable after reaching an interim or final grade. Crushed stone or coarse gravel can be used as a permanent cover to provide control of soil emissions.
5. Barriers – Existing windbreak vegetation shall be marked and preserved. Snow fencing or other suitable barrier may be placed perpendicular to prevailing air currents at intervals of about 15 times the barrier height to control air currents and blowing soil.
6. Calcium Chloride - This chemical may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage. Application rates should be strictly in accordance with suppliers' specified rates.

Table 7.5.1 Adhesives for Dust Control

Adhesive	Water Dilution (Adhesive: Water)	Nozzle Type	Application Rate Gal./Ac.
Latex Emulsion	12.5:1	Fine	235
Resin in Water Acrylic Emulsion (No-traffic)	4:1	Fine	300
Acrylic Emulsion (No-traffic)	7:1	Coarse	450
Acrylic Emulsion (Traffic)	3.5:1	Coarse	350

7. Operation and Maintenance - When Temporary Dust Control measures are used; repetitive treatment should be applied as needed to accomplish control.

Street Cleaning - Paved areas that have accumulated sediment from construction should be cleaned daily, or as needed, utilizing a street sweeper or bucket -type endloader or scraper.

7.6 Grade Treatment (Surface Roughening)



Description

Grade Treatment or surface roughening creates horizontal depressions in the soil surface that help to reduce erosion by reducing runoff velocity and increasing infiltration. These depressions aid in the establishment of vegetative cover and provide localized trapping of sediments. Grade Treatment is typically created by operating tillage implements on the contour or by running tracked equipment up and down a slope without fine grading the surface.

Conditions Where Practice Applies

1. All slopes steeper than 3:1 require grade treatment, either stair-step grading, grooving, furrowing, or tracking if they are to be stabilized with vegetation.
2. Areas with grades less steep than 3:1 should have the soil surface lightly roughened and loose to a depth of 2 to 4 inches prior to seeding.
3. Areas that have been graded and will not be seeded immediately may be roughened to reduce runoff velocity until seeding takes place.
4. Slopes with a stable rock face do not require roughening or stabilization.

Planning Considerations

- A grading plan should be developed to establish drainage areas, direct drainage patterns, and decrease runoff velocities. The plan should coordinate the grading with the erosion/sedimentation control plan and the stormwater management plan. Grading should be done in stages according to the implementation schedule, thus limiting the amount of surface

area left in a disturbed, unstable condition. When grading, leave a natural buffer between the disturbed areas and the water body (50 ft. minimum width recommended.) If a natural buffer cannot be left, construct a berm or install other appropriate sediment control BMPs (i.e. sediment trap, silt fence) adjacent to the water body.

Prior to placing fill, topsoil and organic materials should be removed. To prevent differential settlement, fill should be free of objectionable materials such as logs, rocks and stumps. Frozen fill or organic (muck) materials should not be used.

Spoil and topsoil piles shall not be located in or near drainageways and shall be stabilized as soon as possible by seeding and mulching. Placing piles adjacent to channel banks where it may create bank failure or result in deposition of sediment downstream should be avoided.

Graded areas with smooth, hard surfaces give a false impression of “finished grading” and a job well done. It is difficult to establish vegetation on such surfaces due to reduced water infiltration and the potential for erosion. Rough slope surfaces with uneven soil and rocks left in place may appear unattractive or unfinished at first, but encourage water infiltration, speed the establishment of vegetation, and decrease runoff velocity.

Rough loose soil surfaces give lime, fertilizer and seed some natural coverage. Niches in the surface provide microclimates that generally provide a cooler and more favorable moisture level than hard flat surfaces; this aids seed germination.

Design Criteria

Grade Treatment is to be performed only after all cuts and fills are made and brought to the final shape and grade.

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Grading methods include stair-step grading, grooving, and tracking.

Stair-step grading. This method should be done on slopes steeper than 3:1 with material soft enough to be bulldozed and which will not be mowed. The vertical cut should be less than the horizontal distance and should not exceed 2 feet in soft material and 3 feet in rocky material. The horizontal position of the “step” should be sloped toward the vertical up-hill wall.

