State of Indiana
Office of Technology
Geographic Information Office

January 25, 2010

Water AECOM

Professional Services to Develop Local-Resolution National Hydrography Data (NHD) for the State of Indiana Watersheds

RFP 10-47

AECOM
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Greensboro, NC 27407
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January 25, 2010

Mr. James Osborne
Indiana Department of Administration
Procurement Division
402 West Washington Street, Room W478
Indianapolis, IN 46204

RE: Professional Services to Develop Local-Resolution NHD for State of Indiana Watersheds
RFP-10-47

Dear Mr. Osborne:

It is AECOM's pleasure to offer our services in response to the request for proposal (RFP) for Professional Services to Develop Local-Resolution National Hydrography Data (NHD) for State of Indiana Watersheds. We are grateful to have previously had the opportunity to discuss our project experience in local-resolution NHD creation with the Indiana Geographic Information Council's (IGIC) Water Workgroup, and to provide a pilot study in Hamilton County, Indiana to assist the workgroup in making informed decisions regarding the future of Indiana's local-resolution NHD project. AECOM has thoroughly enjoyed working with the members of the IGIC Waters Workgroup, and is excited about the opportunity to be involved with the implementation of such an important project for the state. From our working relationship with the workgroup, we have a good understanding of the needs for this project including compliance with NHD standards, accuracy standards for the NHD hydrography features, and the budgetary challenges.

The development of local-resolution NHD for State of Indiana watersheds is a valuable project and we look forward to working with the State to make it a success. We have a strong project team, comprised of highly trained and experienced staff from AECOM, Cripe Architects + Engineers and Pinnacle Mapping Technologies. AECOM is a global provider of professional technical and management support services to a broad range of markets, including water, transportation, facilities, environmental, energy, and government. For Indiana's local-resolution NHD project, AECOM will serve as the prime contractor and will be providing services related to terrain processing, NHD conversion, NHD conflation and QA/QC. Our subcontractors for this project, Cripe Architects + Engineers and Pinnacle Mapping Technologies, will be performing NHD conversion tasks for several areas in the State. Our project team's understanding of the NHD is exceptional and our unique specialty is the development of quality hydrography data for large-scale projects such as this.

***Experience*:** With our previous experience in creating local-resolution NHD, we will be able to provide unmatched services in modifying the State of Indiana's NHD. We recently worked with the State of North Carolina Center for Geographic Information and Analysis (CGIA) to create a digital surface water feature dataset for 19 counties in the western part of the State. Our team utilized orthophotography and terrain data to map NHD features and conflate attributes from the 1:24,000 high-resolution NHD to the newly-created local-resolution NHD. For that project, we mapped over 65,000 miles of stream and attributed over 500,000 NHD features. Several key project members who were involved in the NC local-resolution NHD project will also be dedicated to the Indiana local-

resolution NHD project, including Project Manager Zsolt Nagy, GIS Lead Susan Phelps, QA/QC Lead Terri McLean, NHD Conversion Lead John Hendricks, and NHD Conflation Lead Peter Perry. Additionally, we have digitized over 75,000 miles of streamlines for FEMA mapping projects in 1,000 counties in the United States. This includes Federal Emergency Management Agency (FEMA) floodplain mapping for Boone, Davies, Green, Knox, and Martin Counties in Indiana. Both team partners, Cripe Architects + Engineers and Pinnacle Mapping Technologies, also have significant experience working with orthophotograhy, elevation models, and/or FEMA flood mapping products.

Commitment and Client Service: AECOM's success is measured by the success of our clients. Our commitment to quality and forward-thinking has allowed us to maintain long lasting relationships with our clients and given us multiple opportunities to make them successful. We are dedicated to providing the highest level of client service to the State of Indiana by following our core values, which include excellence and integrity in our work, innovation to anticipate and prevent problems before they arise, and agility to adapt to our client's needs.

Local Presence: Our project team includes a Principal in Charge from AECOM's Indianapolis office who has 25 years of water resource experience in the state. Additionally, AECOM has assigned 5 qualified local staff experienced in water resources engineering and GIS to this project. Our subcontractors, Cripe Architects + Engineers and Pinnacle Mapping Technologies, are both locally-owned and operated, and have excellent reputations for GIS capabilities in Indiana. They will be assigning a minimum of 10 local Indiana staff members to this project, the majority of whom have completed GIS projects for the State and local counties and have a good working knowledge of hydrology in the State.

As requested in section 2.2.1 of the RFP, AECOM has thoroughly reviewed the RFP provided by the Indiana Department of Administration (IDOA) and the Indiana Office of Technology (IOT) and understands the requirements/conditions listed in Section 1 of the **"**General Information and Requested Products/Services". We agree to the conditions provided in Section 1 of the RFP, including but not limited to, Sections 1.19 and 1.22. The proposal provided herewithin by AECOM is valid for a period of 180 days, beginning on Monday, January 25th, 2010.

As requested in section 2.2.2 of the RFP, the AECOM project team is willing to provide the services required for the development of local-resolution NHD in the State of Indiana watersheds subject to the terms and conditions provided by the State. AECOM tentatively agrees to the terms and conditions set forth in RFP-10-47 including, but not limited to, the State's mandatory contract clauses outlined in section 2.3.5. Provisions to the State's non-mandatory contract clauses have also been included in section 1.5 of this proposal.

As requested in section 2.2.3 of the RFP, this transmittal letter has been signed by a representative of AECOM who is authorized to commit AECOM contractually with the State and who can certify that the information provided in section 2.3.4 is accurate. Documentation of such authority has been included in section 1.8 of this proposal.

As requested in section 2.2.4 of the RFP, AECOM prefers to be contacted via the email address of the Principal Contact listed below.

As requested in section 1.7 of the RFP, this proposal has been printed on recycled paper. We have exceeded the RFP requirement by using 50% post-consumer recycled content paper for the body of this document and 100% post-consumer recycled content paper for the cover and divider tabs.

AECOM understands that the information contained in this proposal is considered public information under the Access to Public Records Act (APRA), IC 5-14-3 *et seq,* and that a purpose must be included if statutory exemptions are requested. **We respectfully request that the Indiana Department of Administration consider Section 2.4 (Technical Proposal) of this proposal to be confidential information under the following exemption:**

"Records that are intra-agency or interagency advisory or deliberative material, including material developed by a private contractor under a contract with a public agency, that are expressions of opinion or are of a speculative nature, and that are communicated for the purpose of decision making"
http://sunshinereview.org/index.php/Indiana_Access_to_Public_Records_Act#Must_a_purpose_be_stated.3F

We look forward to the opportunity to discuss our approach for the development of local-resolution NHD for State of Indiana watersheds and answer your questions in person.

Sincerely,

Scott K. Edelman, P.E.
National Director

Principal Contact:

Zsolt Nagy, GISP, Project Manager

AECOM
3333 Regency Parkway, Suite 120
Cary, NC 27518
919.460.6895 x4224 (Desk)
919.518.4312 (Mobile)
919.460.6896 (Fax)
zsolt.nagy@aecom.com

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Compliance with the RFP

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1. Business Proposal

1.1 General

On the following pages, we will introduce the AECOM project team to the State and provide the information requested in section 2.3 of the RFP, including:

- Company structure (with certificate of authority)
- Company financial information (balance sheets and income statements attached)
- Documentation of the integrity of our company structure and financial reporting
- Contract terms/clauses and provisions
- References from several GIS and hydrology-related projects of similar scope and size as this project
- Registration status with the Indiana Department of Administration (IDOA) and IDOA's Procurement Division
- Authorizing document for contract authority
- Subcontractors and project commitment agreements
- Evidence of financial responsibility
- Facilities and resources for the project team, including AECOM, Cripe Architects + Engineers, and Pinnacle Mapping.

The AECOM project team's experience, capabilities, commitment to serving the client, and local presence make our project team the obvious choice for the State of Indiana's Local-Resolution NHD project.

Experience: Our project team has the skills and experience required to help the State achieve its goal of successfully completing the Indiana Local-Resolution NHD project. Our Project Manager, **Zsolt Nagy**, has first-hand experience in local-resolution NHD creation at the state government level, through his former position as Program Manager at North Carolina's Center for Geographic Information and Analysis (CGIA). Our Principal in Charge, **Todd Frauhiger**, brings 24 years of local water resources experience to the State of Indiana. Our Project Managers from Cripe Architects + Engineers and Pinnacle Mapping have over 20 years of GIS experience, and have successfully completed several mapping projects for the State and local counties.

Capabilities: The AECOM project team has a highly-qualified staff of GIS personnel dedicated to this project, many of whom have previous experience in local resolution NHD creation and conflation, as well as the NHDinGeo schema. Our GIS Lead, **Susan Phelps**, oversaw a project with a similar scope for the State of North Carolina. **Terri McLean**, QA/QC Lead, and senior team members **John Hendricks** and **Peter Perry** also had key roles on the project in North Carolina. All four key team members have attended USGS training for NHD. AECOM's GIS staff, as well as that of our subcontractors, has extensive experience in orthophotography and terrain interpretation for the purpose of mapping hydrography features.

Client Commitment: We pride ourselves on the service we provide to our clients. A reference letter from Tim Johnson, the Director of CGIA and AECOM's client on the NC local-resolution NHD project, has been included for this proposal and attests to the importance we place on client satisfaction. The AECOM project team understands the importance of this project to the State of Indiana and will work closely with the State to ensure the success of Phase I so that future phases of work and funding can be attained.

Local Presence: AECOM has several staff from our Indianapolis office who will be involved with this project. In addition, we are committed to the Buy Indiana initiative and as such, have subcontracted with Cripe Architects + Engineers, and Pinnacle Mapping, to assist with NHD conversion tasks for the project. Additionally, AECOM will be utilizing the services of Prison Enterprises Network (PEN) Products, who will be providing inmates skilled in GIS data development to assist with NHD conversion tasks.

1.2 Respondent's Company Structure

AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including water, environmental, transportation, facilities, and energy. With 45,000 employees around the world, AECOM is a leader in all key markets that it serves. Blending global reach, local knowledge, innovation, and collaborative technical excellence, AECOM delivers solutions that enhance and sustain the world's built, natural and social environments to clients in more than 100 countries.

"AECOM," refers to AECOM Technology Corporation and its consolidated subsidiaries; it was established in Delaware in 1980. AECOM Technical Services, Inc. represents North America operations and was incorporated in California in 1970 (see certificate of authority on page 1-4). It is the legal name under which any contracts with the State will be held.

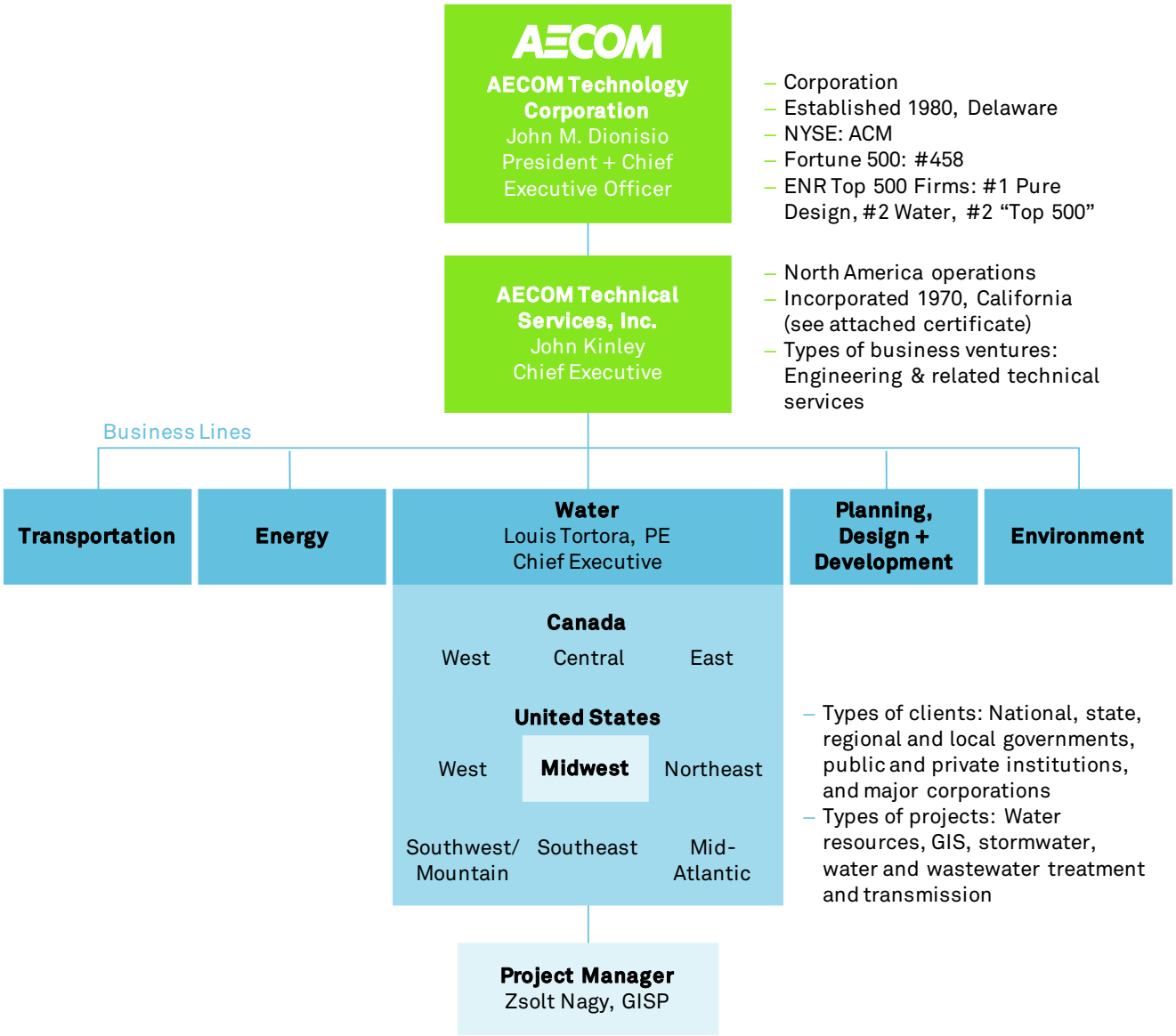
AECOM has defined five business lines within the organization in order to provide focused service to our clients:

- Water
- Transportation
- Energy
- Planning, Design, + Development
- Environment

AECOM Water professionals have roots in CTE, Earth Tech, Metcalf + Eddy, ENSR, Watershed Concepts, STS, Boyle, TCB, and UMA. AECOM Water has integrated these talents and resources to provide valued-added services for our clients regardless of the challenge or the size of the project. With thousands of water professionals in the US, AECOM Water is ranked among the top three firms providing water services nationwide.

Our clients include national, state, regional and local governments, public and private institutions, and major corporations. We excel at a wide range of projects, including water resources, GIS, stormwater, water and wastewater treatment, and water and wastewater transmission.

The chart on the facing page illustrates the organization of our firm's legal entities, business lines, and geographical segments, as well as relevant details requested in the RFP.


AECOM
AECOM Technology Corporation
John M. Dionisio
President + Chief Executive Officer
– Corporation
– Established 1980, Delaware
– NYSE: ACM
– Fortune 500: #458
– ENR Top 500 Firms: #1 Pure Design, #2 Water, #2 "Top 500"
AECOM Technical Services, Inc.
John Kinley
Chief Executive
– North America operations
– Incorporated 1970, California (see attached certificate)
– Types of business ventures: Engineering & related technical services
Business Lines
Transportation
Energy
Water
Louis Tortora, PE
Chief Executive
Planning, Design + Development
Environment
Canada
West
Central
East
United States
West
Midwest
Northeast
Southwest/ Mountain
Southeast
Mid-Atlantic
– Types of clients: National, state, regional and local governments, public and private institutions, and major corporations
– Types of projects: Water resources, GIS, stormwater, water and wastewater treatment and transmission
Project Manager
Zsolt Nagy, GISP

Certificate of Authority

State of California
Secretary of State

CERTIFICATE OF STATUS

ENTITY NAME:

AECOM TECHNICAL SERVICES, INC.

FILE NUMBER:	C0608461
FORMATION DATE:	09/29/1970
TYPE:	DOMESTIC CORPORATION
JURISDICTION:	CALIFORNIA
STATUS:	ACTIVE (GOOD STANDING)

I, DEBRA BOWEN, Secretary of State of the State of California, hereby certify:

The records of this office indicate the entity is authorized to exercise all of its powers, rights and privileges in the State of California.

No information is available from this office regarding the financial condition, business activities or practices of the entity.

IN WITNESS WHEREOF, I execute this certificate and affix the Great Seal of the State of California this day of July 27, 2009.

DEBRA BOWEN
Secretary of State

NP-25 (REV 1/2007)

OSP 06 9973 SCH

1.3 Company Financial Information

"AECOM," refers to AECOM Technology Corporation and its consolidated subsidiaries. AECOM offers services through two business segments: Professional Technical Services (PTS) and Management Support Services. AECOM Technology Services, Inc. (ATS), the legal name under which any contracts with the State will be held, falls under the PTS segment.

Publicly traded on the New York Stock Exchange and a *Fortune 500* company, AECOM serves clients in more than 100 countries and had revenue of $6.1 billion during its fiscal year 2009. Our PTS segment contributed $5.0 billion, or 83% of our fiscal 2009 revenue.

AECOM Technology Corporation files consolidated audited financial statements with the SEC annually. Balance sheets and income statements for fiscal years 2008 and 2009 are included on the following four pages. Full financial statements are included in Section 1.12, Supporting Legal & Financial Documentation.

AECOM Balance Sheet: FY2009

AECOM Technology Corporation

Consolidated Balance Sheets

(In thousands, except share data)

	September 30, 2009	September 30, 2008
ASSETS		
CURRENT ASSETS:		
Cash and cash equivalents	$ 263,489	$ 173,471
Cash in consolidated joint ventures	27,288	23,651
Total cash and cash equivalents	290,777	197,122
Marketable securities	—	81,449
Accounts receivable—net	1,732,959	1,637,614
Prepaid expenses and other current assets	82,195	74,543
Current assets held for sale	74,527	93,403
Income taxes receivable		1,599
Deferred tax assets—net	34,077	30,620
TOTAL CURRENT ASSETS	2,214,535	2,116,350
PROPERTY AND EQUIPMENT—NET	228,835	223,217
DEFERRED TAX ASSETS—NET	91,139	45,886
INVESTMENTS IN UNCONSOLIDATED JOINT VENTURES	34,505	46,432
GOODWILL	1,062,919	949,089
INTANGIBLE ASSETS—NET	61,979	80,297
OTHER NON-CURRENT ASSETS	95,969	134,919
TOTAL ASSETS	$ 3,789,881	$ 3,596,190
LIABILITIES AND STOCKHOLDERS' EQUITY		
CURRENT LIABILITIES:		
Short-term debt	$ 13,268	$ 7,898
Accounts payable	401,239	397,063
Accrued expenses and other current liabilities	722,531	643,693
Billings in excess of costs on uncompleted contracts	333,952	296,910
Income taxes payable	19,585	18,944
Current liabilities held for sale	50,325	63,834
Current portion of long-term debt	15,839	24,137
TOTAL CURRENT LIABILITIES	1,556,739	1,452,479
OTHER LONG-TERM LIABILITIES	336,635	334,694
LONG-TERM DEBT	142,102	365,974
TOTAL LIABILITIES	2,035,476	2,153,147
MINORITY INTEREST	24,687	20,050
STOCKHOLDERS' EQUITY:		
Convertible preferred stock—authorized, 7,799,780; issued and outstanding, 25,130 and 26,423 shares as of September 30, 2009 and 2008; respectively, $100 liquidation preference value	2,513	2,642
Common stock—authorized, 150,000,000 shares of $0.01 par value; issued and outstanding, 110,890,075 and 102,983,378 shares, as of September 30, 2009 and 2008, respectively	1,109	1,030
Preferred stock, Class C—authorized, 200 shares; issued and outstanding, 56 and 69 shares as of September 30, 2009 and 2008, respectively; no par value, $1.00 liquidation preference value	—	—
Preferred stock, Class E—authorized, 20 shares; issued and outstanding, 5 and 10 shares as of September 30, 2009 and 2008, respectively; no par value, $1.00 liquidation preference value	—	—
Additional paid-in capital	1,458,326	1,309,493
Accumulated other comprehensive loss	(146,575)	(111,549)
Retained earnings	414,345	221,377
TOTAL STOCKHOLDERS' EQUITY	1,729,718	1,422,993
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	$ 3,789,881	$ 3,596,190

See accompanying Notes to Consolidated Financial Statements.

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AECOM Income Statement: FY2009

AECOM Technology Corporation

Consolidated Statements of Income

(in thousands, except per share data)

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
Revenue	$ 6,119,465	$ 5,194,682	$ 4,237,270
Cost of revenue	5,768,262	4,907,784	4,039,317
Gross profit	351,203	286,898	197,953
Equity in earnings of joint ventures	22,557	22,191	11,828
General and administrative expenses	86,894	70,582	53,842
Income from operations	286,866	238,507	155,939
Minority interest in share of earnings	14,182	13,390	16,404
Gain on sale of equity investment			11,286
Other income (expense)	1,713	(3,438)	—
Interest (expense) income, net	(10,691)	1,336	(3,321)
Income from continuing operations before income tax expense	263,706	223,015	147,500
Income tax expense	77,002	76,493	47,203
Income from continuing operations	186,704	146,522	100,297
Discontinued operations, net of tax	2,992	704	—
Net income	$ 189,696	$ 147,226	$ 100,297
Net income allocation:			
Preferred stock dividend	$ 139	$ 168	$ 249
Net income available for common stockholders	189,557	147,058	100,048
Net income	$ 189,696	$ 147,226	$ 100,297
Net income per share:			
Basic			
Continuing operations	$ 1.73	$ 1.44	$ 1.37
Discontinued operations	0.03	0.01	
	$ 1.76	$ 1.45	$ 1.37
Diluted			
Continuing operations	$ 1.70	$ 1.41	$ 1.15
Discontinued operations	0.03		
	$ 1.73	$ 1.41	$ 1.15
Weighted average shares outstanding:			
Basic	108,003	101,456	73,091
Diluted	109,706	104,215	87,537

See accompanying Notes to Consolidated Financial Statements.