Grooving. This method can be done on any area, which can safely accommodate disks, tillers, spring harrow, or the teeth of a front-end loader bucket. In areas, which will not be mowed, use equipment to create grooves perpendicular to the slope. Grooves should not be less than 3 inches deep, nor more than 15 inches apart. In cuts, fills, and areas that will be mowed, grooves should be less than 10 inches apart and not less than 1 inch deep.

Tracking. This method is done by running tracked machinery (such as bulldozers) up and down slopes to leave horizontal depressions in the soil. Back-blading should not be done during the final grading operation.

Tracking or roughening with tracked machinery is not recommended on clayey soils unless other alternatives are unavailable due to its likelihood of causing compaction of the surface soil. Sandy soils do not compact severely, and may be tracked. In no case is tracking as effective as the other roughening methods described. To roughen with tracked machinery, operate the equipment up and down the slope to leave horizontal depressions in the soil with as few passes of the machinery as possible to minimize compaction.

Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

1. Disturbed areas, which will not require mowing, may be stair-step graded, tracked, grooved, or left rough after filling.
2. Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each "step" catches material shed from above, and provides a level site where vegetation can become established.
3. Areas that will be mowed (these areas should have slopes 3:1 or flatter) may have small furrows left by discing, harrowing, raking, or seed-planting machinery operated on the contour.
4. Avoid excessive compacting of the soil surface when scarifying. Tracking with bulldozer treads is preferable to not roughening at all, but is not as effective as other forms of roughening, as the soil surface may be compacted and runoff increased.

Maintenance

Roughened areas shall be seeded and mulched within seven (7) days of last disturbance to obtain optimum seed germination and seedling growth.

Common Problems / Concerns

Severe compaction due to equipment operation – results in unsuitable seedbed and poor vegetation establishment.

Rough areas difficult to mow – caused by cutting grooves too deep or excessive erosion from grooves not being on the contour.

Grooving done perpendicular, rather than parallel to slope – results in accelerated erosion.

Specifications
for
Grade Treatment

Cut Slopes-Greater than 3:1 Slopes

1. Stair-step grading may be carried out on any material soft enough to be ripped with a bulldozer. The ratio of the horizontal distance to the vertical cut distance shall be flatter than 1:1 and the horizontal portion of the "step" shall slope toward the vertical wall. Individual vertical cuts shall not be more than 24 inches on soft soil materials and not more than 36 inches in rocky materials.
2. Grooving may be made with any appropriate implement which can be safely operated on the slope and which will not cause undue compaction. Suggested implements include discs, tillers, spring harrows, and the teeth on a front-end loader bucket. Such grooves shall not be less than 3 inches deep nor further than 15 inches apart.

Fill Slopes-Greater than 3:1 Slopes

Fill slopes steeper than 3:1 shall be grooved or allowed to remain rough as they are constructed utilizing method (1) or (2) below.

1. Grooving may be made with any appropriate implement which can be safely operated on the slope and which will not cause undue compaction such as discs, tillers, spring harrows, and the teeth on a front-end loader bucket. Grooves left shall not be less than 3 inches deep nor further than 15 inches apart.
2. As lifts of the fill are constructed, soil and rock materials may be allowed to fall naturally onto the slope surface. At no time shall slopes be bladed or scraped to produce a smooth, hard surface.

Cuts, Fills, and Graded Areas Which Will Be Mowed

1. Mowed slopes should not be steeper than 3:1 and shall avoid excessive roughness. These areas may be roughened with shallow grooves such as those, which remain after tilling, discing, harrowing, raking, or use of a cultipacker-seeder. The final pass of any such tillage implement shall be on the contour (perpendicular to the slope).
2. Grooves formed by implements shall be not less than 1 inch deep and not further than 12 inches apart. Fill slopes that are left rough during construction may be smoothed with a chain harrow or similar implement to facilitate mowing.

Roughening With Tracked Machinery

1. Avoid tracking clayey soils if possible, due to their potential for compaction. Conversely sandy soils will have low potential for compaction.
2. Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. As few passes of the machinery should be made as possible to minimize compaction.

7.7 Topsoiling



Description

Topsoiling occurs during grading operations as the upper most organic layer of soil is stripped and stockpiled from areas being graded and subsequently replaced on the newly graded areas. Topsoil provides a more suitable growing medium than subsoil or on areas with poor moisture, low nutrient levels, undesirable pH, or in the presence of other materials that would inhibit establishment of vegetation. Replacing topsoil helps plant growth by improving the water holding capacity and nutrient content and consistency of the soils.

Conditions Where Practice Applies

This practice applies anywhere a good stand of vegetation is desired, whether turf, ornamental plants, and/ or vegetative cover especially in areas where high-quality turf is desirable to withstand intense use or meet aesthetic requirements, although it may not be appropriate for areas with slopes greater than 2:1.

This practice is especially applicable to areas where:

- existing soil structure, pH, or nutrient balance cannot be easily improved with soil amendments to be a suitable growth medium.
- existing soils are too shallow to provide adequate rooting depth or;
- the existing soil contains substances toxic to the desired vegetation.

Planning Considerations

Topsoil is the upper layer of natural soil (A horizon), which is typically darker and more fertile than the subsoil due to increased amounts of organic material. This layer is typically very evident as a person excavates through soil horizons. Project sites will have varying degrees of topsoil resources prior to construction, with some historically eroded sites having limited topsoil resources. These sites may have less justification for moving, stockpiling and re-spreading the top horizon of soil. If in question, assistance by a trained soils professional should be sought to determine the extent of topsoil resources on the project site.

Although replacing topsoil is critical to establishing good vegetation and limiting runoff from development sites, it comes with additional costs. Stripping, stockpiling and reapplying topsoil or importing topsoil will require greater work in grading operations and therefore will increase costs. Topsoiling will also add time to grading operations and may increase the exposure time of denuded areas. Additionally, depending on the original vegetative cover, topsoil often contains weed seeds that may compete with desirable species.

In site planning, the option of topsoiling should be compared with that of preparing a seedbed in subsoil. The clay content of subsoil does provide high moisture availability and deters leaching of nutrients. When adjusted for optimal pH and nutrient availability, subsoil may provide an adequate growth medium that is generally free of weeds. Topsoiling may not be required to establish less demanding, lower maintenance plants, although runoff will be increased due to the lack of topsoil from the site.

If topsoiling is planned, locations for topsoil stockpiles must be determined where drainage and site work will not be encumbered. Construction scheduling must be adjusted to allow sufficient time for moving, stockpiling and spreading topsoil between grading and re-vegetation operations.

Design Criteria

These are provided in the specifications that follow.

Maintenance

Topsoil stockpiles should be stabilized with temporary vegetation and provided sufficient sediment controls. Sediment Controls will need regular inspection and appropriate repairs as needed.

Common Problems / Concerns

- Care must be taken not to apply topsoil to subsoil if the two soils have contrasting textures. Clayey topsoil over sandy subsoil is a particularly poor combination, as water may creep along the junction between the soil layers, leading to sloughing of the topsoil. Sandy topsoil over clay subsoil is equally likely to fail.
- If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. Topsoiling of steep slopes is highly discouraged, unless good bonding of soils can be achieved.
- Topsoil should not be applied in excessively wet/moist conditions.

Specifications
for
Topsoiling

Salvaging and Stockpiling

1. Determine the depth and suitability of topsoil at the site. (For help, contact your local SWCD office to obtain a county soil survey report).
2. Prior to stripping topsoil, install appropriate downslope erosion and sedimentation controls such as sediment traps and basins.
3. Remove the soil material no deeper than what the county soil survey describes as "surface soil" (ie. A or Ap horizon).
4. Construct stockpiles in accessible locations that do not interfere with natural drainage. Install appropriate sediment controls to trap sediment such as silt fence immediately adjacent to the stockpile or sediment traps or basins downstream of the stockpile. Stockpile side slopes shall not exceed a ratio of 2:1.
5. If topsoil is stored for more than 21 days, it should be temporary seeded, or covered with a tarp.

Spreading the Topsoil

1. Prior to applying topsoil, the topsoil should be pulverized.
2. To ensure bonding, grade the subsoil and roughen the top 3-4 in. by disking.
3. Do not apply when site is wet, muddy, or frozen, because it makes spreading difficult, causes compaction problems, and inhibits bonding with subsoil.
4. Apply topsoil evenly to a depth of at least 4 inches and compact slightly to improve contact with subsoil.
5. After spreading, grade and stabilize with seeding or appropriate vegetation.