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AECOM Balance Sheet: FY2008

AECOM Technology Corporation

Consolidated Balance Sheets

(in thousands, except share data)

	September 30, 2008	September 30, 2007
ASSETS		
CURRENT ASSETS:		
Cash and cash equivalents	$ 170,871	$ 180,339
Cash in consolidated joint ventures	23,651	36,572
Total cash and cash equivalents	194,522	216,911
Marketable securities	81,449	200,783
Accounts receivable—net	1,638,814	1,091,682
Prepaid expenses and other current assets	80,243	67,087
Other current assets held for sale	75,802	—
Deferred tax asset—net	34,420	—
TOTAL CURRENT ASSETS	2,105,250	1,576,463
PROPERTY AND EQUIPMENT—NET	223,017	118,202
DEFERRED TAX ASSETS—NET	45,886	61,594
INVESTMENTS IN UNCONSOLIDATED JOINT VENTURES	46,432	23,551
GOODWILL	949,089	592,233
INTANGIBLE AND OTHER ASSETS—NET	80,297	30,928
OTHER NON-CURRENT ASSETS	146,219	88,850
TOTAL ASSETS	$ 3,596,190	$ 2,491,821
LIABILITIES AND STOCKHOLDERS' EQUITY		
CURRENT LIABILITIES:		
Short-term debt	$ 7,898	$ 1,926
Accounts payable	406,963	228,350
Accrued expenses and other current liabilities	642,693	491,989
Billings in excess of costs on uncompleted contracts	306,610	192,400
Income taxes payable	17,744	42,664
Deferred tax liability—net	—	14,641
Current liabilities held for sale	68,034	—
Current portion of long-term obligations	24,137	6,838
TOTAL CURRENT LIABILITIES	1,474,079	978,808
OTHER LONG-TERM LIABILITIES	282,394	174,253
LONG-TERM DEBT	365,974	39,186
TOTAL LIABILITIES	2,122,447	1,192,247
MINORITY INTEREST	50,750	21,089
STOCKHOLDERS' EQUITY:		
Convertible preferred stock—authorized, 7,799,780; issued and outstanding, 26,423 and 49,779 shares as of September 30, 2008 and 2007; respectively, $100 liquidation preference value	2,642	4,978
Preferred stock, Class C—authorized, 200 shares; issued and outstanding, 69 and 72 shares as of September 30, 2008 and 2007, respectively; no par value, $1.00 liquidation preference value	—	—
Preferred stock, Class E—authorized, 20 shares; issued and outstanding, 5 shares as of September 30, 2008 and 2007, respectively; no par value, $1.00 liquidation preference value	—	—
Common stock—authorized, 150,000,000 shares of $0.01 par value; issued and outstanding, 102,983,378 and 99,061,692 shares, as of September 30, 2008 and 2007, respectively	1,030	991
Additional paid-in capital	1,309,493	1,224,164
Accumulated other comprehensive loss	(111,549)	(26,211)
Retained earnings	221,377	74,563
TOTAL STOCKHOLDERS' EQUITY	1,422,993	1,278,485
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	$ 3,596,190	$ 2,491,821

See accompanying Notes to Consolidated Financial Statements.

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AECOM Income Statement: FY2008

AECOM Technology Corporation

Consolidated Statements of Income

(In thousands, except per share data)

	Fiscal Year Ended		
	September 30, 2008	September 30, 2007	September 30, 2006
Revenue	$ 5,194,482	$ 4,237,270	$ 3,421,492
Cost of revenue (as reclassified)	4,907,286	4,039,317	3,278,430
Gross profit	287,196	197,953	143,062
Equity in earnings of joint ventures	22,192	11,828	6,554
General and administrative expenses (as reclassified)	70,581	53,842	46,207
Income from operations	238,807	155,939	103,409
Minority interest in share of earnings	13,590	16,404	13,924
Gain on sale of equity investment	—	11,286	—
Other expense	(3,438)	—	—
Interest income (expense), net	736	(3,321)	(10,576)
Income from continuing operations before income tax expense	222,515	147,500	78,909
Income tax expense	76,321	47,203	25,223
Income from continuing operations	146,194	100,297	53,686
Discontinued operations, net of tax	1,032	—	—
Net income	$ 147,226	$ 100,297	$ 53,686
Net income allocation:			
Preferred stock dividend	$ 168	$ 249	$ 2,205
Net income available for common stockholders	147,058	100,048	51,481
Net income	$ 147,226	$ 100,297	$ 53,686
Net income per share:			
Basic			
Continuing operations	$ 1.44	$ 1.37	$ 0.94
Discontinued operations	0.01	—	—
	$ 1.45	$ 1.37	$ 0.94
Diluted			
Continuing operations	$ 1.40	$ 1.15	$ 0.74
Discontinued operations	0.01	—	—
	$ 1.41	$ 1.15	$ 0.74
Weighted average shares outstanding:			
Basic	101,456	73,091	54,856
Diluted	104,215	87,537	72,658

See accompanying Notes to Consolidated Financial Statements.

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1.4 Integrity of Company Structure and Financial Reporting

Evidence of AECOM's integrity of company structure and financial reporting is provided within various sections of our FY09 consolidated audited financial statement. Pertinent information from the financial report is included below. The full document can be found in Section 1.12, Supporting Legal & Financial Documentation.

Statements from AECOM's Chief Executive Officer (CEO) and Chief Financial Officer (CFO) regarding the accuracy and completeness of the financial information provided in the report are provided on pages 126-130. In general, these statements attest to the fact that AECOM's CEO and CFO have personally reviewed the FY09 consolidated audited financial statement, and that the information provided within it is accurate and true to the best of their knowledge.

Pages 52-53 of the document include a report written by Ernst & Young LLP, an Independent Registered Public Accounting Firm. This company was hired to perform an independent audit of AECOM Technology Corporation's consolidated balance sheets, statements of income, stockholder's equity and cash flows for fiscal years 2007-2009. The report shows that in Ernst & Young's opinion, AECOM's financial statements accurately represent the financial position of the company.

1.5 Contract Terms/Clauses

As mentioned in the transmittal letter, AECOM understands that the mandatory contract terms are non-negotiable and tentatively agrees to the mandatory clauses set forth by the State in Attachment B, subject to AECOM's corporate approval of the mutually acceptable final contract. The mandatory terms include:

- Authority to Bind Contractor
- Duties of Contractor, Rate of Pay, and Term of Contract
- Compliance with Laws
- Drug-free Workplace Provision and Certification
- Funding Cancellation
- Indemnification
- Governing Laws
- Non-discrimination clause
- Payments
- Penalties/Interest/Attorney's Fees
- Non-collusion and Acceptance
- Information Technology

AECOM has also reviewed the non-mandatory contract clauses in the sample contract, and respectfully requests alternative contract language in reference to these non-mandatory clauses:

- Condition of Payment,
- Continuity of Services,
- Ownership of Documents, and
- Work Standards.

As requested in section 2.3.5 of the RFP, AECOM's provisions for these clauses are included on the following pages.

EXCEPTIONS TO THE SAMPLE CONTRACT

Client	State of Indiana Office of Technology (IOT), Geographic Information Office (GIO)
Service Provider	AECOM Technical Services, Inc. ("AECOM")
Project	Local-Resolution National Hydrography Data (NHD) for the State of Indiana Watersheds
Contract/RFP	Request for Proposal for Professional Services - November 13, 2009, RFP # 10-47 ("RFP")
Date	January 19, 2010

AECOM is in receipt of the Sample Contract, attached to the RFP as its Attachment B. AECOM is requesting the changes to this Sample Contract, as indicated below.

10. Condition of Payment.
All services provided by the Contractor under this Contract must be performed to the State's reasonable satisfaction, ~~as determined at the discretion of the undersigned State representative and~~ in accordance with the care and skill ordinarily exercised by reputable members of the professional engineering community practicing under similar conditions at the same time in the same or similar locality and all applicable federal, state, local laws, ordinances, rules and regulations. The State shall not be required to pay for work found to be unsatisfactory, inconsistent with this Contract or performed in violation of any~~d~~ federal, state or local statute, ordinance, rule or regulation.

12. Continuity of Services.
A. The Contractor recognizes that the service(s) to be performed under this Contract are vital to the State and must be continued without interruption and that, upon Contract expiration, a successor, either the State or another contractor, may continue them. The Contractor agrees to:
1. Furnish phase-in training, and
2. Exercise its ~~best~~ diligent efforts and cooperation to effect an orderly and efficient transition to a successor. […]

C. The Contractor shall allow as many personnel as practicable to remain on the job to help the successor maintain the continuity and consistency of the services required by this Contract. ~~The Contractor also shall disclose necessary personnel records and allow the successor to conduct on-site interviews with these employees. If selected employees are agreeable to the change, the Contractor shall release them at a mutually agreeable date and negotiate transfer of their earned fringe benefits to the successor.~~

32. Ownership of Documents. Please insert the following clauses at the end of this article: The parties hereto agree that all documents, records, maps, drawings, surveys and other work product provided by Contractor are developed specifically for the purposes anticipated in this Agreement. Any use or reuse of such work product by the State for purposes other than specifically anticipated herein shall be at the State's sole risk and with no liability to Contractor.

45. Work Standards. The Contractor shall execute its responsibilities by following and applying at all times the ~~highest~~ professional and technical guidelines and standards ordinarily exercised by reputable members of the professional engineering community practicing under similar conditions at the same time in the same or similar locality. If the State becomes reasonably dissatisfied with the work product of or the working relationship with those individuals assigned to work on this Contract, the State may request in writing the replacement of any or all such individuals, and the Contractor shall grant such request.

AECOM's acceptance of the terms and conditions of the contract with the State, both mandatory and non-mandatory, will be subject to a corporate approval.

1.6 References

Project:
North Carolina Stream Mapping Program

Client:
North Carolina Center for Geographic Information and Analysis (NC CGIA)
20322 Mail Service Center
Raleigh, NC 27699
T: 919.754.6580
F: 919.715.8549

Contact:
Tim Johnson, GISP
Director, CGIA
Office: 919.754.6588
Reference letter from Mr. Johnson included on the following page.

Project:
FEMA Flood Insurance Study Revisions

Client:
Indiana Department of Natural Resources
Division of Water
402 West Washington Street
Room W264
Indianapolis, IN 46204
T: 317.232.4124
F: 317.233.8654

Contact:
Dave Knipe, PE
Water Resources Manager
Office: 317.232.4173

Project:
On-call Services for Indiana Department of Transportation

Client:
Indiana Department of Transportation
100 North Senate Room N642
Indianapolis, IN 46204
T: 317.232.5533
F: 317.232.5144

Contact:
Merril Dougherty, PE
Unit Hydraulic Manager
Office: 317.232.6776

Project:
North Carolina Floodplain Mapping Program

Client:
North Carolina Office of Geospatial & Technology Management
1812 Tillery Place, Suite 105
Raleigh, NC 27604
T: 919.715.5711
F: 919.715.4080

Contact:
Mr. John Dorman
Director, Geospatial and Technology Management
Office: 919.715.5711, Ext. 102

Reference: North Carolina Local-Resolution NHD

State of North Carolina
Office of Information Technology Services
Center for Geographic Information and Analysis

Beverly Eaves Perdue
Governor

Gerald L. Fralick
State Chief Information Officer

January 19, 2010

To Whom It May Concern:

I am pleased to serve as a reference for the work of AECOM on the mapping of local resolution streams and development of the National Hydrography Data (NHD) in North Carolina. During the period of 2005–2007, AECOM performed these professional services under my supervision for the North Carolina Center for Geographic Information and Analysis (CGIA).

AECOM staff worked diligently and successfully created the local resolution stream data set that is now used by federal, state, and local agencies, and the general public. The completed dataset covers nineteen counties in western North Carolina and nearly 8,000 square miles. The database is available on the North Carolina OneMap website at **www.nconemap.com** for public access.

AECOM designed, implemented and populated a custom geodatabase, based on the NHD database schema maintained by the United States Geological Survey (USGS). AECOM worked closely with CGIA and an advisory committee composed of personnel from the USGS, the NC Division of Water Quality, the NC Department of Transportation, and local municipalities and satisfied all stakeholders involved.

The NC Stream Mapping project was a "first of its kind" implementation of new mapping techniques for an area of this size and in creation of NHD tools for the purpose of conflation. Typical of most cutting edge projects, the project team faced several challenges. If it were not for the leadership of Susan Phelps and contributions of all AECOM project staff, we would have been at risk of significant delays and possible cost overruns. Instead, we have a model that will serve us for the long run in completing local resolution NHD for the rest of the state.

AECOM handled all aspects of the project in a professional manner and exceeded project expectations.

Tim Johnson, GISP
Director

P.O. Box 17209, Raleigh, NC 27619-7209
20322 Mail Service Center, Raleigh NC 27699-0322
Telephone: 919-754-6580
An Equal Opportunity/Affirmative Action Employer

1.7 Registration to do Business

AECOM is registered with Indiana's Secretary of State under the legal entity AECOM Technical Services, Inc. and is in good standing (certification number 2010011566304). A copy of the Certificate of Authority and the Business Entity Report provided by the Indiana Secretary Of State are included in Section 1.12, Supporting Legal & Financial Documentation.

AECOM Technical Services, Inc. is also registered with the Indiana Department of Administration's Procurement Division. Our bidder number is 0000023950.

1.8 Authorizing Document

Scott Edelman, the respondent personnel signing the Transmittal Letter, is legally authorized by the organization to commit the organization contractually. Supporting documentation with proof of such authority is provided on the following page.

AECOM TECHNICAL SERVICES, INC.

CERTIFICATE OF ASSISTANT SECRETARY

The undersigned, Edward Benes, hereby certifies that he is now and at all times relevant hereto has been the duly elected and acting Assistant Secretary of AECOM Technical Services, Inc., a California corporation, and that the following resolutions amending the Restated By-Laws of said corporation were duly adopted by Unanimous Action of the Board of Directors of this corporation on November 2, 2009:

> RESOLVED that, Section 3 of Article V of the Restated By-Laws of this Corporation be amended to read as follows:
>
> "Section 3. CONTRACTS, LEGAL INSTRUMENTS, ETC., HOW EXECUTED. Any officer of this corporation holding the title of Senior Vice President or higher, or any other person designated by resolution of the Board of Directors, may execute contracts or other legal instruments on behalf of the corporation or its divisions."

The undersigned does further certify that the foregoing resolution has not been revoked, amended or modified, and is in full force and effect as of the date hereof.

The undersigned does further certify that, Scott K. Edelman is a Senior Vice President of AECOM Technical Services, Inc. and in accordance with Section 3, Article V of the By-Laws of said corporation, Scott K. Edelman may execute contracts or other legal instruments on behalf of the corporation or its divisions.

IN WITNESS WHEREOF, The undersigned has executed this Certificate of Assistant Secretary and has affixed the corporate seal of this corporation this 19th day of January, 2010.

AECOM TECHNICAL SERVICES, INC.

By: _____
Edward Benes, Assistant Secretary

(CORPORATE SEAL)

1.9 Subcontractors

This section identifies the subcontractors included on the AECOM team: Cripe Architects + Engineers (Cripe) and Pinnacle Mapping Technologies, Inc. (Pinnacle).

Cripe Architects + Engineers

Company Information
Paul I. Cripe, Inc. dba Cripe Architects + Engineers
3939 Priority Way South Drive
Suite 400
Indianapolis, Indiana 46420

Additional offices are located in Carmel, Evansville, and Fort Wayne.

Cripe was established in Indiana in 1937 and is an S-corporation.

MWBE Status
Cripe is a certified MBE in the State of Indiana.

Type and Value of Work
Cripe's responsibilities will be to support the GIS data generation for this project—specifically, digitizing streamlines.

Cripe will receive approximately 12% of the contract value. The subcontract value for Phase 1 is approximately $18,480.

Qualifications
Cripe Architects + Engineers has offered its clients GIS services for more than 10 years, creating needs analyses and implementation plans to fit individual communities. Cripe's GIS team uses computer-based tools to map and analyze elements and events by integrating common database operations such as querying and statistical analysis, with the unique visualization and geographical analysis offered by traditional cartography.

Cripe's GIS team has worked on GIS projects around the state of Indiana for State and local agencies including the Indiana Department of Natural Resources, the City of Westfield, the City of Noblesville, Hamilton County, and LaPorte County. Cripe has been voted one of Indiana's Best Places to Work for three years in a row.

Section 1.11.2 provides additional information on Cripe's project experience and staff assigned to this project.

Letter of Agreement
Cripe's letter of agreement to participate in this role on the AECOM team is presented on the following page.

Cripe
Architects + Engineers
Solutions by Design Since 1937
Telephone 317 844 6777
Facsimile 317 706 6464
3939 Priority Way South Drive, Suite 400 Indianapolis, Indiana 46240
www.cripe.biz

January 21, 2010

Zsolt Nagy
Project Manager
AECOM
3333 Regency Parkway, Suite 120
Cary, North Carolina, 27518

Subject: Local Resolution National Hydrography Data for the State of Indiana, Solicitation: RFP 10-47

Dear Mr. Nagy,

This letter is to confirm that Cripe Architects + Engineers is pleased to join the AECOM Team as an exclusive subcontractor for RFP NO. 10-47 Local Resolution National Hydrography Data (NHD) for the State of Indiana.

Cripe Architects + Engineers understands that our role on the team is to support GIS mapping services for NHD data conversion and digitization. Cripe Architects + Engineers will utilize our existing public/private contractual partnership with PEN Products, Prison Enterprise Networks (an organization in the Indiana Department of Corrections) to meet project obligations. We understand our subcontract amount will be a minimum of 12% of the contract value. The subcontract value for Phase 1 is approximately $18,480 (12% of $154,000) based on the anticipated scope of work. We also understand that the amount of funding for the remainder of the state has not yet been secured by the State of Indiana. Cripe Architects + Engineers is ready to begin work on February 22, 2010 and is prepared to provide these services through February 21, 2013.

We look forward to working with you.

Sincerely,

CRIPE ARCHITECTS + ENGINEERS

Fredrick J. Green
President and Chief Operating Officer

PEN Products

Company Information
PEN Products, Prison Enterprises Network, is a division of the Indiana Department of Correction. It was established in 1917 by the Indiana Legislature for the purpose of "...providing useful and stimulating employment to the inmates…" Today, PEN Products employs nearly 2,000 offenders in ten correctional facilities across the state in jobs that range from wood working to clothing production to GIS data development.

MWBE Status
PEN Products does not have MWBE status in the State of Indiana

Type and Value of Work
PEN Products' responsibilities will be to support the GIS data generation for this project—specifically, digitizing streamlines.

As a subcontractor directly to Cripe, PEN Products' share of the work will come from Cripe's approximately 12% of the contract value. The subcontract value for Phase 1 is approximately $18,480.

Qualifications
PEN's GIS facility offers an array of data development services and is supported by outstanding technical capabilities. Located at the Plainfield Correctional Facility, the shop features state-of-the-art GIS technology and a staff familiar with computer aided drafting and mapping software and techniques. PEN strives to make GIS technology accessible by providing high quality data at or below market rates. Furthermore, Indiana Code facilitates the use of PEN Products by other government departments, resulting in a streamlined department-to-department contracting process.

PEN Products' GIS team has worked on GIS projects around the state of Indiana, including:

- Indiana Department of Natural Resources Federal Insurance Rate Mapping (FIRM) Conversion
- LaPorte County, Indiana Land Parcel Conversion
- Marshall County, Indiana Parcel Conversion

Letter of Agreement
PEN Products has an existing agreement with Cripe to work on a variety of projects.

Pinnacle Mapping Technologies, Inc.

Company Information
Pinnacle Mapping
Technologies, Inc.
8021 Knue Road, Suite 113
Indianapolis, IN 46250

Additional regional sales offices are located in Palm Beach, Florida and Albuquerque, New Mexico.

Pinnacle Mapping was established as a C-Corporation in the State of Indiana in 2002.

Pinnacle Mapping was formed as a result of an acquisition of another company's Indianapolis assets – that company's name was MD Atlantic Technologies, established in 1961. Pinnacle Mapping bought MDAT's Indianapolis Office and opened it in 1989.

MWBE Status
Pinnacle is a certified woman-owned, veteran-owned small business.

Type and Value of Work
Pinnacle's responsibilities will be to support the GIS data generation for this project—specifically, digitizing streamlines for the purposes of IndianaMap and the National Hydrography Dataset (NHD), acceptable to the USGS standards

Pinnacle will receive a minimum of 12% of the contract value. The subcontract value for Phase 1 is approximately $18,480.

Qualifications
Pinnacle Mapping Technologies, Inc. (Pinnacle) is a certified woman-owned, veteran-owned small business with its headquarters and production office in Indianapolis, Indiana. Pinnacle has offered professional services since its incorporation nearly 8 years ago. Pinnacle experts provide services in GIS consulting and development, Independent Quality Control and Quality Assurances, and Aerial Photogrammetry and Photogrammetric Mapping. This includes working with Digital Elevation Models, Digtial Terrain Models, Topographic and Planimetric Mapping, and Digital Orthoimagery.

Pinnacle's team has worked on GIS and Photogrammetric projects for numerous state and local government agencies including the Indiana Department of Homeland Security, Virginia Geographic Information Network (VGIN), and Jasper County IN, among others. Pinnacle's federal client list includes USGS, USDA, NOAA, and BLM.

Pinnacle employs a highly qualified staff including two ASPRS Certified Photogrammetrists, experienced Stereoplotter Compilers, Digital Orthophoto Specialists, Digital Cartographers, and GIS Analysts. These professionals bring between 10 and 30 years of industry experience with Pinnacle and other mapping companies. All aerial mapping work is supervised by a Certified Photogrammetrist and every project has a designated Project Manager assigned.

Pinnacle is a corporate member of the American Society for Photogrammetry and Remote Sensing (ASPRS) and the Urban and Regional Information Systems Association (URISA).

Pinnacle has all the equipment and software necessary to perform the services on the NHD project, including the following:

- 4 Orthophoto workstations: Z/I Imaging OrthoPro software, INPHO's OrthoVista software, IRAS-C software, PhotoShop, Geomedia, LizardTech MrSID
- 3 Graphic edit/GIS Workstation: ArcGIS 9 (Desktop & Workstation), MicroStation, MGE, AutoCAD, Geomedia, MapInfo
- 1 HP Designjet 1050-C Plus Plotter

Section 1.11.2 provides additional information on Pinnacle's project experience and staff assigned to this project.

Letter of Agreement
Pinnacle's letter of agreement to participate in this role on the AECOM team is presented on the following page.

PINNACLE MAPPING TECHNOLOGIES, INC.