7.8 Temporary Seeding



Description

Temporary seedings establish temporary cover on disturbed areas by planting appropriate rapidly growing annual grasses or small grains. Temporary seeding provides erosion control on areas in between construction operations. Grasses, which are quick growing, are seeded and usually mulched to provide prompt, temporary soil stabilization. It effectively minimizes the area of a construction site prone to erosion and should be used everywhere the sequence of construction operations allows vegetation to be established.

Conditions Where the Practice Applies

Temporary seeding should be applied on exposed soil where additional work (grading, etc.) is not scheduled for more than 21 days. Permanent seeding should be applied if the areas will be idle for more than one year.

Planning Considerations

This practice has the potential to drastically reduce the amount of sediment eroded from a construction site. Erosion control efficiencies greater than 90% will be achieved with proper applications of temporary seeding. Because practices used to trap sediment are usually much less effective, temporary seeding is to be use even on areas where runoff is treated by sediment trapping practices. Because temporary seeding is highly effective and practical on construction sites, its liberal use is highly recommended.

Design Criteria

Specifications follow these explanations of important aspects of temporary seeding.

Plant Selection: Select the plants appropriate from the table in the Specifications for Temporary seeding. Choose varieties of tall fescue that are endophyte free or have non-toxic endophytes. Seeding rates for dormant seedings are increased by 50 percent. More information on dormant seedings is given in the permanent seeding section.

The length of time the area will idle and the season in which seeding occurs should influence the selection of seeding species. For areas remaining idle for over a year, a mixture containing perennial ryegrass is recommended. Cereal grains (rye, oats and wheat) are included in some of the mixtures as cover crops. These are annual plants that will die after producing seed. Realize that oats will not over-winter and continue to grow as wheat and rye do.

Site preparation: Temporary seeding is best done on a prepared soil seedbed of loose pulverized soil. However, seedings should not be delayed, if additional grading operations are not possible. At a minimum, remove large rock or debris that will interfere with seeding operations. If the ground has become crusted, a disk or a harrow should be used to loosen the soil. Overall the best soil conditions will exist immediately after grading operations cease, when soils remain loose and moist.

Soil amendments: A soil test is necessary to adequately predict the need for lime and fertilizer. Seedings that are expected to be long lasting (over 1-3 months), should have lime and fertilizer applied as recommended by a soil test. In lieu of a soil test, fertilizer can be broadcast and worked into the top inch of soil at the rate of 6 pounds/1000 ft² or 250 pounds per acre of 10-10-10 or 12-12-12.

Seeding Methods: Seed shall be applied uniformly with a cyclone spreader, drill, culti-packer seeder, or hydroseeder. When feasible, seed that has been broadcast shall be covered by raking or dragging and then lightly tamped into place using a roller or cultipacker. If hydroseeding is used, the seed and fertilizer will be mixed on-site and the seeding shall be done immediately and without interruption.

Maintenance

Areas failing to establish vegetative cover adequate to prevent erosion shall be reseeded as soon as such areas are identified.

Seeding performed during hot and dry summer months shall be watered at a rate of 1 inch per week.

Common Problems / Concerns

- Insufficient topsoil or inadequately tilled, limed, and/ or fertilized seedbed results in poor establishment of vegetation.
- An overly high seeding rate of nurse crop (oat, rye or wheat) in the seed mixture results in over competition with the perennials.
- Seeding outside of seeding dates results in poor vegetation establishment and a decrease in plant hardiness.
- An inadequate rate of mulch results in poor germination and failure.

Specifications
for
Temporary Seeding

Table 7.8.1 Temporary Seeding Species Selection

Seeding Dates	Species	Lb./1000 ft2	Lb/Acre
March 1 to August 15	Oats	3	128 (4 Bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Perennial Ryegrass	1	40
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Annual Ryegrass	1.25	55
	Perennial Ryegrass	3.25	142
	Creeping Red Fescue	0.4	17
	Kentucky Bluegrass	0.4	17
August 16th to November	Oats	3	128 (3 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Rye	3	112 (2 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Wheat	3	120 (2 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Perennial Rye	1	40
November 1 to Feb. 29	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Annual Ryegrass	1.25	40
	Perennial Ryegrass	3.25	40
	Creeping Red Fescue	0.4	40
Use mulch only or dormant seeding			

Note: Other approved species may be substituted.