8021 Knue Road
Suite 113
Indianapolis, IN 46250
(317) 585-2011 phone
(317) 585-2014 fax
www.pinnaclemapping.com

January 21, 2010

Zsolt Nagy
Project Manager
AECOM
3333 Regency Parkway, Suite 120
Cary, North Carolina 27518

Subject: Local Resolution National Hydrography Data for the State of Indiana, Solicitation: RFP 10-47

Dear Mr. Nagy,

This letter is to confirm that Pinnacle Mapping Technologies, Inc. is pleased to join the AECOM Team as an exclusive subcontractor for RFP NO. 10-47 ***Local Resolution National Hydrography Data (NHD)*** for the State of Indiana.

Pinnacle understands that our role on the team is to support GIS mapping services for NHD data conversion and digitization. We understand our subcontract amount will be a minimum of 12% of the contract value. The subcontract value for Phase 1 is approximately $18,480 (12% of $154,000). We also understand that the amount of funding for the remainder of the state has not yet been secured by the State of Indiana. Pinnacle is ready to begin work on February 22, 2010 and prepared to provide these services through February 21, 2013.

We look forward to working with you.

Sincerely,

Ryan M. King
Regional Business Development Manager
8021 Knue Road, Suite 113
Indianapolis, IN 46250

O: 317-585-2011
C: 317-509-5619
F: 317-585-2014

1.10 Evidence of Financial Responsibility

AECOM understands that evidence of financial responsibility is a requirement of this project, and must be provided for each task order awarded by the State. Within 10 days of contract award, AECOM will provide a payment to the Indiana Department of Administration in the amount of 5% of the Phase 1 project total. A performance bond will be placed with Federal Insurance Company (Chubb) as the Surety. The bond will remain in effect for the full term of the contract, and will be renewed in the amount of 5% of each new task order awarded by the State.

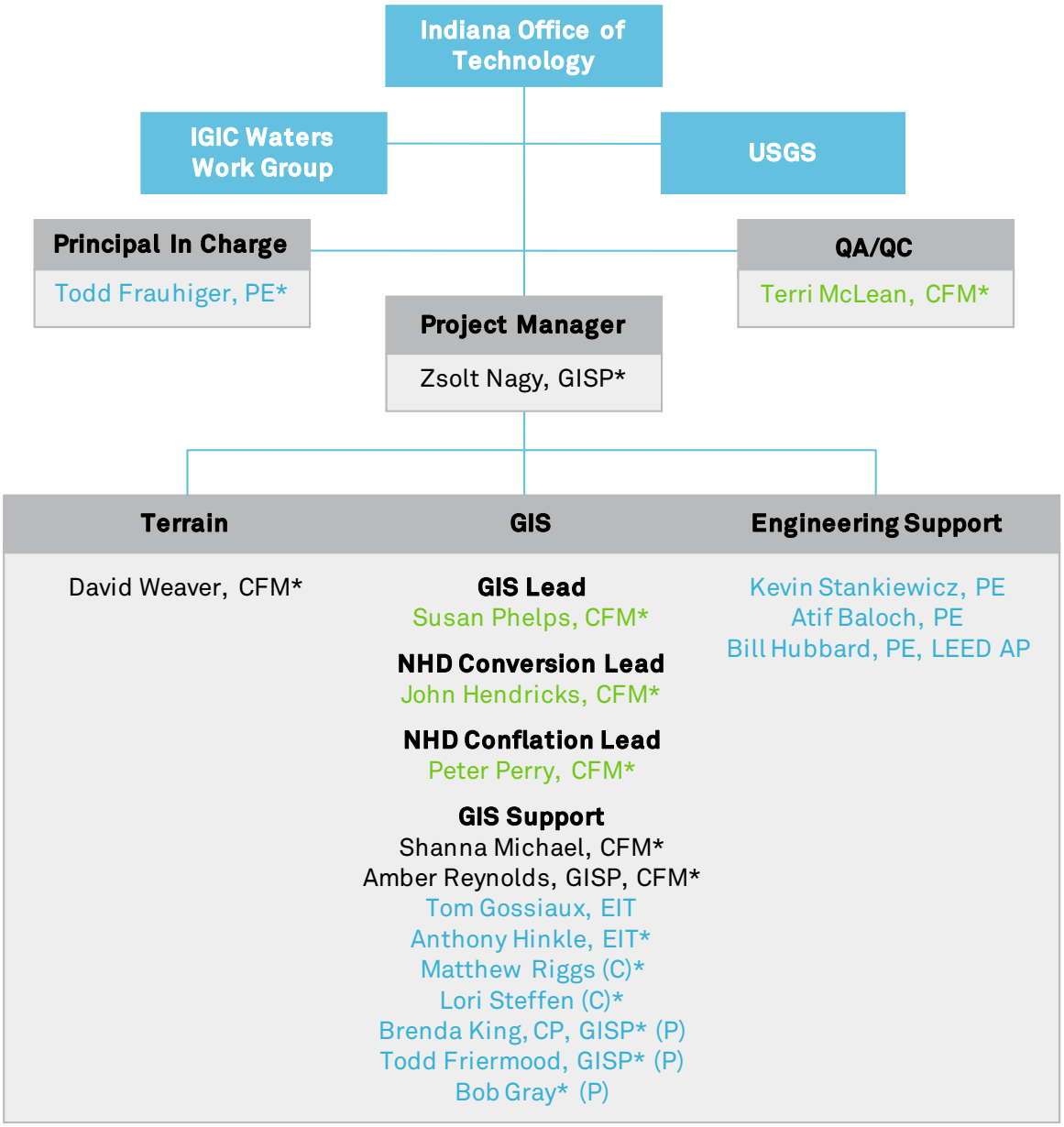
1.11 Facilities and Resources

The AECOM team has significant resources that would be advantageous to the successful provision of the requested products and services. The figure on the following page illustrates the overall organization of the AECOM project team.

Team Organization

Mr. Todd Frauhiger will serve as the Principal in Charge (PIC) for AECOM and will be supported by Mr. Zsolt Nagy as the Project Manager. Team leaders experienced with local resolution NHD production have been assigned for the various phases of the project, including terrain production, NHD conversion, NHD conflation, and QA/QC. Talented GIS staff from Cripe and Pinnacle will provide GIS support including digitizing linework. AECOM also has a large supporting staff available to assist with database administration; GIS tasks such as feature modification, attribution and terrain; and technical writing for any documentation required on the project.

The organization chart on the following page highlights the fact that our team has four key staff that have completed USGS training on NHD tools, as well as 11 team members local in Indiana.



Legend
All staff are AECOM unless otherwise noted:
(C) Cripe Architects + Engineers
(P) Pinnacle Mapping Technologies, Inc.

Local staff in Indiana
Trained in NHD tools
* Resume included in Section 1.11

1.11.1 AECOM Information

AECOM Technical Services, Inc. is the prime respondent for the Development of Local-Resolution NHD for State of Indiana Watersheds Project.

AECOM Water professionals have roots in CTE, Earth Tech, Metcalf + Eddy, ENSR, Watershed Concepts, STS, Boyle, TCB, and UMA. AECOM Water has integrated these talents and resources to provide valued-added services for our clients regardless of the challenge or the size of the project. Additionally, our GIS practice is skilled in a range of geospatial projects. Our GIS professionals use industry standard products to deliver cost-effective solutions for our clients, from a single stand-alone desktop to one of the largest enterprise GIS implementations in the world. Our service lines include custom geospatial solutions for desktop, Web, mobile and enterprise platforms tailored to meet our clients' business processes. AECOM's staff is dedicated to helping our clients use spatial and non-spatial data more efficiently to address their real-world challenges.

We bring a specialized expertise in NHD from our previous successful completion of a large-scale project that key team members completed for the State of North Carolina. Our proposed project manager, Zsolt Nagy, brings significant project management and oversight of NHD and stream mapping projects at CGIA over two decades. Key AECOM staff also completed a pilot project for Indiana Local-Resolution NHD several months ago.

The following sections outline the qualifications, experience, and resources that AECOM will bring to this project to ensure its success.

Proof of Current Professional Licensure and Certification

AECOM is licensed in the State of Indiana to provide engineering services.

AECOM is currently implementing the ISO 9001:2000 compliance standards company-wide. To achieve this certification, AECOM is developing written policies and procedures that govern a Quality Management System (QMS). This QMS is based on the system in place at the former Metcalf + Eddy (now AECOM), which was ISO-certified. The AECOM Design business line also currently maintains an ISO-certified quality program called "AECOM Design Excellence".

Throughout our 60+-year history, we have fine-tuned our firm's quality assurance plan to best suit the needs of our clients. Following this plan, we will establish, monitor, assess, and maintain quality of contract deliverables for this project. Upon ISO-certification firm-wide, AECOM will continue to demonstrate through audits and reporting that the QMS is followed to maintain certification. The principles of AECOM's QMS emphasize the importance of understanding client needs and preferences, and striving to meet or exceed requirements and expectations.

Project Team Training: NHD Tool Training

When the project commences on February 22nd, 2010, AECOM will be able to start work on the project immediately, without delay or interruption to the schedule outlined by the State of Indiana, because of our prior training and experience.

From our previous experience in local-resolution NHD creation in North Carolina, we realized that USGS NHD training would be necessary to better serve future clients. For this reason, AECOM sent four key staff members, all of whom are assigned to this project, to NHD tool training at the USGS facilities in Rolla, Missouri. In January and February 2009, Susan Phelps, Terri McLean, John Hendricks, and Peter Perry attended three-day NHDGeoEdit and NHDGeoConflate tool training sessions. AECOM also sent Susan Phelps and John Hendricks to the NHD Stewardship conference in April 2009 to learn about the challenges and progress of NHD creation across the nation.

If awarded the project, AECOM will send available project employees to refresher training as soon as USGS training schedules allow. When the project commences on February 22nd, 2010, AECOM will be able to start work on the project immediately, without delay or interruption to the schedule outlined by the State of Indiana.

AECOM Project Team

The project team assembled for the Local-Resolution NHD model project includes skilled and experienced professionals in all areas of expertise required for this contract. AECOM's approach to project management is based on a strong project manager directing the firm's resources in a coordinated manner. The team organization concept is structured so it recognizes and takes advantage of technical expertise of specific team

members, helping to identify the most highly-qualified individuals to perform the appropriate procedures. The success of this project is contingent upon building quality and accuracy into every part of the process. Providing the necessary training of GIS staff is critical to AECOM's operations. The approach to training involves, but is not limited to, the following methods:

- Training in the QA/QC plan and processes
- Ongoing software training, including USGS NHD tools
- Evaluating and applying lessons learned from previous projects
- Project team meetings with the State Project Team and USGS to review specifications
- Internal project team meetings to review specifications

Above all else, thorough reviews of the data and continuous feedback on the project team's performance will ensure that the data generated during this project meets USGS' NHD standards and successfully loads into the National NHD Database.

Qualifications and Experience of AECOM Staff Assigned to this Project, and Project Responsibilities

Principal In Charge, Mr. Todd Frauhiger, PE– As the Principal in Charge, Mr. Frauhiger will be responsible for finalizing all contract negotiations with the State of Indiana, and providing senior leadership to the management team. Mr. Frauhiger brings over 24 years of water resources experience to this project, and has the local knowledge needed to ensure this project's success. He will be responsible for ensuring that project schedule, budget, and quality requirements are met.

Project Manager, Mr. Zsolt Nagy, GISP – Mr. Nagy will be the single point of contact with the State. He will be responsible for the step-by-step development, execution, quality control and delivery of the project. Mr. Nagy has 25 years of professional public sector experience in the development, management, and application of GIS. For several stream mapping projects at CGIA, he coordinated closely with the USGS, including on the creation of statewide NHD and related tools. He will also be the direct contact for subcontractors. Additional Project Manager responsibilities include:

- Attending regularly scheduled meetings
- Providing technical direction
- Final review of all documents and deliverables before submission to the State, including making sure that all quality standards have been implemented
- Facilitating access to necessary project resources
- Managing and where possible eliminating risks to successful project administration
- Managing the project team, schedule, resources, and budgets
- Reviewing and submitting the monthly status reports
- Preparing Invoices

GIS Manager, Ms. Susan Phelps, CFM – Ms. Phelps will oversee all GIS efforts on the project, including NHD conversion, NHD conflation, and support tasks, and will lead technical training for the team's subcontractors. She will perform reviews and provide feedback to the subcontractors as needed. Ms. Phelps will report any problems related to GIS production directly to the Project Manager. Ms. Phelps has over 10 years of GIS knowledge, and extensive project management experience. She led AECOM's recent pilot project for Indiana Local-Resolution NHD. Her experience also includes coordinating and supervising the production of local resolution NHD for the State of North Carolina, and she has completed USGS training on NHD.

QA/QC Lead, Ms. Terri McLean, CFM – Ms. McLean will serve as the QA/QC Lead for the project. She will coordinate closely with the Project Manager and Technical Lead to ensure that the QA/QC Plan is being followed and that project deliverables meet USGS' requirements for the creation of local resolution NHD. Ms. McLean will oversee implementation, delegation, and execution of internal and

independent QC reviews and will verify these reviews are conducted by qualified team members. She brings extensive experience as a QA/QC Lead on various other GIS and water resources projects. Additionally, she had key roles on the Local-Resolution NHD pilot project for Indiana and the previously completed NC project. She has successfully completed USGS training on NHD.

NHD Conversion Lead, Mr. John Hendricks, CFM – Mr. Hendricks will be responsible for the direction of the NHD production team staff. This includes overseeing the GIS staff efforts to edit existing NHD features and create new NHD features, as well as preparing of the data for conflation efforts. He has 9 years of experience in GIS and terrain data development, including 3 years of experience in creating local resolution NHD for the State of North Carolina. He has also successfully completed the USGS training program on NHD.

NHD Conflation Lead, Mr. Peter Perry, CFM – Mr. Perry will oversee the conflation of the 1:24,000 scale NHD to the local-resolution NHD and attribution of the new NHD features, as well as determining an appropriate workflow for the project. He has 12 years of experience in GIS and terrain data development, including 3 years of experience in attributing local resolution NHD for the State of North Carolina and significant contributions to the Indiana pilot project. Mr. Perry has also successfully completed the USGS training program on NHD.

Terrain Lead, Mr. David Weaver – Mr. Weaver will be responsible for the acquisition and use of the statewide terrain data, including DEMs and contours, from the State. He will also be responsible for overseeing the creation of 6-acre drainage basins for the project. Mr. Weaver has 10 years of experience in GIS and terrain data development, and has managed the production of a statewide, hydro-correct LIDAR terrain dataset as well as other statewide terrain projects.

GIS Support Staff – The AECOM GIS staff assigned to the Local-Resolution NHD Model Project consists of qualified individuals that will assist in the creation of local resolution NHD. These staff members will be responsible for data conversion and conflation processes, and QA/QC of the resulting data. Experienced and capable GIS staff from Cripe Architects + Engineers as well as PEN Products and Pinnacle will also assist in the creation of the local-resolution hydrography.

Engineering Support Staff – The AECOM engineering support staff assigned to the Local-Resolution NHD Model Project generate 6-acre basins and will provide crucial reviews. They are all located in Indiana and bring extensive local knowledge to the team. They have varying project experience across the state, including GIS tasks.

Resumes of Key Project Team Members
AECOM project team resumes begin on the following page.

Todd Frauhiger, PE
Principal In Charge

Mr. Frauhiger brings over 24 years of water resources experience and has the local knowledge needed to ensure this project's success.

Professional History
Years of Experience: 24

AECOM
1994 – Present
Associate Vice President

Location: Indianapolis, IN

Certification
Professional Engineer – IN

Academic Training
B.S., 1986, Civil & Environmental Engineering, Purdue University

Affiliations
Indiana Water Resources Association

American Society of Civil Engineers

Indiana Association of Stormwater and Floodplain Managers – Charter Member, Stormwater Committee

Mr. Frauhiger brings 24 years of experience managing a variety of large- and small-scale projects in Indiana, including coordination with various agencies and local stakeholders. He formed and directed the activities of the Utility Coordination Council, the goal of which was to improve the coordination between utilities and INDOT. Many of the suggestions recommended by the council were implemented by the utility coordination group at INDOT.

Prior to joining AECOM, Mr. Frauhiger was employed for 8 years at INDOT, where he worked in both the Hydraulic and Utility Coordination sections. His tenure at INDOT resulted in numerous projects which utilize both local and state funding resources to make the projects economically possible.

Project History

Indiana DNR Floodplain Delineation and Mapping Project, City of Brazil, IN. Project Manager responsible for supervising the hydraulic modeling of a split flow condition through downtown Brazil. Managed the production of flood mapping for the 100-year and 500-year flood events. The Indiana DNR approved the mapping and it is used by city planning to determine building permits in conjunction with the city's participation in the National Flood Insurance Program.

INDOT Utility Coordination, Statewide. Manages and directs the activities of the utility coordination staff for AECOM's ongoing utility coordination services to INDOT. AECOM is currently coordinating more than 130 INDOT projects. Including the current four-year contract, AECOM will have managed the contract for 11 consecutive years.

Mount Comfort Commercial Park, Western Hancock Utilities (Precedent Development), Hancock County, IN. Project Manager for the stormwater management system for a 152-acre industrial development. Supervised the design process, coordinated with local regulatory agencies, and conducted public meetings to explain the project to various concerned citizens groups. Made all presentations to the regulatory agencies and received all approvals required to complete the project. Final project resulted in decreased flooding downstream of the project. Removed 50 acres from a flooding area.

INDOT, Accelerate 465 Interstate Reconstruction/DPW Sanitary Sewer Coordination and Relocation Project, Indianapolis, IN. Project Manager responsible for coordination between the City of Indianapolis and INDOT in all matters related to the City's sanitary sewer facilities for the project duration. All potential conflicts were identified and mitigated, leading to no delays.

Drainage Ordinance, White County, IN. Engineer responsible for writing ordinance. Reviewed all development plans for County Drainage Board and presented reviews at board meetings. Managed QA/QC, worked closely with County engineers.

Zsolt Nagy, GISP
Project Manager

Zsolt Nagy is a proven manager of geospatial projects and brings first-hand experience in local-resolution NHD creation at the state government level.

Professional History
Years of Experience: 28

AECOM
2009 – Present
Project Manager

Location: Cary, NC

Academic Training
B.S., 1981, College of Natural Resource, North Carolina State University

Geographic Information Systems Professional – National

Affiliations
National States Geographic Information Council
- Former President and Board member, 2001 - 2006
- Founding Co-chair of Outreach & Legislative Issues committee
- State Representative for North Carolina from 1999 to 2009
- Corporate Representative

US National Geospatial Advisory Committee:
- Appointed by Secretary of Interior in 2008 to represent state government sector
- Chaired subcommittees on vision statement development and national geospatial policy benefits

National Association of Counties
- GIS Subcommittee Member 2004-2009

Federal Geographic Data Committee
- Cadastral Subcommittee Member Since1998

American Society for Photogrammetry & Remote Sensing, Corporate Representative

MAPPS, Corporate Representative

Mr. Zsolt Nagy is a proven leader in the field of geospatial technologies, with more than 25 years of professional public sector experience in the development, management, and application of GIS. His work in collaborative networks is extensive and transcends numerous local, state, and federal programs and organizations, including member agencies and constituents of the National States Geographic Information Council (NSGIC), National Geospatial Advisory Committee (NGAC), National Digital Information Infrastructure Preservation Partnership (NDIIPP), NC Geographic Information Coordinating Council (GICC), Federal Geographic Data Committee (FGDC), and the NOAA Digital Coast Partnership.

Mr. Nagy was previously the Program Manager for Statewide Geospatial Coordination at the North Carolina Center for Geographic Information and Analysis. He managed or co-led numerous customer service projects at the Center, totaling over $10M in contracts or grants. As Program Manager, he provided executive staff expertise, consultation, and facilitation to members and committees of the North Carolina Geographic Information Coordinating Council and led the Center's Coordination Program. A major focus was on the implementation and evolution of NC OneMap, a concept to operations initiative intended to plan, organize and provide access to geospatial content through spatial data infrastructure. Responsibilities included development and implementation of consensus-based policies, best practices, standards, and efficient cost leveraging mechanisms, in partnership with stakeholders.

In 2005, he implemented a program for leveraging federal assistance dollars with local government, as part of local-state-federal collaboration on NC OneMap. Over a 5-year span, $6M was leveraged among government agencies in 70 counties for contracted aerial imagery products. He played a key role in the successful development of a $12 million award by the NC911 Board for acquisition of statewide imagery in 2009. Mr. Nagy served 6 years as a principal investigator in two Library of Congress grants supporting the interests of U.S. Congress for development of digital geospatial preservation and long term access strategies.

In 2004, Mr. Nagy testified in a congressional hearing on the progress of national geospatial programs held by the U.S. House of Representatives Committee on Government Reform Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census.

Project History

CNMS (Coordinated Needs Management Strategy) Stream Centerline Inventory, FEMA Risk MAP Program, Production & Technical Services, Regions IV, VIII, and IX. 2009 – Ongoing. GIS Specialist – Contributing to the validation of flood study source data in numerous counties for FEMA Region IV. Supporting CNMS for tracking lifecycle of needs, specifying opportunities to capture needs, and proposing methods for their evaluation to inform the planning process for this nationwide program.

Prior to Joining AECOM

NHD Model Development: "A New Surface Waters Data Resource for North Carolina," State of North Carolina, Commonwealth of Virginia, and USGS. 1999 – 2002
Program Manager – Conversion and conflation of 17 river basins in NC and adjacent states – covering approximately 48,000 square miles – from USGS 1:24,000 scale Digital Line Graphs into USGS NHD high resolution. Responsible for deliverables from GIS Project Manager, Analysts and Technicians Facilitated stakeholder meetings; Developed and managed Joint Funding Agreements between departments of the State, Commonwealth of Virginia, and the USGS. Served as Principal Investigator on the USGS Agreement. Program value: $2.3M.

Statewide Geospatial Coordination, NC Center for Geographic Information & Analysis. 2003 – 2009.
Coordination Program Manager – responsible for coordination program involving statewide geospatial activities. Work included program management, contract and grant administration, strategic planning, professional support of Geographic Information Coordinating Council and committees, partnership development; policy analysis, outreach and research. Key involvement in formulating NC OneMap strategy.