1. Structural erosion and sediment control practices such as diversions and sediment traps shall be installed and stabilized with temporary seeding prior to grading the rest of the construction site.
2. Temporary seed shall be applied between construction operations on soil that will not be graded or reworked for 21 days or greater. These idle areas shall be seeded within 7 days after grading.
3. The seedbed should be pulverized and loose to ensure the success of establishing vegetation. Temporary seeding should not be postponed if ideal seedbed preparation is not possible.
4. Soil Amendments—Temporary vegetation seeding rates shall establish adequate stands of vegetation, which may require the use of soil amendments. Base rates for lime and fertilizer shall be used.
5. Seeding Method—Seed shall be applied uniformly with a cyclone spreader, drill, cultipacker seeder, or hydroseeder. When feasible, seed that has been broadcast shall be covered by raking or dragging and then lightly tamped into place using a roller or cultipacker. If hydroseeding is used, the seed and fertilizer will be mixed on-site and the seeding shall be done immediately and without interruption.

Specifications
for
Temporary Seeding

Mulching Temporary Seeding

1. Applications of temporary seeding shall include mulch, which shall be applied during or immediately after seeding. Seedings made during optimum seeding dates on favorable, very flat soil conditions may not need mulch to achieve adequate stabilization.
2. Materials:
 - Straw—If straw is used, it shall be unrotted small-grain straw applied at a rate of 2 tons per acre or 90 lbs./ 1,000 sq. ft. (2-3 bales)
 - Hydroseeders—If wood cellulose fiber is used, it shall be used at 2000 lbs./ ac. or 46 lb./ 1,000-sq.-ft.
 - Other—Other acceptable mulches include mulch mattings applied according to manufacturer's recommendations or wood chips applied at 6 ton/ ac.
3. Straw Mulch shall be anchored immediately to minimize loss by wind or water. Anchoring methods:
 - Mechanical—A disk, crimper, or similar type tool shall be set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but left to a length of approximately 6 inches.
 - Mulch Netting—Netting shall be used according to the manufacturers recommendations. Netting may be necessary to hold mulch in place in areas of concentrated runoff and on critical slopes.
 - Synthetic Binders—Synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Track or equivalent may be used at rates recommended by the manufacturer.
 - Wood-Cellulose Fiber—Wood-cellulose fiber binder shall be applied at a net dry wt. of 750 lb./ac. The wood-cellulose fiber shall be mixed with water and the mixture shall contain a maximum of 50 lb. / 100 gal.

7.9 Mulching



Description

A protective layer of mulch, usually of straw, applied to bare soil is used to abate erosion by shielding it from raindrop impact. Mulch also helps establish vegetation by conserving moisture and creating favorable conditions for seeds to germinate.

Conditions Where Practice Applies

Mulch should be used liberally throughout construction to limit the areas that are bare and susceptible to erosion. Mulch can be used in conjunction with seeding to establish vegetation or by itself to provide erosion control when the season does not allow grass to grow. Mulch and other vegetative practices must be applied on all disturbed portions of construction-sites that will not be re-disturbed for more than 21 days.

Design Criteria

See specifications for Mulching.

Maintenance

Additional mulching is necessary to cover exposed soil conditions when observed during routine maintenance inspections.

Common Problems / Concerns

The application of synthetic binders must be conducted in such a manner as to not be introduced into watercourses.

Weather considerations must be addressed to ensure the application of synthetic binders are not washed away and introduced into watercourses.

The use of a mulch cover is not recommended for areas, which will exhibit higher velocities than 3.5 feet/second. An erosion control matting is recommended for areas which will exhibit higher velocities.

Areas which have been mulched should be inspected and maintained if necessary every 7 days or within 24 hours of a rain event greater than or equal to 0.5 inches to ensure adequate protection.