Statewide Orthoimagery Acquisition – First and Second Generations, USGS, NC Department of Transportation, NC Department of Environment and Natural Resources. 1993 – 2001.
Project Manager and Principal Investigator – for development and implementation of Joint Funding Agreements on the acquisition and delivery of 1998 statewide infrared orthoimagery and 1993 statewide digital orthoimagery. Both projects included 1 meter resolution and covered approximately 48,000 square miles. Project values: $1.5M and $2M.

Statewide Conversion of Topographic Maps for Hydrography, Transportation, and Boundaries into USGS Digital Line Graphs (DLG), USGS, NC Department of Transportation, NC Department of Environment and Natural Resources, EPA Albemarle–Pamlico Estuarine Study. 1982 – 1999.
Program Manager & Technical Lead – involved in various aspects of USGS Digital Line Graph conversion of USGS topographic analog map layers, including hydrography, transportation, and boundaries. Created the first DLG external to USGS; published professional paper at 1989 ESRI Proceedings on creating 'true' DLGs using Arc/Info. Responsible for GIS Analysts and Technician performance in production operations. Served as Principal Investigator on series of USGS Joint Funding Agreements. Data were incorporated into the USGS National Database. Project value: $2.86M.

National States Geographic Information Council/Digital Coast. 2008 – 2009.
Consultant/Advisor, Representative of NSGIC to NOAA's Digital Coast Partnership. Emphasis on business planning and a pilot project on coastal inundation. The partnership includes other stakeholder associations key to coastal issues and the Digital Coast, an initiative of the NOAA Coastal Services Center to provide data, tools, and training on coastal planning and management. Other partners included National Association of Counties, The Nature Conservancy, The Coastal States Organization, and the Association of State Floodplain Managers.

North Carolina Floodplain Mapping Program, NC. 2001 – 2003.
GIS Coordinator – consulted for development of geographic information (GI) plans and GIS capacity for the Floodplain Mapping Program; developed initial program protocol and practices; negotiated and wrote LIDAR cost share proposal, recruited and maintained partnerships for cost sharing and data exchange with federal, state, and local agencies. Evaluated/developed specifications and issue papers for creation, integration, and management of Digital Flood Insurance Rate Maps.

Database Administration, NC Center for Geographic Information & Analysis. 1991 – 2001.
Database Administrator/ Coordinator– led development and maintenance of the state corporate geographic database and led the coordination program. Managed multi-faceted highway planning project for NCDOT, including collection of 30+ categories of statewide data. Developed land cover/land use classification and water distribution/sanitary sewer content standards. Led several NSDI projects funded by FGDC on standards development and outreach; Represented CGIA, GICC, and the State on GI activities in local, national, and international forums, including North Carolina Sister State partnership events in Germany and Hungary. Supervision (up to 16 analysts and technicians on 2 shifts).

U.S. Department of Commerce, NOAA, Coastal Service Center. 2004 – 2005.
Co-Principal Investigator for Development of National Geospatial Inventory Tool: RAMONA, on behalf of National States Geographic Information Council, NOAA Award No. NA04NOS4730011.

Terri McLean, CFM
QA/QC Lead

Ms. McLean had key roles on the Local-Resolution NHD pilot for Indiana and the previously completed NC Local-Resolution NHD project. She is highly skilled at managing QA/QC tasks.

Professional History
Years of Experience: 10

AECOM
2000 – Present
GIS Manager

Location: Greensboro, NC

Academic Training
B.S., 1999, Geology, Appalachian State University

Certified Floodplain Manager – National

Specialized Training

USGS NHD GeoEdit Tool

USGS NHD Conflation Tool

Terri McLean is a GIS Manager with extensive experience providing engineering technical support and leading QA/QC on a range of projects. Her project experience covers a range of geospatial capabilities: GIS project development, including creation of digital maps, maps of stormwater drainage systems, and maps identifying flood-prone structures; floodplain management, including identification and mapping of flood-prone structures; assembling stormwater inventory data; and field work, including QA/QC of stormwater inventory data and water quality monitoring. Ms. McLean has a background in environmental science, including hydrology and geomorphology. She also has experience creating GIS data sets and is proficient in ArcGIS.

Project History

IN Local-Resolution NHD Pilot – IGIC Waters Workgroup, 2009. GIS Specialist – for development of a pilot project for local-resolution NHD hydrography in Hamilton County, Indiana to address concerns related to horizontal accuracy of hydrography features. Tasks included terrain processing, digitization of streamlines and water bodies using 2005 IndianaMap orthophotography and ISTAR terrain data, comparisons of automated and manual methods used to create hydrography, and a report summarizing the findings.

NC Stream Mapping Program, NC Center for Geographic Information & Analysis – Western NC. 2005 – 2007. External Project Coordinator – for the horizontal placement of streamlines representing streambeds in a 19-county area. This included the design and creation of a custom NHD geodatabase and tools used to create and manage hydrographic data for mapping and hydrologic modeling using geometric networks, routes and related linear events; the management of GIS personnel; and close coordination with the client, as well as state, local, and private organizations.

CNMS (Coordinated Needs Management Strategy), FEMA Risk MAP Program, Production & Technical Services, Regions IV, VIII, and IX. 2009 – Ongoing. GIS Specialist – will contribute to the compilation and validation of flood data in numerous counties for FEMA Region IV. Will be responsible for the compilation of data from several sources including the NSVI, DFIRM databases, and the 24k NHD, and QA/QC. CNMS tracks the lifecycle of needs, specifying opportunities to capture needs, and proposing methods for their evaluation to inform the planning process for this nationwide program.

Stormwater Infrastructure Inventory Project, City of Durham Stormwater Services – Durham, NC. 2000 – 2005. QA/QC Lead – responsible for locating, mapping and recording detailed data for approximately 46,000 stormwater structures. Led the quality assurance and quality control of data received, including work in the field.

David Weaver, CFM
Terrain Technical Director

David Weaver directs AECOM's terrain team and has extensive experience with large seamless terrain models. He frequently compiles NHD data for water resources projects.

Professional History
Years of Experience: 10

AECOM
2000 – Present
Terrain Technical Director

Location: Greensboro, NC

Academic Training

B.S., 1998, Environmental Resources, California University of Pennsylvania

Specialized Training
PSMJ – Project Management

Affiliations
American Society of Photogrammetry and Remote Sensing (ASPRS)

Association of State Floodplain Managers (ASFPM)

Maryland Association of Floodplain and Stormwater Managers (MAFSM)

David Weaver has over 10 years of experience working with terrain data used for water resources projects and directs AECOM's terrain team. He supervises and processes Digital Terrain Models (DTMs) used by H&H modeling. His software skills include: ArcGIS, ArcView, AutoCAD, Microstation, WISE, and WTA. Mr. Weaver works closely with the AECOM Research and Development team to improve software development. His tasks include program testing, technical support, and production procedures.

Project History

Upper Mississippi River System Flood Frequency Study (UMRSFFS), USACE, FEMA – NE, IA, KS, MO, IL, MN, WI. 2006 – 2008.
Terrain Lead – was responsible for topographic data development of the UMRSFFS. FEMA Region VII contracted with USACE to compute a floodway for 1,600 river miles of the Missouri and Mississippi Rivers based on the UMRSFFS 1% probability flood profile in an effort to incorporate the study into countywide flood studies. AECOM compiled the bluff to bluff photogrammetrically derived datasets and built a seamless terrain model of the entire area. Responsibilities included acquisition of the data from USACE, pre-processing the data into a WISE format data type, developing TIN and DEM surface models, and compiling deliverables of the source and output data. A single terrain model will significantly expedite the computation of the floodway for levee protected and unprotected areas.

Terrain Development for Flood Studies & Map Production IDIQs, FEMA Regions IV & VI– Various locations. 2003 – 2009.
Terrain Analyst/Supervisor – was responsible for compiling source terrain data from a variety of local and national data sources, including: NHD, LIDAR, mass point and breaklines, contours, DEMs, and NED datasets. Datasets were prioritized and built into a seamless terrain dataset. He performed hillshade and breakline QC reviews of bare earth DEMs, and performed RMSE analysis on bare earth data.

North Carolina Floodplain Mapping Program – Statewide, North Carolina. 2001 – Ongoing.
Terrain Analyst/Supervisor – supervised/processed DTMs used by H&H modeling. These processes included creation of Triangular Irrregular Networks (TINs) and hydro-enforcement of digital elevation models (DEMs). His responsibilities included: compiling raw and bare earth LIDAR datasets, performing hillshade and breakline quality control reviews of the bare earth DEMs, and performing RMSE analysis on the bare earth data to ensure FEMA and NC specifications were met. Mr. Weaver worked closely with the LIDAR subcontractor to ensure proper workflow. This project is the largest seamless LIDAR dataset in the nation with over 3 terabytes of TIN and DEM data.

Susan Phelps, CFM
GIS Lead

Ms. Phelps led AECOM's recent pilot project for Indiana Local-Resolution NHD, made significant contributions to local-resolution NHD in NC, and has completed USGS training on NHD.

Professional History
Years of Experience: 10

AECOM
2000 – Present
Project Manager

Location: Greensboro, NC

Academic Training
B.A., 2000, Geography, Environmental Science Concentration,
University of North Carolina at Greensboro

Certified Floodplain Manager – National

Specialized Training
USGS NHD GeoEdit Tool

USGS NHD Conflation Tool

PSMJ – Project Management

Affiliations
Association of State Floodplain Managers

North Carolina Floodplain Mapping Association

Carolina Urban & Regional Information Systems Association

North Carolina Arc Users Group

As a GIS Manager, Ms. Phelps oversees GIS and map production, which involves coordinating and training GIS specialists and analysts, implementing QC procedures, and developing mapping standards. She has 10+ years of GIS experience, including four years in project management of GIS-related projects. She has extensive knowledge with GIS data development, including creation of digital data and maps; table attribution; data projection, and acquisition and analysis; floodplain management, including identification and mapping of flood-prone structures; field work; and QA/QC of data.

Project History

IN Local-Resolution NHD Pilot – IGIC Waters Workgroup, 2009.
Pilot Project Manager – coordinated with the IGIC Waters Workgroup on development of a pilot project for local-resolution NHD hydrography in Hamilton County, IN to address concerns related to horizontal accuracy of hydrography features. Included terrain processing, digitization of streamlines and water bodies using 2005 IndianaMap orthophotography and ISTAR terrain data, comparisons of automated and manual methods used to create hydrography, and a pilot report summarizing the findings. Results were provided to the workgroup in June 2009.

NC Stream Mapping Program, NC Center for Geographic Information & Analysis – Western NC. 2005 – 2007.
Internal Project Coordinator – responsibilities included assisting with and overseeing several GIS tasks such as: a horizontal accuracy study; creation of a customized NHD enterprise geodatabase; development of a suite of customized ArcGIS tools; digitization, attribution and QA/QC of surface water features such as streams, lakes and ponds; and point data event creation. This project required close coordination with an advisory committee composed of several state, local and federal agencies and other project stakeholders.

Spatial Analyses Projects, FEMA Risk MAP Program, Production & Technical Services, Regions IV, VIII, IX. 2009 – Ongoing.
Special Projects Manager – directs GIS staff in various projects. The National Flood Risk Analysis uses GIS to overlay various datasets such as flood insurance claims and policies, 1:100,000 scale NHD streams, federal lands, and population and housing unit estimates to determine risk deciles for every county, Census Block Group, HUC 12 watershed and FEMA Community in the nation. This data is frequently used by FEMA regions to prioritize floodplain mapping and allocate funding to areas of greatest need.

GIS Risk Analysis, FEMA Flood Map Modernization, Nationwide. 2003 – 2009.
GIS Manager – managed GIS effort to develop estimated flood risk in the US by relating each of the 211,684 Census block groups in the nation to land use and FEMA flood hazard data. Was highlighted in FEMA 2006 Report to Congress.

John Hendricks, CFM
NHD Conversion Lead

Mr. Hendricks is highly qualified to lead NHD conversion based on his prominent roles in the Indiana Local-Resolution NHD Pilot and the NC local-resolution NHD projects.

Professional History
Years of Experience: 9

AECOM
2004 – Present
GIS Specialist III

Location: Greensboro, NC

Academic Training
B.A., 2000, Geography, University of North Carolina at Greensboro

B.A., 2000, Archeology, University of North Carolina at Greensboro

B.A., 2000, Classical Studies, University of North Carolina at Greensboro

Certified Floodplain Manager – National

Specialized Training
USGS NHD GeoEdit Toolset
USGS NHD GeoConflation Toolset, 2009

Affiliations
North Carolina Floodplain Mapping Association

John Hendricks is a GIS Specialist with 9 years experience in GIS and topographic data development. His focus has been primarily in the area of digital terrain model development and analysis for countywide and regional studies. He has contributed intensive procedural and standard developments for several unique projects. Experience includes: table attribution, data projection, acquisition and analysis, translations, image processing, and GIS training and troubleshooting. Mr. Hendricks has also worked extensively with the LIDAR terrain data for statewide projects. He has been responsible for QA/QC review of over 10,000 square miles of bare earth LIDAR data sets. His GIS software skills include ArcSDE, ArcGIS and extensions, ArcView 3.x, and ARC/INFO.

Project History

IN Local-Resolution NHD Pilot – IGIC Waters Workgroup, 2009.
GIS Specialist – was responsible for creating a local resolution NHD pilot project that meets the general guidelines of 1-meter horizontal accuracy and 6 acre basin upstream limits. Responsibilities included: downloading and preparing for processing the 2005 IndianaMap orthophotography, DEM data and Hamilton County local stream data; processing DEMs to create 6 acre basins; and digitizing streamlines and water bodies up to 6 acre basin limits. Investigated automated processes to increase production speed.

NC Stream Mapping Program, NC Center for Geographic Information & Analysis – Western NC. 2005 – 2007.
GIS Specialist – team was responsible for creating a complete process for this first-in-the-nation project. Responsibilities included: developing a production terrain model for the 19 counties in western NC; assisting in stream digitization; investigating automated and manual forms of digital stream creation; developing business rules for a suite of customized tools; coordinating with internal team members and subcontractors about QA/QC procedures and standards; QA/QC of 570,000+ stream features; creation of a customized geodatabase that could be linked to the NHD; and managing 19 counties of DEM, hillshades, contours, and orthophotography within an ArcSDE production environment. The completed digital surface water feature data set is available on the State of North Carolina Center for Geographic Information and Analysis (CGIA) website for access by federal, state, and local agencies, as well as the general public.

Terrain Development, Flood Insurance Studies IDIQ, FEMA Regions VI & IV – TX, OK, LA. 2004 – 2009.
GIS Specialist – developed DTMs by compiling and processing digital terrain data from a variety of sources, including NHD datasets, LIDAR, IFSAR, photogrammet-rically derived mass points and breaklines, vectorized topographic maps, contours, DEMs, CAD data, and NED data. He integrated source data into seamless terrain models, hydrocorrected DEMs, performed QA/QC, and compiled deliverables.

Peter Perry, CFM
NHD Conflation Lead

Mr. Perry brings specialized expertise in NHD conflation; he created local-resolution NHD for the State of NC over a 3-year span, and recently completed USGS training on NHD tools.

Professional History
Years of Experience: 12

AECOM
2004 – Present
GIS Specialist III

Location: Greensboro, NC

Certification
Certified Floodplain Manager – National

Training
USGS NHD GeoEdit Toolset
USGS NHD GeoConflation toolset 2009

ArcGIS, Geodatabases, and ArcPad, ESRI

Introduction to Scripting with Python

HEC-RAS, Internal training

Affiliations
North Carolina Floodplain Mapping Association

Peter Perry has 12 years of GIS experience, including one year of department management experience with a GIS firm. He brings extensive experience with problem-solving and trouble-shooting in a GIS environment. He brings in-depth knowledge of terrain processing and stream line generation in a 3D environment, utilizing varied source data and software platforms. Experience includes using GIS in utility mapping projects, photogrammetry, floodplain mapping, and parcel mapping, as well as field experience as a land surveyor. He has extensive experience using: ArcGIS 8.1 – 9.x (Map, Catalog, Toolbox, Workstation, and Info), ArcView 3.x, spatial analysis and geoprocessing, Microstation, and Autocad.

Project History

NC Stream Mapping Program, NC Center for Geographic Information & Analysis – Western NC. 2005 – 2007.
GIS Specialist – created local resolution NHD for 19 western NC counties with a horizontal tolerance of + / - 1 meter. He contributed to the migration of the NHD into an ArcSDE environment, and also helped to further refine the scope and resolution of the data down to a local level. The project required extensive database management as well as an in-depth knowledge of the core structure of the NHD database and ArcGIS functionality. Mr. Perry contributed to the creation of business rules for software tool development that facilitated the attribute migration and population of over half a million NHD features.

CNMS (Coordinated Needs Management Strategy), FEMA Risk MAP Program, Production & Technical Services, Regions IV, VIII, and IX. 2009 – Ongoing.
GIS Specialist – contributed to the compilation and validation of flood data in numerous counties for FEMA Region IV. Was responsible for the compilation of data from several sources including the NSVI, DFIRM databases, and the 24k NHD for 42 counties and the QA/QC of portions of Tennessee and North Carolina. Validation of 41 coastal counties in Region IV is currently underway. CNMS tracks the lifecycle of needs, specifying opportunities to capture needs, and proposing methods for their evaluation to inform the planning process for this nationwide program.

Terrain Modeling & Data Development, Flood Insurance Studies & DFIRM Production IDIQs, FEMA Regions IV & VI. 2004 – 2009.
GIS Specialist – developed DTMs for 18 countywide studies. Integrated diversified source data into a seamless terrain model, hydro-corrected DEM data, performed QA/QC to ensure FEMA specifications were met, and compiled a deliverable including source and output data. Also helped develop standards for scoping maps that were used during meetings with local officials; assembled and integrated data in countywide map databases; performed QC on data integrity; and mapped floodplains. He assisted in production and QA/QC of draft and/or preliminary maps in TN, GA, SC, OK, and NM.

Shanna Michael, CFM
GIS Specialist

Ms. Michael is skilled in a wide range of GIS tasks, and is currently working with NHD data in a stream centerline inventory.

Professional History
Years of Experience: 8

AECOM
2004 – Present
GIS Specialist, HAZUS Lead

Location: Kansas City, MO

Academic Training
B.S., 2002, Environmental Science with Geology Emphasis

Geographic Information Systems Certificate, 2006

Coursework, Masters of Public Health with Environmental Health and Emergency Preparedness with Homeland Security – Present

Certified Floodplain Manager – National

40 Hr HAZWOPER – National

HAZUS Trained Professional – National

Affiliations
Association of State Floodplain Managers

Shanna Michael has 8 years of GIS experience, including: GIS product development, project management, spatial data creation, maintenance, and training. She has focused expertise in GIS tools for the production of flood maps and geodatabases, and HAZUS-based risk assessments. Ms. Michael was the technical lead for the first Level 1 and Level 2 HAZUS analysis and reporting completed for an entire FEMA Region, and won the *Innovative Applications Award for HAZUS-MH* from FEMA HQ for the project. Her GIS skills include: ArcGIS, ArcInfo, ArcView, HAZUS, ARC Info Workstation, WISE, geodatabase design, and GPS applications.

Project History

CNMS (Coordinated Needs Management Strategy) Stream Centerline Inventory, FEMA Risk MAP Program, Production & Technical Services, Regions IV, VIII, and IX. 2009 – Ongoing.
GIS Specialist – contributing to the compilation and validation of flood data in numerous counties for FEMA Region IV. Is responsible for the compilation of data from several sources including the NSVI, DFIRM databases, and the 24k NHD. CNMS tracks the lifecycle of needs, specifying opportunities to capture needs, and proposing methods for their evaluation to inform the planning process for this nationwide program.

Situational Awareness Web Tool, FEMA Region 1, Hazard Mitigation Technical Assistance Program (HMTAP) – CT, MA, ME, NH, RI, VT. 2008 – 2009.
GIS Specialist – led HAZUS analysis and reporting for this award-winning project. Performed Level 1 HAZUS analysis at one square mile for all counties in Region 1. Provided floodplain boundaries for counties that didn't have existing digital data. Annualized loss reports were combined by Census block group. This data is being used to create a mitigation and response website for responders to monitor weather and flooding and create reports for high-risk communities and critical facilities.

HAZUS-MH Stream Network Creation, Georgia CTP Flood Map Modernization, GA DNR. 2008.
GIS Analyst – performed HAZUS-MH analysis for stream network creation. Stream networks were run at 1 square mile and 10 square mile density for various scoping projects.

National Mid-Term Levee Database (MLI) & Levee Implementation, FEMA Flood Map Mod National Service Provider, Subcontractor Support, Region VII. 2004 – 2008.
Senior GIS Specialist – assisted in levee implementation by coordinating the National Mid-Term Levee Database (MLI) with regional Provisionally Accredited Levee work; provided GIS support in MLI data collection and maintenance of data; and provided mapping data to states for early map adoption. Coordinated with communities regarding map delivery, status of adoption, questions, and problems.

Amber Reynolds, GISP, CFM
GIS Support

Ms. Reynolds is skilled in relational database development and management, system implementation, and a range of other GIS skills.

Professional History
Years of Experience: 14

AECOM
2007 – Present
GIS Manager

Location: Kansas City, MO

Academic Training
M.A., Ongoing, Geography, University of Kansas

B.A., 1997, Anthropology, University of Kansas

Certifications
Geographic Information Systems Professional – National

Certified Floodplain Manager – National

Kansas GIS Professional

Affiliations
Executive Board, MidAmerica GIS Consortium (MAGIC)

Executive Board, Kansas Association of Mappers

Amber Reynolds is an accomplished GIS professional with 14 years of experience in a variety of disciplines. Her primary emphasis has been on technical system implementation and management, project management, and coordination and collaboration with local, state and federal governments as well as with private industry. Ms. Reynolds technical skills include integrating GIS, web application development and architecture, and relational database development and management. She has expertise the ArcGIS suite of products, including ArcGIS, ArcSDE and ArcIMS, as well as web and map services, ColdFusion, HTML, JavaScript, Oracle, SQL Server and SQL.

Project History

GIS Special Projects, FEMA Flood Map Mod National Service Provider, Subcontractor Support, Nationwide. 2007 – Ongoing.
GIS Manager – managed staff tasked with scoping, data collection, spatial analysis and digital flood insurance rate map production for FEMA Regions IV, VI, VII, VIII and IX. Ms. Reynolds was also responsible for emergency management coordination for FEMA Region VII.

Situational Awareness Web Tool, FEMA Hazard Mitigation Technical Assistance Program (HMTAP), FEMA Region I, New England. 2007 – Ongoing.
Lead Developer – responsible for designing, developing, and implementing a suite of online mapping tools that allows stakeholders within the Region to access critical facility data in the event of a flood disaster. This interactive web-based geospatial application will assist FEMA and New England's emergency managers in preparation and response to riverine flooding events. This tool will help FEMA regional staff as well and state emergency managers in New England have real-time access to spatial and non-spatial data on critical facilities and DFIRM information. It will also improve FEMA situational response and planning with information related to population bases.

Prior to Joining AECOM

Database Design & Online Water Use Reporting System, KS Department of Agriculture/ KS Division of Water Resources. 2003 – 2007.
Web Portal Manager/Lead Developer – entities within Kansas that consume water, which includes municipalities, rural water districts, well owners and farmers totaling 50,000 users, must file an annual water use report with DWR. Traditionally this has been through hardcopy submission, with considerable staff time dedicated to data entry. The Online Water Use Reporting System provided a mechanism for DWR to virtually eliminate staff effort on data entry and standardized the input on the water use forms. She provided the application design, database design, graphical design and layout, management and maintenance of this application using ColdFusion and Oracle.

Anthony Hinkle, EIT
GIS Support

Mr. Hinkle brings a unique combination of GIS skills, civil engineering experience, and vast local knowledge to the project team.

Professional History
Years of Experience: 11

AECOM
2004 – Present
Associate Vice President

Location: Indianapolis, IN

Certification
Engineer in Training – IN

Academic Training
B.S., 1999, Civil Engineering, Environmental Engineering Minor, Rose-Hulman Institute of Technology

Affiliations
American Water Works Association

American Society of Civil Engineers

Mr. Hinkle has 11 years of experience on a variety of large- and small-scale water resources projects in Indiana, including coordination with various agencies and local stakeholders. He is experienced in GIS, as well as sewer and stormwater planning and modeling. He is proficient in the use of in ArcGIS, SWMM, WaterCAD, CulvertMaster, AutoCAD, HEC-HMS, HEC-RAS, Visual ModFlow, MicroStation, and MOUSE.

Project History

Milwaukee Municipal Sewerage District, Illicit Discharge Study and Storm Sewer Utility Mapping– Milwaukee, WI. Project engineer and field technician for generating stormwater utility maps in GIS format and water sampling at stormwater discharge points inspecting for illicit discharge in storm sewer system.

INDOT On-Call Hydraulic Services, Indiana. 2005 – Ongoing. Project engineer for assessment of bridges and culverts along state roads and interstate highways. Has performed hydraulic and hydrologic analysis and design using HY8, HEC-HMS, and WSPRO on projects throughout the state. Contributed to field inspections finding length, slope, size, and channel shape of hydraulic structures. Analyzed hydraulic capacity of existing culverts and bridges and designed replacement structures as needed.

INDOT, Hancock to Madison Counties, IN. 2006. Project manager for engineering assessment of all hydraulic structures (bridges and culverts over 36 inches in diameter) within the existing US 36 right of way from 0.49 miles east of the intersection with SR 13 in Hancock County to the SR 9 intersection. Contributed to determination of the location of structures, visual inspection to determine site characteristics, and collection of preliminary field survey information and photographs.

INDOT, LaGrange County, IN. 2006. Project engineer for engineering assessment of all hydraulic structures within the existing SR 5 right of way from the intersection of SR 5 and US 20 north to the intersection of SR 5 and SR 120.

INDOT, I-70 from Mount Comfort Road to SR 9, Hancock County, Indiana. 2006. Project engineer for engineering assessment of all hydraulic structures within the existing I-70 right of way from 0.50 miles east of the Mount Comfort Road interchange to the SR 9 interchange.

Long Term Combined Sewer Control Plan, Marion, IN. Project engineer and principal SWMM modeler responsible for modeling existing combined sewer capacities for several design storms to estimate CSO discharge to surrounding water sources, estimating future discharges due to development of area, and providing alternatives to substantially reduce CSO discharge in a fiscally responsible manner. Provided a fiscal impact statement for a 20-year planned growth period.

Relevant Project Experience

AECOM has extensive GIS and water resources experience that is relevant to this project. This includes floodplain mapping projects across the US, for which we use NHD data in the scoping/data gathering at the beginning of each project. Detailed information about representative AECOM projects is outlined in the descriptions on the following pages. We meet schedule and budget requirements for the successful completion of tasks.

The projects include:

- Indiana Local-Resolution NHD Pilot
- North Carolina Stream Mapping Program
- Stream Centerline Inventory for Coordinated Needs Management Strategy (CNMS), FEMA Risk MAP Program
- FEMA Flood Insurance Study Revisions, Indiana Department of Natural Resources
- On-call Services for Indiana Department of Transportation
- North Carolina Floodplain Mapping Program

Indiana Local-Resolution National Hydrography Dataset (NHD) Pilot

Client: Indiana Geographic Information Council (IGIC) Waters Workgroup
Location: Hamilton County, Indiana
Duration: May – June 2009
Contract Value: $0

Scope of Services:
- ✓ Creation of NHD-based hydrographic features up to 6 acre drainage limit
- ✓ Comparisons of accuracy standards using automated and manual methods
- ✓ Report of pilot study findings

Performance:
- ✓ N/A (This project did not have a budget)

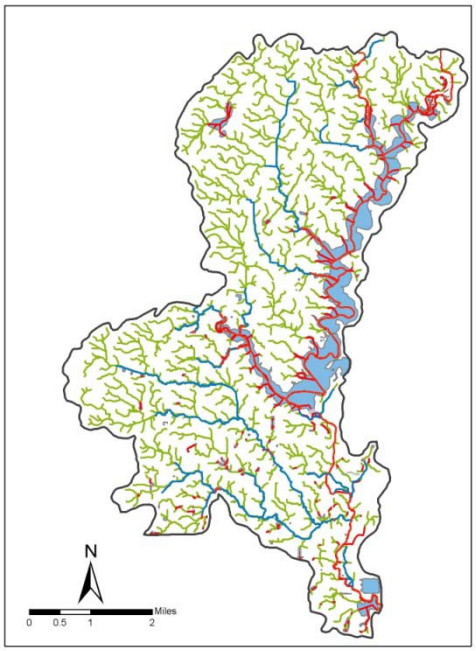
Key Staff:
- ✓ John Hendricks, Susan Phelps, Terri McLean

AECOM conducted a stream mapping pilot study for the State of Indiana to assist with the development of scope and accuracy standards for the Indiana Local-Resolution NHD Project. The pilot provided the IGIC Waters Workgroup with a basis for stream location accuracy and upstream drainage area limit assessments.

Pilot Location: AECOM selected a small watershed in Hamilton County, just north of Indianapolis, as the location for the pilot project. The pilot area included a wide representation of the water features that would be included in the Indiana Local Resolution NHD project, and also offered a basis of comparison to another pilot study completed in the same area in July 2008.

Base Data: AECOM utilized several Geographic Information System (GIS) datasets to locate and digitize hydrographic features for the pilot project. Digital Elevation Models (DEMs) created from ISTAR terrain data and ADS40 imagery, collected for the 2005 IndianaMap Orthophotography Project, were the primary sources of data. Six acre drainage basins and streams, as well as contours and hillshades, were all generated from the ISTAR terrain data, and used as reference layers. A recent stream file created by Hamilton County also provided a basis for stream and water body creation.

Accuracy analysis: AECOM manually digitized water features up to a 6 acre drainage limit and tested two approaches to automating feature extraction, one from the ISTAR terrain data and one from the orthophotography. For the manual approach, Hamilton County's stream shapefile was used as a base source and additional streams were digitized, creating 309 miles of streamlines in the pilot area. The 6-acre streamlines added to the existing 1:24,000 scale NHD are shown in green in the figure below. For the automated approaches, AECOM used ERDAS to extract streams from the 2005 ADS40 imagery and ArcHydro to generate streams from the ISTAR DEM.



AECOM completed a pilot study in Hamilton Co, Indiana to assess local-resolution NHD hydrographic standards.

Findings: AECOM determined that manual digitization of hydrographic features was the best method to utilize for the Indiana Local-Resolution NHD Project. However, because this is not necessarily the most cost-effective method, stream extraction from orthophotography could be effective in areas where streams and water bodies are clearly visible. AECOM also provided a comparison of the six acre streams generated from both pilot projects to show that different software programs will provide very different results and will affect the mileage of streams collected.

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North Carolina Stream Mapping Program

Client: North Carolina Center for Geographic Information & Analysis (CGIA)
Location: Western North Carolina
Duration: 2005 – 2007
Contract Value: $1.9M

Scope of Services:

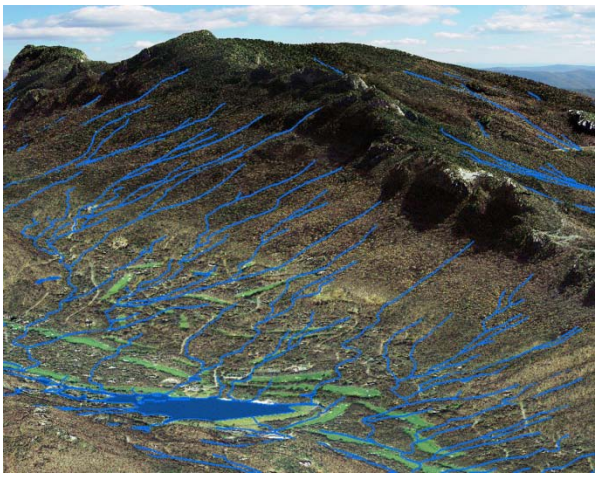
- ✓ Accuracy study report that detailed proposed procedures and established data limitations
- ✓ Custom NHD geodatabase including custom metadata tables, transactional tables, and erosion point event tables
- ✓ Fully attributed, high-resolution data set

Performance:

- ✓ All tasks were within schedule and budget
- ✓ *2008 Honors Award for Engineering Excellence*, from ACEC NC chapter

Key Staff:

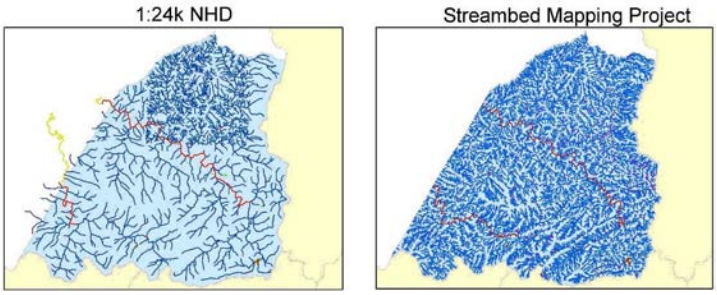
- ✓ Susan Phelps, Terri McLean, John Hendricks, Peter Perry



AECOM worked with the State of North Carolina CGIA to create a digital surface water feature data set that is used by federal, state, and local agencies as well as the general public. The completed data set is now available on the CGIA website, **www.ncstreams.net**, for public access. The data will be updated periodically once it is placed into maintenance status.

Our team designed, implemented and populated a custom geodatabase for CGIA that was based on the NHD database schema maintained by the USGS. Working closely with CGIA and an advisory committee composed of personnel from the USGS, the North Carolina Division of Water Quality, the North Carolina Department of Transportation, and several local municipalities, we created a database that met USGS NHD standards and satisfied the needs of all other North Carolina stakeholders.

Watauga Basin



The resolution is significantly better than the existing 1:24,000-scale NHD surface water data set.

The spatial data set contains surface water features present on the ground up to a six-acre drainage limit, including single line intermittent and perennial streams, double line streams, water bodies greater than or equal to one-quarter acre in size, and artificial paths through water bodies. Base data sources such as the 1:24,000-scale NHD, LIDAR-derived raster and vector products, and high-resolution digital orthophotography were used for horizontal alignment of surface water features.

Project deliverables included:

- Accuracy study report that detailed proposed procedures and established data limitations depending upon best available data sources
- Design and implementation of a custom NHD enterprise geodatabase that included custom metadata tables, relationship classes, domains, transactional tables, and erosion point event tables
- Development of custom ArcGIS desktop extension to aid production, QC and attribution
- A fully attributed, high-resolution data set containing hundreds of thousands of surface water features for 19 counties in western NC
- Extensive documentation that included a requirements specification document, database dictionary, user guide, testing documents and geodatabase entity relationship diagram (ERD)

Stream Centerline Inventory for Coordinated Needs Mapping Strategy

Client: FEMA HQ, Region IV
Location: AL, FL, GA, KY, MS, NC, SC, TN
Duration: 2009 – Ongoing
Contract Value: $137,548

Scope of Services:

- ✓ Created a stream centerline inventory for 421 counties in FEMA Region IV, 300,000+ miles
- ✓ Compiled effective digital DFIRM data and NHD data into a single dataset
- ✓ Populated a series of attributes that will help track New, Validated, or Updated Engineering (NVUE) status for stream centerlines throughout Region IV

Performance:

- ✓ We met client expectations after reviewing and adjusting the project scope under a tight schedule.

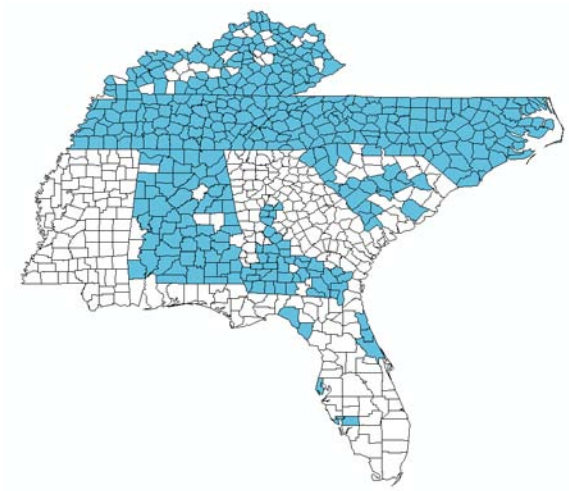
Key Staff:

- ✓ Zsolt Nagy, Terri McLean, Peter Perry, Shanna Michael

As part of the Coordinated Needs Management Strategy (CNMS) Stream Centerline Inventory, the AECOM created an inventory of over 300,000 miles of stream centerlines in FEMA Regions IV, covering 421 counties. This inventory will be used to validate streams that were previously studied in FEMA's National Flood Insurance Program (NFIP), and will help track portions of the inventory that attain status as New, Validated, or Updated Engineering (NVUE) studies. This dataset will be used to assist FEMA in determining where to focus their efforts during the Risk Mapping, Assessment, and Planning (Risk MAP) program and estimate potential costs for conducting new studies in areas that are deemed necessary.

Our team developed the inventory based on existing stream centerlines created in FEMA's Map Modernization Program. The inventory was supplemented with streams from the National Hydrography Dataset (NHD) in order to provide a better dataset from which to compare miles of studied streams versus miles of unstudied streams. All stream overlap along county boundaries was addressed through a county edge matching process to avoid duplication of stream centerlines in the inventory. Streams were examined to ensure proper naming and correct attribution of zone type compared to the Special Flood Hazard Area (SFHA) associated with the specific flooding source. The stream study type is recorded in the attributes as well since there are instances where the zone type may not be a correct match for the study type. For instance, a tributary may be studied by approximate methods while part or all of the reach may be contained by backwater from a detailed flooding source – this results in a stream that does not have an approximate zone designation despite it being the study type designation.

In addition to zone type and study type attributes, watershed and mileage information were also attached to the centerlines. The most critical attribute – validation status – was determined using a set of business rules and will serve as the basis for calculating NVUE status. Although an effort was made to populate this field during the inventory creation, the validation status will continue to be investigated on a more detailed level and updated in the inventory as necessary. In conjunction with detailed validation efforts of the stream centerlines, a CNMS database will be generated that will house polygons identifying areas where flood hazard needs exist based on FEMA guidelines and specifications.



All stream overlap along county boundaries was addressed through a county edge matching process to avoid duplication of stream centerlines in the inventory.

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FEMA Flood Insurance Study Revisions

Client: Indiana Department of Natural Resources
Location: Multiple locations, Indiana
Duration: 2007 – Ongoing
Contract Value: $451,000 to date

Scope of Services:
- ✓ Use topographic data to redelineate detailed floodplain boundaries
- ✓ Create digital work maps and reports
- ✓ Detailed hydraulic modeling
- ✓ QA/QC

Performance:
- ✓ All tasks to date have been within schedule and budget

Key Staff:
- ✓ Bill Hubbard (PM), Todd Frauhiger

AECOM is providing IDNR with engineering assistance to prepare revisions to flood insurance studies for Boone, Knox, Daviess, Greene, and Martin counties in Indiana. The work is as follows:

Redelineation of Detailed Floodplain Boundaries Using Updated Topographic Data: Delineate 1 and 0.2 percent chance annual occurrence floodplain boundaries using topographic data provided by IDNR on digital work maps. Provide digital work maps, a summary report, and supplemental backup information for use in making an independent QA/QC review by others.

Refinement or Creation of Zone A: Delineate 1 percent chance annual occurrence floodplain boundaries using topographic data provided by IDNR on digital work maps. Provide digital work maps, a summary report, and supplemental backup information for use in making an independent QA/QC review by others.

Independent QA/QC Review of Hydraulic Analysis: Review technical and other information provided by IDNR for conformance with FEMA standards. Use CHECK-2 or CHECK-RAS to flag potential problems. Provide summary report to IDNR listing findings of review with recommendations for resolution.

Detailed Hydraulic Modeling: Perform HEC-RAS computer hydraulic modeling analysis for selected identified flooding sources for the 1 and 0.2 percent chance annual occurrence based on peak discharge data provide by IDNR and using cross section and field data provided by IDNR. Delineate 1 and 02 percent chance annual occurrence floodplain boundaries and the 1 percent chance (regulatory) floodway using topographic data provided by IDNR on digital work maps. Provide digital work maps, hydraulic modeling output and data tables, a summary report, and supplemental backup information for use in making an independent QA/QC review by others. Use CHECK-RAS to identify potential problems and make corrections where appropriate, or provide explanation of identified messages. All work will be completed to FEMA data capture standards.

On-call Services for Indiana Department of Transportation

Client: Indiana Department of Transportation
Location: Statewide, Indiana
Duration: 2006 – Ongoing
Contract Value: $447,300 to date

Scope of Services:

- ✓ Engineering and related technical services
- ✓ Topographic survey
- ✓ Flood analysis and mitigation
- ✓ Hydraulic and hydrologic modeling
- ✓ Local stakeholder coordination and outreach

Performance:

- ✓ All tasks to date have been within schedule. Compensation for this project is cost reimbursable based on an original estimated budget for professional services that may not be exceeded without agency approval. Additional labor effort required to date in providing these services may result in a request for additional compensation for two task orders.

Key Staff:

- ✓ Todd Frauhiger, Tony Hinkle, Bill Hubbard, Kevin Stankiewicz, Atif Baloch

AECOM holds a multi-year on-call contract with INDOT to provide engineering and related technical services, including hydraulic analysis, scour calculations, and permitting. The tasks to date include:

Hydraulic Structure Sizing and Layout: AECOM performed hydraulic analysis and sizing of hydraulic structures (bridges and culverts over 36 inches in diameter) where major streams or ditches cross the centerline of the proposed roadway of the proposed SR 25 Hoosier Heartland Highway (Logansport segment) in Cass County. After initial assessment of the project in fall of 2005, a realignment of the proposed roadway was required to avoid major stream environmental impacts determined to occur in the previous alignment. In addition to realignment of a reach of the segment, an interchange for SR 29 and Burlington Avenue, and frontage roads between the interchanges were also added. Preliminary layout drawings were provided by the design consultant (United Consulting Engineers & Architects) indicating that 12 significant crossings (requiring structures over 36 inches in diameter) were required. At three of the crossing locations (#7, #8, and #9), located between the new highway interchanges with SR 29 and Burlington Avenue, the crossings required installation of minimum 3-structure segments to extend under proposed east-west frontage roads located on either side of the new alignment highway, in addition to the highway itself.

Forensic Flooding Investigation and Mitigation Recommendations: AECOM is conducting Phase 2 of a project to determine the causes of flooding of the expressway in August 2007 and reduce the probability of future flooding. In Phase 1, performed under a previous contract, AECOM performed a forensic investigation of the flooding situation. In Phase 2, AECOM is developing a facility plan to evaluate alternative combinations at one major intersection for stormwater conveyance, evaluating storage using detailed hydrologic and hydraulic modeling, recommending pump station capacity to achieve the goal of no standing water during the 100-year rain event and designing the pumping station, including preparation of plans and specifications for bidding. AECOM is conducting the following activities at the interchange location:

- Review of supplemental as-built information
- Topographic survey of hydraulic features
- Identification of existing utilities
- Inspection of existing stormwater collection piping and system
- Hydraulic evaluations of existing system and alternatives using XP-SWMM
- Identification of proposed pump station location(s)
- Obtain land ownership and easement data
- Identification of new property easements or acquisitions
- Evaluation of results of geotechnical investigation performed by INDOT on-call drilling contractor

- Preliminary sizing of pump station(s) footprint and of required pumping capacity
- Design of a 30 cfs pumping station and preparation construction documents
- Identification of permitting requirements
- Estimate of probable construction cost

AECOM is also meeting with project stakeholders including INDOT staff, IDEM, IDNR, USACE, city Hammond, Lake County, and Little Calumet Basin Commission.

Hydraulic Analyses: AECOM provided hydraulic services for bridge design on USH 31 over Sand Creek. AECOM is also providing on-call hydraulic services and scour calculations for bridges over White River at I-465. Services will include:

- Hydrologic and hydraulic modeling
- Engineering assessments of hydraulic structures (bridges, culvers, storm sewers, etc)
- Sizing and layout of hydraulic structures
- Assistance in preparation of permit applications

Bridge Improvement Recommendations: AECOM is responding to questions and comments regarding a report submitted on a previous assignment through the INDOT on-call hydraulic analysis services contract. The previous assignment consisted of hydraulic modeling (using HEC-RAS) following changes to proposed improvements to the I-465 bridge over Eagle Creek. That report was prepared for the INDOT dated May 2005. As part of that modeling, a scour analysis was completed for the proposed bridge improvement project. Recommendations were made regarding placement of piers near the outer limits of the computed 100-year flood elevation at the bridge, so scour at the piers would be minimized. AECOM is now responding to questions and comments regarding the report.