Specifications
for
Mulching

1. Mulch and other appropriate vegetative practices shall be applied to disturbed areas within 7 days of grading if the area is to remain dormant (undisturbed) for more than 21 days or on areas and portions of the site which can be brought to final grade.
2. Mulch shall consist of one of the following:
 - Straw - Straw shall be unrotted small grain straw applied at the rate of 2 tons/ac. or 90 lb./1,000 sq. ft. (two to three bales). The straw mulch shall be spread uniformly by hand or mechanically so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000 sq.ft. sections and place two 45-lb. bales of straw in each section.
 - Hydroseeders - Wood cellulose fiber should be used at 2,000 lb./ac. or 46 lb./1,000 sq. ft.
 - Other - Acceptable mulches include mulch mattings and rolled erosion control products applied according to manufacturer's recommendations or wood mulch/chips applied at 10-20 tons/ac.
3. Mulch Anchoring - Mulch shall be anchored immediately to minimize loss by wind or runoff. The following are acceptable methods for anchoring mulch.
 - Mechanical - Use a disk, crimper, or similar type tool set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but be left generally longer than 6 inches.
 - Mulch Nettings - Use according to the manufacturer's recommendations, following all placement and anchoring requirements. Use in areas of water concentration and steep slopes to hold mulch in place.
 - Synthetic Binders - For straw mulch, synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Tack or equal may be used at rates recommended by the manufacturer. All applications of Synthetic Binders must be conducted in such a manner where there is no contact with waters of the state.
 - Wood Cellulose Fiber - Wood cellulose fiber may be used for anchoring straw. The fiber binder shall be applied at a net dry weight of 750 lb./acre. The wood cellulose fiber shall be mixed with water and the mixture shall contain a maximum of 50 lb./100 gal. of wood cellulose fiber.

7.10 Permanent Seeding



Description

Perennial vegetation is established on areas that will not be re-disturbed for periods longer than 12 months. Permanent seeding includes site preparation, seedbed preparation, planting seed, mulching, irrigation and maintenance.

Permanent vegetation is used to stabilize soil, reduce erosion, prevent sediment pollution, reduce runoff by promoting infiltration, and provide stormwater quality benefits offered by dense grass cover.

Conditions Where Practice Applies

Permanent seeding should be applied to:

- Any disturbed areas or portions of construction sites at final grade. Permanent seeding should not be delayed on any one portion of the site at final grade while construction on another portion of the site is being completed. Permanent seeding shall be completed in phases, if necessary.
- Areas subject to grading activities but will remain dormant for a year or more.

Planning Considerations

Vegetation controls erosion by reducing the velocity and the volume of overland flow and protects bare soil surface from raindrop impact. A healthy, dense turf promotes infiltration and reduces the amount of runoff. The establishment of quality vegetation requires selection of the right plant materials for the site, adequate soil amendments, careful seedbed preparation, and maintenance.

Soil Compaction—Storm water quality and the amount of runoff both vary significantly with soil compaction. Non-compacted soils improve stormwater infiltration by promoting:

- dense vegetative growth;
- high soil infiltration & lower runoff rates;
- pollutant filtration, deposition & absorption; and
- beneficial biologic activity in the soil.

Construction activity creates highly compacted soils that restrict water infiltration and root growth. The best time for improving soil condition is during the establishment of permanent vegetation. It is highly recommended that subsoilers, plows, or other implements are specified as part of final seedbed preparation. Use discretion in slip-prone areas.

Minimum Soil Conditions—Vegetation cannot be expected to stabilize soil that is unstable due to its texture, structure, water movement or excessively steep slope. The following minimum soil conditions are needed for the establishment and maintenance of a long-lived vegetative cover. If these conditions cannot be met, see the standards and specifications for Topsoiling.

- Soils must include enough fine-grained material to hold at least a moderate amount of available moisture.
- The soil must be free from material that is toxic or otherwise harmful to plant growth.

Design Criteria

See specifications for permanent seeding below.