Field Survey, Hydraulic Modeling, Roadway Improvements, and Construction Cost Estimates: AECOM is conducting field surveying to determine the existing SR 258 profile elevations and cross sections on Vehslage Road to the Indian Creek Bridge. AECOM will provide hydraulic modeling of the SR 258 bridge over East Fork White River and of two roadway crossings of two tributaries to evaluate raising the roadway profile above the Q10 flood elevation without causing any negative impact to the Q100 backwater elevation. A preliminary construction cost estimate for raising the roadway grade will also be conducted. The Army Corps of Engineers HEC-RAS program will be used to determine the adequacy of the culvert sizing.

Stormwater Detention Pond Design: AECOM conducted analysis and design of appropriate stormwater detention ponds for a reach of a proposed new alignment of US 24 in Allen County. This reach of new alignment US 24 will cross two Allen County legal drains - Shoaff Ditch and Marsh Ditch. Stormwater runoff from portions of the proposed new alignment of US 24 will also outlet into these two legal drains,. The proposed crossing and stormwater outlet into Shoaff Ditch is located in the NE 1/4 Section 26, Township 31N, Range 14E approximately 0.26 miles west of the proposed US 24 crossing of Rousey Road. The proposed crossing and stormwater outlet into Marsh Ditch is located in the NE 1/4 Section 19, Township 3 IN, Range 15E approximately 0.70 miles west of the proposed US 24 crossing of Bull Rapids Road. INDOT had acquired anticipated right of way for the proposed stormwater detention facilities, but needed to verify that these right-of-way areas are sufficient.

The work included project management; reconnaissance and review of available previous studies and information; site visit to assess local conditions and obtain photos; field survey to provide accurate topographic information of the proposed legal drain crossing locations, reaches of the receiving streams, proposed detention pond locations, and elevations and details of possible affected structures; performing hydrologic analyses and developing watershed models of Shoaff Ditch and Marsh Ditch at locations of the proposed US 24 stormwater outlets to determine peak Q10 and QlOO discharges and corresponding runoff hydrographs for existing and post-developed conditions; performing hydraulic analysis and design to determine final size and layout of structures required for legal drain crossings; performing hydraulic analysis and design to determine size and layout of detention ponds and coordinate detention pond design and layout with possible wetland mitigation projects in immediate vicinity; scheduling appropriate meetings with INDOT Fort Wayne District staff, Allen County Drainage Board staff, and regulatory agencies; preparing necessary information for preparation and submittal of required regulatory permits by INDOT; preparing construction plans, technical specifications, and engineer's estimate for specified detention ponds and outlets to current INDOT standards; and preparing engineering report including necessary detention pond design information to demonstrate that detention ponds meet Allen County stormwater requirements of post-developed peak QlOO outflow no greater than existing peak Q10 from the watershed.

North Carolina Floodplain Mapping Program (NCFMP)

Client: North Carolina Office of Geospatial & Technology Management
Location: Statewide, North Carolina
Duration: 2000 – Ongoing
Contract Value: $77M

Scope of Services:
- ✓ Terrain development
- ✓ Hydrology and hydraulics; floodplain mapping
- ✓ Geodatabase design and migration; IT system; and website design/development
- ✓ Custom tool development

Performance:
- ✓ All tasks have been within schedule and budget
- ✓ *2003 Grand Conceptor Award for Engineering Excellence*, sponsored by ACEC

Key Staff:
- ✓ Susan Phelps, Terri McLean, David Weaver, John Hendricks, Peter Perry

AECOM has been NCFMP's primary contractor for flood hazard analysis and mapping on 11 of the State's 17 river basins. The NCFMP is FEMA's State Cooperating Technical Partner responsible for updating flood hazard data and producing and disseminating updated floodplain maps for all communities in NC. The project involves topographic data development, field survey, H&H analysis, Digital Flood Insurance Rate Map (DFIRM) production, community outreach, IT development, geodatabase design, website design, and emergency response tool development.

Terrain: AECOM developed Digital Terrain Models used for H&H modeling. Our terrain specialists compiled raw and bare earth LIDAR datasets, performed hillshade and breakline quality control reviews of the bare earth DEM, and performed root mean square error (RMSE) analyses on the bare earth TIN surface model to ensure FEMA and North Carolina specifications were met. This is the largest seamless LIDAR dataset in the nation with over three terabytes of TIN and DEM (including hydro-enforced) data.

Hydrology & Hydraulics and Map Production: AECOM develops H&H models using HEC-HMS and HEC-RAS and performs final floodplain mapping using WISE and ArcGIS tools. We have completed over 13,000 stream miles of H&H analysis and 6,000 miles of redelineation—including over 40,000 new base flood elevations (BFEs), which appear on the State's maps. AECOM has produced 5,200+ DFIRM panels to date.

Geodatabase Design and Process Enhancements: AECOM improved processes for production, review, delivery and distribution of DFIRMs. We migrated NCFMP's shapefile-based system to ESRI's Enterprise Geodatabase format using ArcSDE and SQLServer.

IT System and Website Design & Development: AECOM led a team to develop an advanced database system and website that allows users to view floodplain information for specific properties. The website, **www.ncfloodmaps.com**, is available with data for counties in NC completed to date.

Emergency Response and Outreach Tools: AECOM developed a disaster preparedness and response ArcGIS extension called Hazards Analyst, which utilizes an extent polygon on a predicted event, such as a hurricane or ice storm, and calculates response needs based on multiple layers of data, including Census information. AECOM has also developed a tool to help facilitate NC Emergency Management's community outreach activities, which is called NC CIS (North Carolina Community Information System).

North Carolina Flood Inundation Mapping & Alert Network (NCFIMAN): AECOM is contributing to NCFIMAN, which provides real-time or near real-time inundation maps during flooding events at selected stream gage locations throughout NC. NCFIMAN utilizes libraries of inundation maps that correspond to incremental values of river stage at stream gages located in areas vulnerable to flood damage.

AECOM has developed inundation maps for stream gage locations throughout NC.

Project tasks AECOM will perform and percent of the project AECOM will be responsible for
AECOM's tasks will include:

- Project management
- Coordination with the IGIC Waters Workgroup and USGS
- Coordination with Cripe Architects + Engineers and Pinnacle Mapping
- Project Management Plan development
- QA/QC plan development for NHD conversion and conflation
- Creation of 6 acre catchment areas and 6 acre streams
- Digitizing streamlines, water bodies and other NHD hydrography features up to a 6 acre upstream limit
- QA/QC of hydrography features
- NHD conflation from high-resolution dataset to local-resolution NHD
- QA/QC of conflation results

AECOM will receive approximately 76% of the contract value. If it is determined that the State's and the project's needs can be met more effectively by giving additional HUC subbasins to the subcontractors for NHD conversion, AECOM will assign a greater percentage of work to them on future task orders and potentially in Phase I of the project.

1.11.2 Cripe Architects + Engineers Information

Cripe Architects + Engineers has offered its clients GIS services for more than 10 years. With four offices throughout Indiana, Cripe Architects + Engineers has the necessary resources to complete the Development of Local-Resolution NHD for State of Indiana Watersheds Project.

Proof of professional licensure, certification, and training

Cripe Architects + Engineers is licensed to provide Engineering, Surveying, Architecture and Interior Design in Indiana. The GIS team have received training in various GIS tools directly from ESRI.

Qualifications and Experience of Cripe Staff Assigned to this Project, and Project Responsibilities

Cripe brings talented GIS staff with experience in GIS projects around the State of Indiana. Cripe's key staff for this project will include Matthew Riggs and Lori Steffen.

Matthew Riggs will lead Cripe's GIS tasks, and

provide overall project management and technical direction for Cripe's GIS team. He is a Senior Project Manager with 26 years of experience and is a member of the Indiana Geographic Information Council Board. He is currently managing Cripe's DFIRM Modernization work for Indiana DNR, and has managed GIS projects for municipal clients around the State of Indiana. His GIS skills include ArcInfo Workstation, ArcGIS, Avenue, AML, and AutoCAD Map.

Lori Steffen has 24 years of experience in GIS

and will provide Quality Control for Cripe's deliverables. Her software skills include Intergraph MicroStation; Smallworld; ESRI ArcGIS; AutoDesk: Map 2004; Raster Design 2004; IRASB; VMS; and UNIX. She has been serving as a GIS and Quality Control Specialist for the Indiana DNR DFIRM Modernization Program. She has also provided quality control for the Indianapolis Mapping and Geographic Infrastructure System (IMAGIS).

Resumes of Key Project Team Members

Cripe project team resumes begin on the following page.

Matthew Riggs
GIS Manager

Matt Riggs has 26 years of experience managing GIS projects. He has led GIS projects for Indiana DNR and municipal agencies across the State of Indiana.

Professional History
Years of Experience: 26
Cripe Architects + Engineers
Indiana

Academic Training
Southern Illinois University – Master of Science (Geology), 1991

Alfred University – Bachelor of Arts (Geology), 1983

Specialized Training
ESRI Avenue, Visual Basic and Intro to ArcGIS.

Affiliations
Indiana Geographic Information Council Board Member

Matthew Riggs is a Senior Project Manager with 26 years of experience and is a member of the Indiana Geographic Information Council Board. He has managed GIS projects for municipal clients around the State of Indiana. His GIS skills include ArcInfo Workstation, ArcGIS, Avenue, AML, and AutoCAD Map. He has published over 50 geologic maps using GIS and written and/or presented more than 15 papers and workshops related to GIS for professional journals and organizations such as the Implementation of a Sensitive GIS project at the 1996 National ESRI User's conference and E911 Implementation in Hamilton County at the 2004 Indiana GIS Conference.

Project History

Department of Natural Resources DFIRM Modernization Program - State of Indiana. This project involves the migration of Indiana's Flood Insurance Rate Maps (FIRMs) into a series of digital map layers for a FEMA approved GIS system. Work closely with Indiana DNR managing the day-to-day operation of PEN and Cripe's efforts on this project. Duties include design and management of the project workflow, GIS data processing, final production and delivery.

Project Manager, City of Westfield GIS Implementation - Westfield, Indiana. Responsible for project management and data creation. Project included a needs assessment, GPS training, hardware and software consulting, and the creation of several data layers. Municipal boundary was updated and storm and sanitary sewer data model created. GIS asbuilt submittal standards were developed and asbuilts converted from AutoCAD to ArcGIS geodatabase.

Project Manager City of Noblesville GIS Implementation and Management - Noblesville, Indiana. Managed the overall GIS Implementation and day-to-day management of the City of Noblesville GIS. Responsibilities included conversion and creation of GIS data layers, working with city departments to address GIS needs, E911 data creation and maintenance and overall management of the GIS hardware, software and data.

Project Manager LaPorte County GIS Implementation - LaPorte County, Indiana. Managed all components of this project including the parcel conversion, E911 address mapping, and land cover mapping. Lead in the project planning, data conversion process, and QA/QC review.

Project Manager Hamilton County E911 - Hamilton County, Indiana. Project involved developing accurate address mapping to be used for E911 systems. Oversaw all components of this project including field data collection, data processing and final product delivery. Worked closely with Hamilton County representatives to make sure project fulfilled multiple needs.

Lori Steffen
GIS Specialist

Lori Steffen has worked on Indiana GIS projects for the Department of Natural Resources, the Department of Public Works, and LaPorte County.

Professional History
Years of Experience: 24

Cripe Architects + Engineers
Indiana

Lori Steffen has 24 years of experience including nine years working with ESRI software. Her software skills include Intergraph MicroStation; Smallworld; ESRI ArcGIS; AutoDesk: Map 2004; Raster Design 2004; IRASB; VMS; and UNIX. She has been serving as a GIS and Quality Control Specialist for the Indiana DNR DFIRM Modernization Program. She has also provided quality control for the Indianapolis Mapping and Geographic Infrastructure System (IMAGIS).

GIS and Quality Control Specialist, Indiana Department of Natural Resources DFIRM Modernization Program - Indianapolis, Indiana. Project to migrate Indiana's Flood Insurance Rate Maps (FIRMs) into a series of digital map layers for a FEMA approved GIS system. Designed project plan, conversion procedures, and functionality migration to the new system. Used ESRI ArcGIS and FEMA tools to process files for conversion.

Quality Control Specialist, Indianapolis Mapping and Geographic Infrastructure System (IMAGIS) - Indianapolis, Indiana. Paper maps and records for nearly 500-square miles of Indianapolis/ Marion County were converted into graphical and textual databases for the City of Indianapolis. Project tasks included obtaining documents from assessor's offices, quality control, and in-depth problem solving for the conversion team.

Quality Control Specialist, LaPorte County Parcel Data Conversion. LaPorte County, Indiana.

Quality Control Specialist, Indiana Department of Public Works, Indianapolis, Indiana.

Team Leader and Co-Manager, CINergy Corporation - Cincinnati, Ohio. Efforts consisted of converting the paper electrical maps and access database records into graphical and textual databases. Team leader for quality control in three different states, organized maps sent to India for conversion, performed problem solving for the conversion team, responsible for file cleanup, final processing and delivery.

Quality Control Team Leader, Oklahoma Gas & Electric (OG & E) - Oklahoma City, Oklahoma. The project goal was conversion of the utility's electrical maps from hardcopy into graphical and textual databases. As quality control team leader, oversaw conversion staff and developed solutions as problems arose. Performed conversion and organized maps for team.

Quality Control Team Leader, Fort Stewart and Hunter Army Airfield - Hinesville, Georgia. A military project that required converting paper maps of land and utilities into both graphical and textual databases. As team leader, was in charge of preparing and systematizing maps for conversion, creating quality control and conversion processes, performing quality control, and problem solving for the conversion team.

Relevant Project Experience
Cripe's GIS team has worked on GIS projects around the state of Indiana for State and local agencies including the Indiana Department of Natural Resources, the City of Westfield, the City of Noblesville, Hamilton County, and LaPorte County.

Detailed information about Cripe's relevant project experience is outlined in the project descriptions on the following pages. The projects include:

1. Digital Flood Insurance Rate Map Production, Indiana Department of Natural Resources
2. GIS Data Development, Noblesville Wastewater Utility
3. Address Mapping, Hamilton County, Indiana

Project tasks Cripe will perform and percent of the project
Cripe's responsibilities will be to support the GIS data generation for this project—specifically, digitizing streamlines. They will also provide training and oversight for products produced by PEN, who will be contracted as a subcontractor through Cripe through an existing agreement. Cripe provides client liaison, project management, cost estimating, quality control, training, and product delivery to support PEN Products GIS and Data Input shops. This public/private collaboration results in a win-win situation for all parties involved.

Their tasks will include:

- Coordination with AECOM
- Coordination with the IGIC Waters Workgroup and USGS as needed
- Digitizing streamlines, water bodies and other NHD hydrography features up to a 6 acre upstream limit
- QA/QC of hydrography features

Cripe will receive approximately 12% of the contract value.

1. Indiana DFIRM Modernization

Client: Indiana Department of Natural Resources, Division of Water
Location: 87 Counties, Indiana
Duration: Ongoing – 2010
Contract Value: $1.5 MM

Scope of Services:

- ✓ Digital map production meeting FEMA standards
- ✓ Use of GIS and production tools

Performance:

- ✓ All tasks to date have been within schedule and budget

Key Staff:

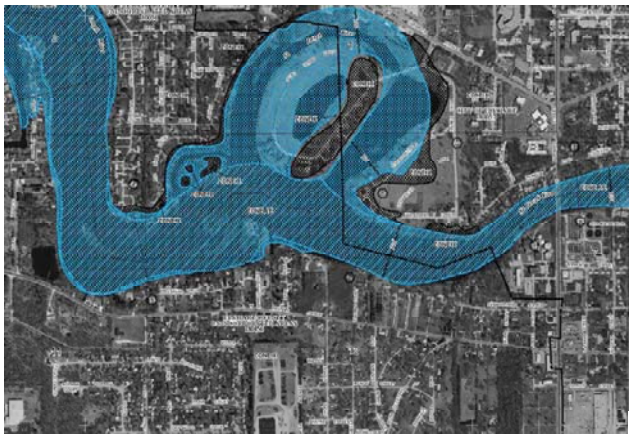
- ✓ Matt Riggs, Lori Steffen

The Federal Emergency Management Agency (FEMA) developed a five-year plan to update the nation's digital flood insurance rate maps (DFIRMs) by creating publicly available flood data in a standard Geographic Information System (GIS) format. DFIRMs are important because they are used to determine the potential flood hazard risks for communities throughout the United States. FEMA contracted with state, local, and regional mapping partners to work through a set of best practices steps to produce an updated product that is standard for all communities.

The Department of Natural Resources, the agency charged with implementing the DFIRM Map Modernization program in Indiana, hired PEN Products and Cripe Architects + Engineers to process flood data for Indiana's counties. The project will provide many benefits to the citizens of Indiana, by:

- Increasing the ability of concerned homeowners to more reliably determine their flood risk and take appropriate action.
- Providing a more comprehensive approach to economic development, mitigation planning, and emergency response based on more realistic data models
- Enabling communities to proactively manage flood risks, land use, water resources, disaster recovery, and other responsibilities.
- Providing communities a way update maps and data as local risks.

Cripe is providing DFIRM production for 83 counties in the State of Indiana from beginning to end. To date, 17 counties have been delivered as preliminary. The first county is in the process of becoming final.



Cripe and PEN Products are working together in Indiana producing updated DFIRMs for 87 counties in the State of Indiana.

2. GIS Data Development

Client: Noblesville Wastewater Utility

Location: Hamilton County, Indiana

Duration: completed 2006

Contract Value: $1.3 MM

Scope of Services:
- ✓ GIS data development, conversion, and QC
- ✓ GPS field data collection
- ✓ GIS data viewing software development

Performance:
- ✓ All tasks were completed within schedule and budget

Key Staff:
- ✓ Matt Riggs

Cripe worked with the City of Noblesville, Indiana from 1997 to 2005 to develop a working GIS system to help the City better manage its resources. Base mapping was obtained from the Hamilton County data set and has been supplemented with information unique to the City of Noblesville. The Noblesville project included the entire County data set plus those features unique to the City such as zoning and utilities.

Over the years, Cripe has worked with several of the City departments to develop data sets including:

- Police, Fire and Communications Department – Detailed street centerline address ranges for E911 address locations
- Wastewater Utility - Sewer, water, and storm system as-built layers
- Planning Department - Zoning and land cover type data sets
- Street and Engineering Departments – Pavement, sidewalk and tree inventories
- Land Cover layers identifying surfaces such as impervious, agriculture, water, deciduous trees, coniferous trees, wetlands, herbaceous, etc.

The street centerline database was created by using planimetric map data from Hamilton County and was augmented with additional information from a city atlas, as-built drawings, Tiger Line files (limited use), and direct communications with the City of Noblesville. This centerline file undergoes routine maintenance as new as-built files are delivered to Cripe or when addresses are assigned or changed. The resultant centerline data forms the base that has allowed Noblesville to become the second FCC Phase II compliant community in Indiana.

Using AutoCAD, the storm and sanitary sewer data and MicroStation files, as well as GPS field collection were extracted. This data covered newly developed subdivisions as well as the older Combined Sewer Overflow (CSO) regions in the City of Noblesville. A key component to the process is the CAD file submittal requirements drafted by Cripe and the City of Noblesville. These requirements ensured that newly submitted digital CAD files were in a format that expedites the extraction of data to be used to update the appropriate GIS data layers.

Cripe also mapped the older CSO sewer network, which involved field collecting GPS locations, top of casting elevations and invert depths for all the sanitary and storm sewer structures. The data layers included storm sewer lines and structures, sanitary sewer lines and structures, water lines and structures, retention ponds, easements and street centerlines.

In order to make this information accessible to as many City employees as possible, Cripe has also developed unique GIS data viewing software.

Cripe has developed data sets (such as detailed street centerlines) for various departments of the City of Noblesville.

3. Address Mapping, Hamilton County, Indiana

Client: Hamilton County, Indiana

Location: Hamilton County, Indiana

Duration: completed 2003

Contract Value: $288k

Scope of Services:
- ✓ Field data verification
- ✓ Data set development
- ✓ Community focus group

Performance:
- ✓ All tasks were completed within schedule and budget

Key Staff:
- ✓ Matt Riggs

Cripe was hired to develop accurate address mapping to be used for FCC Phase II Compliance for the location of wireless phones. There were three components of the project.

- The first was to travel every roadway in Hamilton County and physically verify the posted addresses of every structure in the county, then create address points which were attributed with address information and added to the map.
- The second component consisted of using the existing county street centerline files to topologically clean data sets and add address range information to the centerlines.
- The third component involved creating approximate locations of all fire hydrants in the county using existing utility line maps.

Cripe met regularly with a focus group made up of county representatives along with representatives from the various towns and cities in the county. Taking four months to complete, this project was delivered on time and on budget.

As a side benefit, the focus group continues to meet regularly to ensure clear communication and to foster coordination among the various county agencies.

Cripe has been producing address mapping data for Hamilton County.

1.11.3 PEN Products (with Cripe Architects + Engineers) Information

PEN Products, Prison Enterprises Network, is a division of the Indiana Department of Correction. It was established in 1917 by the Indiana Legislature for the purpose of "...providing useful and stimulating employment to the inmates…" Today, PEN Products employs nearly 2,000 offenders in ten correctional facilities across the state in jobs that range from wood working to clothing production to GIS data development. PEN's GIS facility offers an array of data development services and is supported by outstanding technical capabilities. Located at the Plainfield Correctional Facility, the shop features state-of the-art GIS technology and a staff familiar with computer aided drafting and mapping software and techniques.

PEN strives to make GIS technology accessible by providing high quality data at or below market rates. Furthermore, Indiana Code facilitates the use of PEN Products by other government departments, resulting in a streamlined department to department contracting process.

Cripe Architects + Engineers is able to provide client liaison, project management, cost estimating, quality control, training, and product delivery to support PEN Products GIS.

Proof of professional licensure, certification, and training
Training and quality control supervision of PEN Products GIS is conducted by qualified staff of Cripe. Cripe's qualifications are listed under the summary for Cripe.

Qualifications and Experience of PEN Staff Assigned to this Project, and Project Responsibilities
PEN staff are very experienced with computer aided drafting and mapping software and techniques. PEN Products' GIS team has worked on GIS projects around the state of Indiana for counties and the DNR on digital Flood Insurance Rate Maps.

Cripe's key contact at PEN for this project is:

Tim Vancil
Market Analyst
6075 Lakeside Blvd.
Indianapolis, IN 46278
317-388-8580

Relevant Project Experience
PEN has successfully completed numerous GIS projects in Indiana within schedule and budget requirements. Relevant project experience includes the following:

Indiana Department of Natural Resources Federal Insurance Rate Mapping (FIRM) Conversion
IDNR uses Flood Insurance Rate Maps (FIRMs) to assist the public with issues related to flooding. The FIRMs for Indiana were available only as hard copies, which limited their usefulness. DNR contracted with PEN Products to convert existing FIRMs of 80 of the 92 counties into a series of digital FIRM (DFIRM) map layers. In addition to the creation of the DFIRM data, DNR wanted to add other datasets, including a network of state and local roads, geo-political boundaries, and the U.S. Public Land Survey System (PLSS). The DFIRMs and other data sets were delivered on a county-by-county basis.

LaPorte County, Indiana Land Parcel Conversion
LaPorte County contracted with Cripe Architects + Engineers to create a digital database of all land parcels in this 608 square mile county. To perform the project, Cripe scanned the existing assessor's maps to create image files that were then geo-rectified (moved to their correct geographic position). PEN then used the resulting files along with digital orthophotography to construct a land parcel database that was ultimately delivered to the County in AutoCAD and ESRI software formats.

Marshall County, Indiana Parcel Conversion
The Marshall County land parcel project was divided into ten townships, with each township subdivided into sections. Following specific conversion rules provided by the County, PEN employees created land parcels for each of the 340 sections in the county. Using data from assessor tax maps, subdivision plats, and orthophotography, each parcel was placed in its correct geographic position and annotated with describing data.

PEN Project Tasks
PEN responsibilities will be to support the GIS data generation for this project—specifically, data conversion and digitizing streamlines. This will be conducted under the supervision of Cripe.

PEN's share of the contract value will be included with Cripe's 12% minimum share.

1.11.4 Pinnacle Mapping Technologies, Inc. Information

Pinnacle Mapping Technologies, Inc., is a certified woman-owned, veteran-owned small business. Formed in 2002, Pinnacle's best resource is its people. Our staff comes from larger mapping companies and has on average 18 years in the photogrammetric mapping industry. At Pinnacle, we bring together our large company technical base within a smaller organization to provide creative solutions to technical and budgetary problems and instant communication to our customers. Put simply, we can provide the excellent service and quality customers have come to expect from larger companies at a price those companies could only afford by using a total off-shore labor structure.

Proof of professional licensure, certification, and training
Pinnacle is a corporate member of the American Society for Photogrammetry and Remote Sensing (ASPRS) and the Urban and Regional Information Systems Association (URISA).

Qualifications and Experience of Pinnacle Staff Assigned to this Project, and Project Responsibilities
Nearly half of Pinnacle's staff has served in senior management at larger mapping companies. We have seen what works and what does not; what technologies to embrace and which ones to avoid. The net result of this is a small, dynamic company that can change its production very easily without distraction from corporate objectives or bureaucracy.

In the past 24 months alone, we have re-engineered several processes, including Aerial Triangulation, Digital Ortho production, and our Map Finishing process. The net result of these re-engineering efforts is a 34% average gain in efficiency in those areas – without adding additional overhead or staff. Our low overhead ensures that our audited rates are among the lowest in our industry and our eye on technology means we can easily meet customer schedules and manage their quality and accuracy expectations.

Pinnacle employs a highly qualified staff including three (2) ASPRS Certified Photogrammetrists, experienced Stereoplotter Compilers, Digital Orthophoto Specialists, Digital Cartographers, and GIS Analysts. These professionals have from ten to thirty years of industry experience with Pinnacle and other mapping companies. All aerial mapping work is supervised by our Certified Photogrammetrists and each project has a designated Project Manager assigned. Our staff is committed to customer satisfaction and delivery of high quality, user-friendly geospatial information products.

Pinnacle's key staff for this project will include

- Brenda King, C.P., GISP – President / Project Manager, Management & Oversight
- Todd Friermood, GISP – CAD Manager, Production
- Bob Gray – Quality Control, Production

Resumes of Key Project Team Members
Pinnacle project team resumes begin on the following page.

Brenda King, C.P., GISP
President / Project Manager

As President and majority shareholder, Brenda King has overall responsibility for the day-to-day business activities of Pinnacle Mapping Technologies, Inc.

Professional History
Years of Experience: 20
Pinnacle Mapping Technologies, Inc.
Indiana

Academic Training
MS, 1994, Information Resources Management (IRM), Air Force Institute of Technology, Dayton OH

BA, 1990, Mathematics, Angelo State University

Specialized Training
Manpower and Organizational Management Course, 1991, Keesler Air Force Base MS

Advanced Information Management Officer Training, 1995, Keesler Air Force Base MS

Advanced Communications and Information Officer Training, 1998, Keesler Air Force Base MS

Czech/Slovak Basic Language Course, 1985, Defense Language Institute, Presidio of Monterey CA

Affiliations
ASPRS Certified Photogrammetrist (#1399)
Certified GIS-Professional (GISP)

Brenda King makes all final assessments of job costing to ensure the highest quality of product to achieve customer satisfaction while remaining cost efficient and competitive. Ms. King is responsible for the research and development of equipment and software. She is also closely involved with the evaluation of new technologies as they are presented by equipment and software manufacturers and the evaluation of their impact upon current production activities and technology. She gives final approval on all processes engineered at Pinnacle and provides oversight on all of Pinnacle's projects.

Project History

Orthophoto Production.

Ms. King has also adopted orthophoto production as her direct responsibility. Her extensive database and process management have proved to be a tremendous boon for Pinnacle's orthophoto production. She has engineered the entire process and utilizes data management tools that are readily available to all companies… but used by few.

Her workflow takes full advantage of both automation and the trained human eye. It is truly a combination of the best of both worlds and the results are highly accurate and precise data that is high quality … all at a fraction of the production costs for most other firms.

Quality Assurance & Project Oversight.

Ms. King conducts weekly sessions with Pinnacle staff to ensure that quality standards are met in every area of operations. She routinely monitors the progress of projects through both reports and in-person inspection of mapping products at varying stages of completion. This hands-on approach provides a superior level of quality and consistency among Pinnacle products.

Todd Friermood, GISP
CADD Manager

Todd Friermood has over 6 years of experience in the field of Orthophotography and GIS. including projects in various locations in Indiana.

Professional History
Years of Experience: 6

Pinnacle Mapping Technologies, Inc.
Indiana

Academic Training
AS, 1997 Architectural and Engineering Technology, ITT Technical Institute

Affiliations
Member of the American Society for Photogrammetry and Remote Sensing

Certified GIS Professional (GISP)

Mr. Friermood has over 6 years of experience in the field of Orthophotography/GIS. In his role as an Orthophotography Technician, Mr. Friermood is responsible for the production of orthophotography. Mr. Friermood generated ArcInfo coverages for Butler County, Ohio for MD Atlantic Technologies, Inc. The coverages consisted of all features and had to be run through an AML in Arc to create E00 files for delivery. He was the lead for appending the coverages in Arc as well as importing and exporting in ArcView.

As an employee for Analytical Surveys, Inc., Mr. Friermood worked on the Saskatchewan Power project digitizing electric distribution maps and played an integral role in the start-up and pilot phases. Mr. Friermood was responsible for transfer of digital MicroStation data into target platform software (Smallworld), running quality control processes, editing data, managing data stores, delivering data stores to the client and plotting data. Mr. Friermood worked on site in Regina, Saskatchewan doing edits and updates in target platform software (Smallworld).

Project History
COE-Albuquerque District, Cotton Woods Walnut Project-PINNACLE produced planimetric-topographic mapping at a scale of 1”=100’ with 2-foot contours generated for the entire project area. Geo-referenced digital black-and-white orthophotography was also produced in TIF/TFW format.

COE-Chicago District, Burns Harbor and Little Burns Small Boat Harbor-PINNACLE produced planimetric and DTM data to support 1” = 50’ scale map accuracy. A 10-foot DTM grid was digitized along a 5,900’ of rubble at Burns Harbor shoreline. A 10-foot DTM grid with breaklines was also digitized over the beach area at Little Burns small boat harbor.

Boone County, Indiana- Provided a 100-foot DTM grid and breaklines to produce 100-foot contours and digital orthophotography. Limited planimetric features were also digitized for the 1”=200’ scale mapping project.

COE-Albuquerque District, Abiquiu Dams and Reservoir Project-PINNACLE provided limited digitized planimetric features with topographic mapping at a scale of 1”=100’ to support the generation of 2-foot contours. Black-and-white digital orthophotography was also produced and delivered in TIF/TFW format.

Robert Gray
Quality Control Manager

Robert Gray has 35 years of experience in photogrammetry, land surveying, civil engineering and GIS.

Professional History
Years of Experience: 35

Pinnacle Mapping Technologies, Inc.
Indiana

Academic Training
Texas Technological University, Marketing, 1967-1969

ICS, Civil Engineering/Land Surveying, 1972-1974

Affiliations

Mr. Gray has over 35 years of experience in photogrammetry, land surveying, civil engineering and GIS and has served in numerous technical and managerial roles during his tenure in these industries. A graduate of the International Correspondence Schools in Civil Engineering and Land Surveying, Bob has directly managed hundreds of photogrammetric mapping, GIS, Civil Engineering and Land Surveying projects.

Prior to joining Pinnacle, Bob served as Senior Vice President and Geospatial Division Manager for Pacific Western Technologies, Inc. (PWT) in Albuquerque, NM. While at PWT , Bob was responsible for Project Management, technological innovation and implementation, QA/QC and Business Development.

Project History
Project Manager and Senior Consultant, Worcester County, MD. The nature of this project was to development topo using LiDAR technology and meeting FEMA standards for 2' contour mapping.

Project Manager, Bureau of Land Management, Albuquerque District, Albuquerque, NM. Photogrammetric mapping including topo, cross sections, and orthophoto covering the Rio Grande reach between Cochiti Reservoir and Elephant Butte Reservoir.

Project Manager, New Mexico Department of Transportation, Santa Fe, NM. The nature of the contract was On-Call for various transportation projects in the State of New Mexico. The projects included aerial photography, digital orthophoto, planimetric and topographic mapping.

Project Manager, Virginia Department of Transportation, Richmond Virginia. Various projects which included aerial photography, digital orthophoto, planimetric and topographic mapping.

Project Manager, Government of Saudi Arabia, Riyadh, Saudi Arabia. Land Surveying, platting and photogrammetric mapping for a new town project designed to house over 100,000 people.

Project Manager, Ramah Navajo Chapter, Ramah, NM. This project was a large transportation based GIS and field data collection project required by the Bureau of Indian Affairs.

Project Manager, City of Irving, TX. GIS parcel conversion, planimetric and topographic mapping covering the City and ETJ. GIS utility data conversion covering the City and ETJ. Delineation of pervious and impervious surfaces for NPDES taxation purposes.

Relevant Project Experience
Pinnacle has a diversified background that has established an outstanding reputation for providing quality products and services. Pinnacle possesses the capabilities and technical knowledge to provide quality services on all photogrammetric projects. It is our goal to assist and offer suggestions on our client's needs and potential problems.

Detailed information about Pinnacle's relevant project experience is outlined in the project descriptions on the following pages. The projects include:

1. State of Indiana QA/QC Contract
2. Jasper County, Indiana Data Acquisition
3. Indianapolis Orthophotography

Project tasks Pinnacle will perform and percent of the project
Pinnacle's responsibilities will be to support the GIS data generation for this project—specifically, data conversion and digitizing streamlines. Their tasks will include:

- Coordination with AECOM
- Coordination with the IGIC Waters Workgroup and USGS as needed
- Digitizing streamlines, water bodies and other NHD hydrography features up to a 6 acre upstream limit
- QA/QC of hydrography features

Pinnacle will receive approximately 12% of the contract value.

1. State of Indiana QA/QC Contract

Client: Indiana Dept. of Homeland Security (Sub to Dewberry)
Location: City/County, State
Duration: 2005-2006
Contract Value: $229k

Scope of Services:
- ✓ Independent review of orthophotos
- ✓ Development of Indiana First Response Map Application (INFRM) GIS tool

Performance:
- ✓ All tasks to date have been within schedule and budget

Key Staff:
- ✓ Brenda King, Todd Friermood, Bob Gray

In 2005-2006, for a total project fee of $756,673, the Dewberry team (including Pinnacle Mapping Technologies and Major Engineering) performed a wide variety of independent QA/QC tasks, compiled external hard drives for state deliveries, burned all DVDs for 92 county and 1,011 township deliveries, and provided all final deliverables, data installation and training to state agencies as well as all counties and townships.

The Indiana Map includes a variety of digital orthophoto image-based products for state, regional, and local applications. The base imagery was produced by EarthData using a large number of Leica ADS40 “pushbroom” sensors collecting panchromatic, color, and color infrared (CIR) images and generating digital terrain models (DTMs) by auto-correlation of imagery from the ADS’ forward, downward, and backward-looking sensors.

A total of 66,966 .tif tiles (4000’ x 4000’) were produced, with 6 ” or 1’ ground sample distance, as well as 2,376 color and 2,376 CIR digital orthophoto quarter quads (DOQQs). Dewberry produced the following deliverables, in addition to the base products (66,966 .tif tiles, 66,966 DTM tiles, 2,376 color DOQQ tiles, 2,376 CIR DOQQ tiles, and 2,376 color DOQQ MrSID tiles) produced by EarthData.

The Dewberry Team’s independent QA/QC process consisted of comprehensive reviews and validation cycle for each of the project deliverables. Because of the enormous volume of digital imagery and DTM tiles, a high degree of coordination and process tracking was designed into the work flow process at the planning stages for this project. Our QA/QC review process included:

1. Review of Orthophotos for Acceptable Horizontal Accuracy. Major sub-tasks include the following: (1) Review the actual, post-processed position of ground control points within each lift to ensure each lift was controlled to specifications. (Pinnacle Task) (2) Determine if EarthData’s aerial triangulation (AT) results are adequate to support the production of digital orthophotos at the planned image resolutions, (Pinnacle Task) (3) Review of 100 blind checkpoints provided by Woolpert. (Pinnacle Task) (4) Point selection and survey of 200 additional QA/QC checkpoints statewide. (5) Measurement of checkpoints on digital orthophotos. (6) Computation of horizontal accuracy statistics for each of the 23 production blocks and each of the 92 counties. (7) Provide horizontal accuracy assessment reports for each county.

2. Review of Orthophotos for Aesthetics. Use TIFF-QC software and procedures developed by Dewberry to edit 66,966 tiles of 6” and 1’ digital orthophotos and 2,376 color and 2,376 CIR DOQs. Table 1 summarizes edit calls by category to date. Figures 2, 3 and 4 show examples of images before and after correction.

3. Review of Deliverables for Completeness. Major sub-tasks include the following: (1) Correct the GeoTIFF header files that are commonly in error from ortho-producing software. (Pinnacle Task) (2) Check for correct world files (Tifw and SIDw). (Pinnacle Task) (3) Check for correct datum, projection, State Plane or UTM coordinates. (Pinnacle Task) (4) Check for correct metadata for all datasets. (5) Check that prior edit calls from Dewberry have been corrected by EarthData. (Pinnacle Task) (6) Generate ESRI .aux files for all 6”, 1’ and 1-meter images and county mosaics. (Pinnacle Task) (7) Ensure each

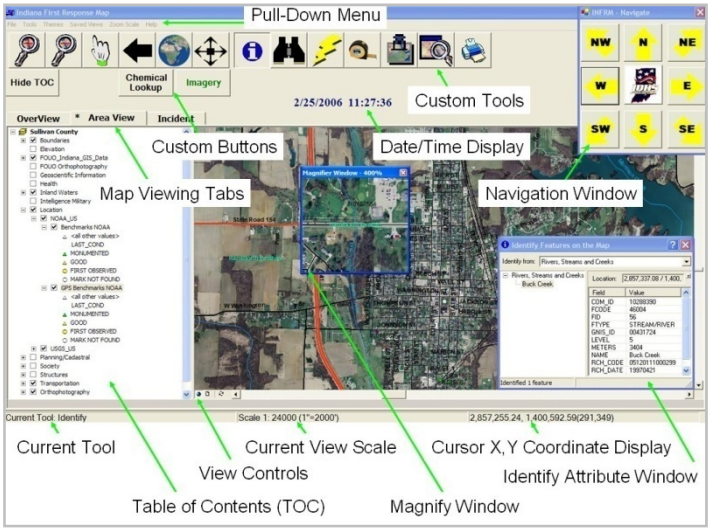
of the 92 county datasets include all 6” or 1’ ortho Tiff images including over-edge buffer tiles, MrSID tiles and DTM tiles for each county; all color and CIR DOQQs for each county; countywide Tiff and MrSID 1-meter mosaics; and county AccuGlobe Viewer Applications and County ArcReader Viewer Applications. (Pinnacle Task) (8) Ensure each of the 1,011 township datasets include all 6” or 1’ ortho Tiff images including over-edge buffer tiles, MrSID tiles and DTM tiles for each township, all color and CIR DOQQs for each township; and 6” or 1’ SID township mosaics in State Plane coordinates as well as Latitude/Longitude. (Pinnacle Task) (9) Resampled imagery for 22 For Official Use Only (FOUO) sites to provide imagery suitable for public dissemination. (Pinnacle Task)

Another significant value added product that was developed as a result of our understanding and performance on this project was the, The Indiana First Response Map Application (INFRM). (Pinnacle Task)

The Indiana First Response Map Application (INFRM) was designed for use by Indiana’s public safety and emergency management community to provide a highly customized GIS viewing application for ease of use in a mobile and emergency environment (with pen/tablet PC). Build-in functions allows First-Responders to easily and quickly display For-Official-Use-Only critical site and infrastructure data displayed over a highly accurate color digital orthophotography base map. The INFRM application is developed to work with ESRI’s ArcReader free GIS viewer technology to view, query and search digital maps displaying Indiana’s detailed 1’ or 6-inch pixel Statewide color orthophotography overlaid with selected vector graphic layers.

The application allows emergency management personnel to quickly switch between three different map views (Incident, Area View, and OverView) in the same map, without the need to redraw. First-Responders can quickly and easily:

- Search for and zoom to specific locations on the map,
- Query and review attribute information associated with map features,
- Retrieve other web-based information via hyperlinks and OGC compliant Web Map Services,
- Search and display of hazardous material information from the 2004 Emergency Response Guidebook (ERG2004) chemical databases, and
- Print maps on demand



Pinnacle performs various QA/QC tasks for the State of Indiana.

2. Jasper County, Indiana Data Acquisition

Client: Jasper County Auditor's Office

Location: Jasper County, Indiana

Duration: 2006

Contract Value: $292k

Scope of Services:
- ✓ Digital orthophotography
- ✓ Contour maps and DTM data
- ✓ Quality control

Performance:
- ✓ All tasks were completed within schedule and budget

Key Staff:
- ✓ Brenda King, Todd Friermood, Bob Gray

Pinnacle Mapping Technologies, Inc. was selected for a two-year contract with Jasper County. The first year was designed to provide the County with new, countywide 1"=100' digital orthophotography with a 0.5' ground pixel resolution. The second year deliverables include countywide 2' contours, building footprints, street centerlines and water bodies – all delivered in a personal GeoDatabase.

The county was flown at a single Negative Contact Scale of 1"=660'. The photography was flown with panchromatic photography using Airborne GPS and photogrammetric industry standards of 60% forward overlap and 30% sidelap.

Pinnacle performed all the necessary ground control, film processing, film scanning, aerial triangulation, stereo compilation and digital orthophotography.

To support the County's requirement to deliver the orthos in the 1st year and the Countywide 2' contours and planimetrics in the 2nd year, Pinnacle had to deviate from its normal approach for countywide projects of this nature.

The County had a pressing need for the orthophotography but didn't need the DTM or 2' contours until later. To support that effort, Pinnacle first compiled a DTM-light, which could be supplemented with additional points later and turned into a rigorous DTM that could support contour modeling. The DTM-light approach allowed us to speed up the production schedule on the orthophotography and deliver a full 3 months ahead of delivering the countywide 2' contours.

The final orthophotos are based on a countywide 2,500' x 2,500' butt-matching tiling schema. Files are delivered in both TIF format as well as a compressed MrSID format. The final contours and DTM data, contours and planimetrics will be delivered in a GeoDatabase format.

3. Indianapolis Orthophotography

Client: City of Indianapolis, Department of Metropolitan Development

Location: Indianapolis, Indiana

Duration: 2007

Contract Value: $209k

Scope of Services:
- ✓ Digital orthophotography

Performance:
- ✓ All tasks were completed within schedule and budget
- ✓ Quality control

Key Staff:
- ✓ Brenda King, Todd Friermood, Bob Gray

Pinnacle captured new true color and color infrared digit imagery at two different photo scales to produce both one-foot and half-foot pixel orthophotography to meet American Society for Photogrammetry and Remote Sensing Class 1 Accuracy Standards for 1”=100’ scale and 1”=200’ scale orthophotography.

The project area covered all of Shelby, Johnson, Morgan, Hancock and Boone counties in central Indiana. Half-foot pixel orthophotography was produced in the urban areas, with one-foot pixel orthophotography in the rural areas. The project was flown with the DiMAC digital camera system with ABGPS & IMU data. Pinnacle targeted both existing and new control throughout the project area. To cover the entire project area, 65 flight lines containing over 3,500 digital images were captured of the urban areas, and 57 flight lines with over 2,000 digital images were captured of the rural areas. Pinnacle performed a QC check on all of the existing DEMs supplied by the Counties and updated the DEMs where needed in order to meet the accuracy standards for the project.

The project was funded by the Indianapolis Metropolitan Planning Organization through Federal Transportation Planning Funds with local matching funds provided by IMAGIS, and with partnership funds contributed by the US Geological Survey.

1.12 Supporting Legal & Financial Documentation

On the subsequent pages, we have provided supporting legal and financial documentation for the following:

- Indiana Certification: Certificate of Authority and Business Entity Report provided by the Indiana Secretary Of State
- AECOM Technology Corporation: Annual Report FY2009

INDIANA SECRETARY OF STATE
BUSINESS SERVICES DIVISION
CORPORATIONS CERTIFIED COPIES

INDIANA SECRETARY OF STATE
BUSINESS SERVICES DIVISION
302 West Washington Street, Room E018
Indianapolis, IN 46204

http://www.sos.in.gov

January 15, 2010

Company Requested:	AECOM TECHNICAL SERVICES, INC.
Control Number:	1995091268

Date	Transaction	# Pages
09/27/1995	Application for Certificate of Authority	5
12/03/2008	Application for Amended Certificate of Authority	3
01/14/2010	Business Entity Report	1

State of Indiana
Office of the Secretary of State

I hereby certify that this is a true and complete copy of this 9 page document filed in this office.