Maintenance

1. Expect emergence within 4 to 28 days after seeding, with legumes typically following grasses. Check permanent seedlings within 4 to 6 weeks after planting. Look for:
 - Vigorous seedlings;
 - Uniform ground surface coverage with at least 30% growth density;
 - Uniformity with legumes and grasses well intermixed;
 - Green, not yellow, leaves. Perennials should remain green throughout the summer, at least at the plant bases.
2. Permanent seeding shall not be considered established for at least 1 full year from the time of planting. Inspect the seeding for soil erosion or plant loss during this first year. Repair bare and sparse areas. Fill gullies. Re-fertilize, re-seed, and re-mulch if required. Consider no-till planting. A minimum of 70% growth density, based on a visual inspection, must exist for an adequate permanent vegetative planting.
 - If stand is inadequate or plant cover is patchy, identify the cause of failure and take corrective action: choice of plant materials, lime and fertilizer quantities, poor seedbed preparation, or weather. If vegetation fails to grow, have the soil tested to determine whether pH is in the correct range or nutrient deficiency is a problem.
 - Depending on stand conditions, repair with complete seedbed preparation, then over-seed or re-seed.
 - If it is the wrong time of year to plant desired species, over-seed with small grain cover crop to thicken the stand until timing is right to plant perennials or use temporary seeding. See Temporary Seeding standard.

3. Satisfactory establishment may require re-fertilizing the stand in the second growing season.
 - Do not fertilize cool season grasses in late May through July (i.e. Kentucky Bluegrass, Orchardgrass, Perennial Ryegrass, Smooth Brome, Fescues, Timothy, Reed Canarygrass and Garrison Grass)
 - Grass that looks yellow may be nitrogen deficient. In lieu of a soil test, an application of 50 lbs. of N-P-K per acre in early spring will help cool season grasses compete against weeds or grow more successfully.
 - Do not use nitrogen fertilizer if the stand contains more than 20 percent legumes.
4. Long-term maintenance fertilization rates shall be established by following soil test recommendations or by using the rates shown in Table 2.

Table 7.10.1 Maintenance for Permanent Seedings Fertilization and Mowing

Mixture	Formula	Lbs./ Acre	Lbs./1,000 sq.ft.	Time	Mowing
Creeping Red Fescue Ryegrass Kentucky Bluegrass	10-10-10	500	12	Fall, yearly or as needed	Not closer than 3"
Tall Fescue	10-10-10	500	12		Not closer than 4"
Turf-type Fescue	10-10-10	500	12		
Crown Vetch Fescue	0-20-20	400	10	Spring, yearly following establishment and every 4-7 years thereafter	Do not mow
Flat Pea Fescue	0-20-20	400	10		Do not mow

Note: Following soil test recommendations is preferred to fertilizer rates shown above.

5. Consider mowing after plants reach a height of 6 to 8 inches. Mow grasses tall, at least 3 inches in height and minimize compaction during the mowing process. Vegetation on structural practices such as embankments and grass-lined channels need to be mowed only to prevent woody plants from invading the stand.

Common Problems / Concerns

- Insufficient topsoil or inadequately tilled, limed, and/or fertilized seedbed - results in poor establishment of vegetation.
- Unsuitable species or seeding mixture - results in competition with the perennials.
- Nurse crop rate too high in the mixture - results in competition with the perennials.
- Seeding done at the wrong time of year - results in poor establishment of vegetation, also plant hardiness is significantly decreased.
- Mulch rate inadequate - results in poor germination and failure.

Specifications
for
Permanent Seeding

Site Preparation

1. Subsoiler, plow, or other implement shall be used to reduce soil compaction and allow maximum infiltration. (Maximizing infiltration will help control both runoff rate and water quality.) Subsoiling should be done when the soil moisture is low enough to allow the soil to crack or fracture. Subsoiling shall not be done on slip-prone areas where soil preparation should be limited to what is necessary for establishing vegetation.
2. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation and seeding.
3. Topsoil shall be applied where needed to establish vegetation.

Seedbed Preparation

1. Lime—Agricultural ground limestone shall be applied to acid soil as recommended by a soil test. In lieu of a soil test, lime shall be applied at the rate of 100 pounds per 1,000-sq. ft. or 2 tons per acre.
2. Fertilizer—Fertilizer shall be applied as recommended by a soil test. In place of a soil test, fertilizer shall be applied at a rate of 25 pounds per 1,000-sq. ft. or 1000 pounds per acre of a 10-10-10 or 12-12-12 analyses.
3. The lime and fertilizer shall be worked into the soil with a disk harrow, spring-tooth harrow, or other suitable field implement to a depth of 3 inches. On sloping land, the soil shall be worked on the contour.

Seeding Dates and Soil Conditions

Seeding should be done March 1 to May 31 or August 1 to September 30. If seeding occurs outside of the above-specified dates, additional mulch and irrigation may be required to ensure a minimum of 80% germination. Tillage for seedbed preparation should be done when the soil is dry enough to crumble and not form ribbons when compressed by hand. For winter seeding, see the following section on dormant seeding.

Dormant Seedings

1. Seedings should not be made from October 1 through November 20. During this period, the seeds are likely to germinate but probably will not be able to survive the winter.
2. The following methods may be used for “Dormant Seeding”:

- From October 1 through November 20, prepare the seedbed, add the required amounts of lime and fertilizer, then mulch and anchor. After November 20, and before March 15, broadcast the selected seed mixture. Increase the seeding rates by 50% for this type of seeding.
- From November 20 through March 15, when soil conditions permit, prepare the seedbed, lime and fertilize, apply the selected seed mixture, mulch and anchor. Increase the seeding rates by 50% for this type of seeding.
- Apply seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydro-seeder (slurry may include seed and fertilizer) on a firm, moist seedbed.
- Where feasible, except when a cultipacker type seeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land, seeding operations should be on the contour where feasible.

Mulching

1. Mulch material shall be applied immediately after seeding. Dormant seeding shall be mulched. 100% of the ground surface shall be covered with an approved material.
2. Materials
 - Straw—If straw is used it shall be unrotted small-grain straw applied at the rate of 2 tons per acre or 90 pounds (two to three bales) per 1,000-sq. ft. The mulch shall be spread uniformly by hand or mechanically applied so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000-sq.-ft. sections and spread two 45-lb. bales of straw in each section.
 - Hydroseeders—If wood cellulose fiber is used, it shall be applied at 2,000 lb./ac. or 46 lb./1,000 sq. ft.
 - Other—Other acceptable mulches include rolled erosion control mattings or blankets applied according to manufacturer's recommendations or wood chips applied at 6 tons per acre.

3. Straw and Mulch Anchoring Methods

Straw mulch shall be anchored immediately to minimize loss by wind or water.

- **Mechanical**—A disk, crimper, or similar type tool shall be set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but, generally, be left longer than 6 inches.
- **Mulch Netting**—Netting shall be used according to the manufacturer’s recommendations. Netting may be necessary to hold mulch in place in areas of concentrated runoff and on critical slopes.
- **Asphalt Emulsion**—Asphalt shall be applied as recommended by the manufacture or at the rate of 160 gallons per acre.

- **Synthetic Binders**—Synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Tack or equivalent may be used at rates specified by the manufacturer.
- **Wood Cellulose Fiber**—Wood cellulose fiber shall be applied at a net dry weight of 750 pounds per acre. The wood cellulose fiber shall be mixed with water with the mixture containing a maximum of 50 pounds cellulose per 100 gallons of water.

Irrigation

Permanent seeding shall include irrigation to establish vegetation during dry weather or on adverse site conditions, which require adequate moisture for seed germination and plant growth.

Irrigation rates shall be monitored to prevent erosion and damage to seeded areas from excessive runoff.

Table 7.10.2 Permanent Seeding

Seed Mix	Seeding Rate		Notes:
	Lbs./acre	Lbs./1,000 Sq. Feet	
General Use			
Creeping Red Fescue	20-40	1/2-1	For close mowing & for waterways with <2.0 ft/sec velocity
Domestic Ryegrass	10-20	1/4-1/2	
Kentucky Bluegrass	20-40	1/2-1	
Tall Fescue	40-50	1-1 1/4	
Turf-type (dwarf) Fescue	90	2 1/4	
Steep Banks or Cut Slopes			
Tall Fescue	40-50	1-1 1/4	
Crown Vetch	10-20	1/4-1/2	Do not seed later than August
Tall Fescue	20-30	1/2-3/4	
Flat Pea	20-25	1/2-3/4	Do not seed later than August
Tall Fescue	20-30	1/2-3/4	
Road Ditches and Swales			
Tall Fescue	40-50	1-1 1/4	
Turf-type (Dwarf) Fescue	90	2 1/4	
Kentucky Bluegrass	5	0.1	
Lawns			
Kentucky Bluegrass	100-120	2	
Perennial Ryegrass		2	
Kentucky Bluegrass	100-120	2	For shaded areas
Creeping Red Fescue		1-1/2	

Note: Other approved seed species may be substituted.