Dated: January 15, 2010
Certification Number: 2010011566304

Secretary of State

The Indiana Secretary of State filing office certifies that this copy is on file in this office.

STATE OF INDIANA
OFFICE OF THE SECRETARY OF STATE

CERTIFICATE OF AUTHORITY

I, SUE ANNE GILROY, Secretary of State of Indiana, hereby certify that the Application for Certificate of Authority to do business in the State of Indiana of the following corporation in the form prescribed by my office has been presented to me at my office, accompanied by the fees together with a Certificate of Existence of the corporation, as prescribed by the provisions of the Indiana Business Corporation Law, as amended.

I further certify that:

The name under which the corporation is to transact business in the State of Indiana, is

EARTH TECH CONSULTING, INC.

The corporation is incorporated under the laws of the State of California

The name and address of its resident agent in Indiana for service of legal process is
CT CORPORATION SYSTEM
ONE N. CAPITOL AVE. INDPLS 462040000

WHEREFORE, I hereby issue to such corporation this Certificate of Authority, and I further certify that it shall have authority to transact business in the State of Indiana effective on September 27, 1995, subject to the terms and conditions prescribed by the Indiana Business Corporation Law, as amended.

In Witness Whereof, I have hereunto set my hand and affixed the seal of the State of Indiana, at the City of Indianapolis, this Twenty-seventh day of September, 1995.

Deputy

The Indiana Secretary of State filing office certifies that this copy is on file in this office.

1995091268

APPLICATION FOR CERTIFICATE OF AUTHORITY OF A FOREIGN CORPORATION

State Form 38784 (R5 / 2-92) Corporate Form 112
Approved By State Board of Accounts 1987

APPROVED AND FILED

95 SEP 27 AM 10 20

RECEIVED

INSTRUCTIONS: *1. Use an 8½" x 11" inch paper for inserts.*
2. Present 2 originally executed copies to:

Secretary of State
Corporations Division
302 W. Washington St. Room E018
Indianapolis, Indiana 46204
(317) 232-6576

*3. **FILING FEE** - $90.00*
*4. **This application cannot be accepted without an original certificate of existence duly authenticated by the proper authority from corporation's domiciliary state within the last sixty (60) days. I.C. 23-1-49-1 et seq.***
5. This application cannot be accepted unless a registered agent with an Indiana street address is listed in ARTICLE II. I.C. 23-1-49-3

APPLICATION FOR CERTIFICATE OF AUTHORITY
OF

~~Earth Tech, Inc.~~ which will do business in Indiana as Earth Tech Consulting, Inc. (Fictitious)

A FOREIGN CORPORATION
TO TRANSACT BUSINESS IN THE STATE OF INDIANA

The undersigned officer of the above corporation which was formed as: California **(State of Domicile)**

[X] A general business corporation [ ] A professional corporation

desiring to effectuate the admittance of the Corporation to transact business in the State of Indiana, certifies the following facts:

ARTICLE I: Name

Name of Corporation: *(Must be identical to name shown in Articles of Incorporation and Amendments thereto)*

Earth Tech, Inc. (Fictitious: Earth Tech Consulting, Inc.)

ARTICLE II: Registered Office and Registered Agent and Principal Office

Name of the registered agent of the corporation

C T Corporation System

Indiana address of the registered office of corporation *(Number and street, city, state and Zip code)*

One North Capitol Avenue, Indianapolis, Indiana 46204

Address of the principal office of corporation *(Number and street, city, state and Zip code)*

100 West Broadway, Suite 5000, Long Beach, California 90802-4443

ARTICLE III: Date of Incorporation and Duration of Existence

Date of incorporation in domiciliary state:

September 29, 1970

Expected period of duration listed in the Articles of Incorporation:

Perpetual

ARTICLE IV: Corporate Officers

The names and business addresses of the officers of the Corporation:

Name	Title	Address *(Number, street, city, state and Zip code)*
Diane C. Creel	President	100 West Broadway, Suite 5000, Long Beach California 90802-4443
Creighton K. Early	Chief Financial	100 West Broadway, Suite 5000, Long Beach California 90802-4443
Charles S. Alpert	General Counsel	100 West Broadway, Suite 5000, Long Beach California 90802-4443
Patricia E. Montgomery	Assistant	100 West Broadway, Suite 5000, Long Beach California 90802-4443

ARTICLE V: Board of Directors	
The names and business addresses of the Board of Directors of the Corporation are as follows:	
Name	**Address** *(Number, street, state and ZIP code)*
Diane C. Creel	100 West Broadway, Suite 5000, Long Beach, California 90802-4443
Creighton K. Early	100 West Broadway, Suite 5000, Long Beach, California 90802-4443

In witness whereof, the undersigned being the Secretary (title) of said corporation executes this Application For Certificate of Authority, and verifies subject to the penalties of perjury, that the facts contained herein are true this 11th day of August, 19 95.

Signature	Printed Name
Charles S. Alpert	Charles S. Alpert

The Indiana Secretary of State filing office certifies that this copy is on file in this office.

APPROVED
AND
FILED
IND. SECRETARY OF STATE

CERTIFIED COPY OF RESOLUTION

CORPORATION ADOPTING A FICTITIOUS NAME FOR USE
IN THE STATE OF INDIANA

I, the undersigned Charles S. Alpert, do hereby certify that the following is a true, complete and correct copy of a certain resolution of the Board of Directors of Earth Tech, Inc., a corporation duly organized and existing under the laws of the State of California, which resolution was duly adopted at a duly called meeting of the said Board, held on September 19, 19 95, a quorum being present, and is set forth in the minutes of the said meeting; that I am the keeper of the corporate seal and of the minutes and records of this corporation; and that the said resolution has not been rescinded or modified:

"RESOLVED that Earth Tech, Inc., organized and existing in the State of California, hereby adopts the name Earth Tech Consulting, Inc. for use in the State of Indiana for all purposes; and further resolved that the officers of the corporation are authorized and directed to take all steps that they deem necessary and appropriate to qualify the corporation to do business within the State of Indiana under the name of Earth Tech Consulting, Inc.; and resolved further that all activities and business of the corporation within the State of Indiana shall be carried out under the name Earth Tech Consulting, Inc.;

RECEIVED
SEP 27 2 52
SECRETARY OF STATE

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed the seal of the said corporation, on this the 19th day of September, 19 95.

Charles S. Alpert
SECRETARY
Charles S. Alpert, Secretary

(INDIANA - 1938 - 4/1/91)

State of California

SECRETARY OF STATE

CERTIFICATE OF STATUS
DOMESTIC CORPORATION

I, BILL JONES, Secretary of State of the State of California, hereby certify:

That on the 29th *day of* September, *19* 70,

EARTH TECH, INC.

became incorporated under the laws of the State of California by filing its Articles of Incorporation in this office; and

That no record exists in this office of a certificate of dissolution of said corporation nor of a court order declaring dissolution thereof, nor of a merger or consolidation which terminated its existence; and

That said corporation's corporate powers, rights and privileges are not suspended on the records of this office; and

That according to the records of this office, the said corporation is authorized to exercise all its corporate powers, rights and privileges and is in good legal standing in the State of California; and

That no information is available in this office on the financial condition, business activity or practices of this corporation.

IN WITNESS WHEREOF, I execute this certificate and affix the Great Seal of the State of California this 10th *day of* August, 1995.

BILL JONES
Secretary of State

SEC/STATE FORM CE-112 (REV. 1-95)

95 28034

The Indiana Secretary of State filing office certifies that this copy is on file in this office.

Indiana Secretary of State
Packet: 1995091268
Filing Date: 12/03/2008
Effective Date: 12/03/2008

WJH

APPROVED
AND
FILED

IND. SECRETARY OF STATE

APPLICATION FOR AMENDED CERTIFICATE OF AUTHORITY
State Form 39034 (R5 / 4-95) Corporate Form No. 115
Approved by the State Board of Accounts 1995

TODD ROKITA
SECRETARY OF STATE
CORPORATIONS DIVISION
302 W. Washington St., Rm. E018
Indianapolis, IN 46204
Telephone: (317) 232-6576

INSTRUCTIONS: *Use 8 1/2" x 11" white paper for inserts.*
Present original and two (2) copies to address in upper right corner of this form.
Please TYPE or PRINT.

Indiana Code 23-1-49-4; 23-17-26-4

FILING FEE: $30.00

NOTE: This application must be accompanied by a certificate of existence duly authenticated by the proper authority from the corporation's domicile state.

APPLICATION FOR
AMENDED CERTIFICATE OF AUTHORITY
OF

Earth Tech Consulting, Inc.
Name of Corporation

A FOREIGN CORPORATION ADMITTED TO
TRANSACT BUSINESS IN INDIANA

The undersigned officers of Earth Tech Consulting, Inc.

(hereinafter referred to as the "Corporation"), which exists pursuant to the provisions of the laws of California

as amended, desire to obtain an Amended Certificate of Authority.

1. The above Corporation received a Certificate of Authority to transact business in the State of Indiana on the 27 day of September, 1995.

2. The Corporation desires to change its corporate name in Indiana as follows.
   AECOM Technical Services, Inc.

3. The Corporation has changed the period of its duration from No Change to No Change.

4. The Corporation has changed the state or country of its incorporation from No Change to No Change.

In Witness Whereof, the undersigned, being the President (Title) of said Corporation executes this Application for Amended Certificate of Authority and verifies, subject to penalties of perjury, that the statements contained herein are true, this 14th day of November, 20 08.

Signature	Printed name
Alan Krusi	Alan P. Krusi

Indiana Secretary of State
Packet: 1995091268
Filing Date: 12/03/2008
Effective Date: 12/03/2008

State of California
Secretary of State

CERTIFICATE OF STATUS

ENTITY NAME:

AECOM TECHNICAL SERVICES, INC.

2008 DEC -3 PM 4:11

FILE NUMBER:	C0608461
FORMATION DATE:	09/29/1970
TYPE:	DOMESTIC CORPORATION
JURISDICTION:	CALIFORNIA
STATUS:	ACTIVE (GOOD STANDING)

I, DEBRA BOWEN, Secretary of State of the State of California, hereby certify:

The records of this office indicate the entity is authorized to exercise all of its powers, rights and privileges in the State of California.

No information is available from this office regarding the financial condition, business activities or practices of the entity.

IN WITNESS WHEREOF, I execute this certificate and affix the Great Seal of the State of California this day of November 20, 2008.

Debra Bowen

DEBRA BOWEN
Secretary of State

2008 DEC -1 PM 4:34

NP-25 (REV 1/2007)

OSP 06 99731 RLS

State of Indiana
Office of the Secretary of State

APPLICATION FOR AMENDED CERTIFICATE OF AUTHORITY

of

EARTH TECH CONSULTING, INC.

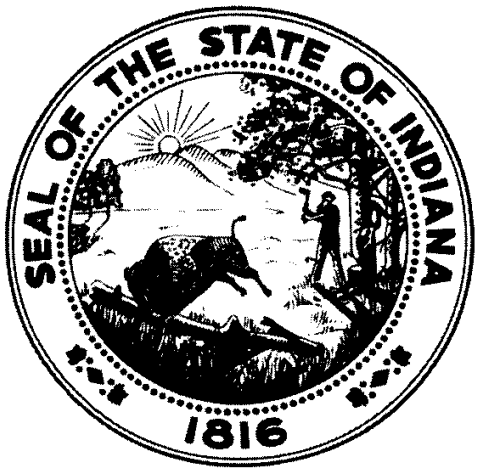
I, TODD ROKITA, Secretary of State of Indiana, hereby certify that Application for Amended Certificate of Authority of the above California For-Profit Foreign Corporation has been presented to me at my office, accompanied by the fees prescribed by law and that the documentation presented conforms to law as prescribed by the provisions of the Indiana Business Corporation Law.

The name following said transaction will be:

AECOM TECHNICAL SERVICES, INC.

Indiana Secretary of State
Packet: 1995091268
Filing Date: 12/03/2008
Effective Date: 12/03/2008

NOW, THEREFORE, with this document I certify that said transaction will become effective Wednesday, December 03, 2008.



In Witness Whereof, I have caused to be affixed my signature and the seal of the State of Indiana, at the City of Indianapolis, December 3, 2008.

TODD ROKITA,
SECRETARY OF STATE

1995091268 / 2008120572247

INDIANA BUSINESS ENTITY REPORT

Indiana Secretary of State

1/14/2010 10:03:10 AM

Filer Name
WILLIAM E. GARRETT

Filer Title
SECRETARY

Years Filed
2009/2010

Entity name and current principal office address
AECOM TECHNICAL SERVICES, INC.
515 S. FLOWER STREET
4TH FLOOR
LOS ANGELES, CA 90071

Entity Creation Date
9/27/1995

Domicile State
CALIFORNIA

Entity Type
FOR-PROFIT FOREIGN CORPORATION

Current registered agent and registered address
CT CORPORATION SYSTEM
251 E. OHIO STREET
SUITE 1100
INDIANAPOLIS, IN 46204

Current principal(s) and address(es)

PRESIDENT
ALAN P KRUSI
515 S. FLOWER STREET
4TH FLOOR
LOS ANGELES, CA 90071

SECRETARY
WILLIAM E. GARRETT
515 S. FLOWER STREET
4TH FLOOR
LOS ANGELES, CA 90071

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Form 10-K

AECOM TECHNOLOGY CORP - ACM

Filed: November 27, 2009 (period: September 30, 2009)

Annual report which provides a comprehensive overview of the company for the past year

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SIGNATURE

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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 10-K

(Mark one)

☒

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

FOR THE FISCAL YEAR ENDED SEPTEMBER 30, 2009

OR

☐

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from to

Commission file number 0-52423

AECOM TECHNOLOGY CORPORATION
(Exact name of Registrant as specified in its charter)

Delaware (State or other jurisdiction of incorporation or organization)	**61-1088522** (I.R.S. Employer Identification No.)

555 South Flower Street, Suite 3700
Los Angeles, California 90071
(Address of principal executive offices, including zip code)

(213) 593-8000
(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Act:

Title of Each Class	Name of Exchange on Which Registered
Common Stock, par value $0.01 per share	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act:**None**

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. ☒ Yes ☐ No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. ☐ Yes ☒ No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. ☒ Yes ☐ No

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). ☐ Yes ☐ No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of "large accelerated filer," "accelerated filer" and "smaller reporting company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer ☒	Accelerated filer ☐	Non-accelerated filer ☐ (Do not check if a smaller reporting company)	Smaller reporting company ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). ☐ Yes ☒ No

The aggregate market value of registrant's common stock held by non-affiliates on March 31, 2009 (the last business day of the registrant's most recently completed second fiscal quarter), based upon

the closing price of a share of the registrant's common stock on such date as reported on the New York Stock Exchange was approximately $1.87 billion.

Number of shares of the registrant's common stock outstanding as of November 18, 2009: 112,610,790

DOCUMENTS INCORPORATED BY REFERENCE

Part III incorporates information by reference from the registrant's definitive proxy statement for the 2010 Annual Meeting of Stockholders, to be filed within 120 days of the registrant's fiscal 2009 year end.

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PART I

ITEM 1. BUSINESS

In this report, we use the terms "AECOM," "the Company," "we," "us" and "our" to refer to AECOM Technology Corporation and its consolidated subsidiaries. Unless otherwise noted, references to years are for fiscal years. Our fiscal year consists of 52 or 53 weeks, ending on the Friday closest to September 30. For clarity of presentation, we present all periods as if the year ended on September 30. We refer to the fiscal year ended September 30, 2008 as "fiscal 2008" and the fiscal year ended September 30, 2009, as "fiscal 2009."

Overview

We are a global provider of professional technical and management support services for commercial and government clients around the world. We provide planning, consulting, architectural and engineering design, and program and construction management services for a broad range of projects, including highways, airports, bridges, mass transit systems, government and commercial buildings, water and wastewater facilities and power transmission and distribution. We also provide program and facilities management, training, logistics and other support services, primarily for agencies of the U.S. government.

Through our network of approximately 43,200 employees (as of September 30, 2009), we provide our services in a broad range of end markets, including the transportation, facilities, environmental, and energy and power markets. According to Engineering News-Record's (ENR) 2009 Design Survey, we are the largest general architectural and engineering design firm in the world, ranked by 2008 design revenue. In addition, we are ranked by ENR as the leading firm in a number of design end markets, including transportation and general building.

We were formed in 1980 as Ashland Technology Company, a Delaware corporation and a wholly owned subsidiary of Ashland, Inc., an oil and gas refining and distribution company. Since becoming independent of Ashland Inc., we have grown by a combination of organic growth and strategic mergers and acquisitions from approximately 3,300 employees and $387 million in revenue in fiscal 1991, the first full fiscal year of operations, to approximately 43,200 employees at September 30, 2009 and $6.1 billion in revenue for fiscal 2009. We completed the initial public offering of our common stock in May 2007 and such shares are traded on the New York Stock Exchange.

We offer our services through two business segments: Professional Technical Services and Management Support Services.

Professional Technical Services (PTS). Our PTS segment delivers planning, consulting, architectural and engineering design, and program and construction management services to commercial and government clients worldwide in major end markets such as transportation, facilities, environmental, and energy and power markets. For example, we are providing program management services through a joint venture for the Second Avenue subway line in New York City, development management services to create the new Saadiyat Island Cultural District in Abu Dhabi and engineering and environmental management services to support global energy infrastructure development for a number of large petroleum companies. Our PTS segment contributed $5.0 billion, or 83% of our fiscal 2009 revenue.

Management Support Services (MSS). Our MSS segment provides program and facilities management and maintenance, training, logistics, consulting, technical assistance and systems integration services, primarily for agencies of the U.S. government. For example, we manage more than 8,000 personnel in Kuwait that provide logistics, security, communications and information technology services for the U.S. Army Central Command-Kuwait. We also provide organizational and limited direct support services for equipment sent to the U.S. Army's Corpus Christi Depot in Texas. Our MSS segment contributed $1.1 billion, or 17% of our fiscal 2009 revenue.

Our Business Strategy

Our business strategy focuses on leveraging our competitive strengths and leadership positions in our core markets while opportunistically entering new markets and geographies. Key elements of our strategy include:

Expand our long-standing client relationships and provide our clients with a broad range of services

We have long-standing relationships with a number of large corporations, public and private institutions and governmental agencies worldwide. We will continue to focus on client satisfaction along with opportunities to sell a greater range of services to clients and deliver full-service solutions for their needs. For example, as our environmental business has grown, we have provided environmental services for transportation and other infrastructure projects where such services have in the past been subcontracted to third parties.

By integrating and providing a broad range of services, we believe we deliver maximum value to our clients at competitive costs. Also, by coordinating and consolidating our knowledge base, we believe we have the ability to export our leading edge technical skills to any region in the world in which our clients may need them.

Capitalize on opportunities in our core markets

We intend to leverage our leading positions in the transportation, facilities, environmental and energy and power markets to continue to expand our services and revenue. We believe that the need for infrastructure upgrades, environmental management and government outsourcing of support services, among other things, will result in continued opportunities in our core markets. With our track record and our global resources, we believe we are well positioned to compete for projects in these markets.

Continue to pursue our acquisition strategy

We intend to continue to attract other successful companies whose growth can be enhanced by joining us. This approach has served us well as we have strengthened and diversified our leadership positions geographically, technically and across end markets. We believe that the trend towards consolidation in our industry will continue to produce candidates that align with our acquisition strategy.

Strengthen and support human capital

Our experienced employees and management are our most valuable resources. Attracting and retaining key personnel has been and will remain critical to our success. We will continue to focus on providing our personnel with training and other personal and professional growth opportunities, performance-based incentives, opportunities for stock ownership and other competitive benefits in order to strengthen and support our human capital base. We believe that our employee stock ownership and other programs align the interests of our personnel with those of our clients and stockholders.

Our Business Segments

The following table sets forth the revenue attributable to our business segments for the periods indicated(1):

	Year Ended September 30, (in thousands)		
	2009	2008	2007
Professional Technical Services (PTS)	$ 5,057,688	$ 4,327,871	$ 3,418,683
Management Support Services (MSS)	1,061,777	866,811	818,587
Total	$ 6,119,465	$ 5,194,682	$ 4,237,270

(1)

For additional financial information by segment, see Note 22 to the notes to our consolidated financial statements.

Our Professional Technical Services Segment

Our PTS segment is comprised of a broad array of services, generally provided on a fee-for-service basis. These services include planning, consulting, architecture and engineering design, program management and construction management for industrial, commercial, institutional and government clients worldwide. For each of these services, our technical expertise includes civil, structural, process, mechanical, geotechnical systems and electrical engineering, architecture, landscape and interior design, urban and regional planning, project economics, and environmental, health and safety work.

With our technical and management expertise, we are able to provide our clients with a broad spectrum of services. For example, within our environmental management service offerings, we provide remediation, regulatory compliance planning and management, environmental modeling, environmental impact assessment and environmental permitting for major capital/infrastructure projects.

Our services may be sequenced over multiple phases. For example, in the area of program management and construction management services, these services may begin with a small consulting or planning contract, and may later develop into an overall management role for the project or a series of projects, which we refer to as a program. Program and construction management contracts typically employ a staff of 10 to more than 100 and, in many cases, operate as an outsourcing arrangement with our staff located at the project site. For example, since 1990, we have been managing renovation work at the Pentagon for the U.S. Department of Defense. Another example of our program and construction management services would be our services related to the development of educational facilities for K-12 school districts and/or community colleges throughout the United States, including the cities of Dallas, Los Angeles and Houston.

We provide the services in our PTS segment both directly and through joint ventures or similar partner arrangements to the following key end markets:

Transportation.•
Transit and Rail. Projects include light rail, heavy rail (including high speed, commuter and freight) and multimodal transit projects. For example, we have provided engineering design services for the new World Trade Center Terminal for PATH and the Second Avenue Subway (8.5-mile rail route and 16 stations) in New York City, the Ma On Shan Rail (7-mile elevated railway) in Hong Kong, and Crossrail (74-mile railway) in the United Kingdom.

•
Marine, Ports and Harbors. Projects include wharf facilities and container port facilities for private and public port operators. For example, we have provided marine design and engineering services for container facilities in Hong Kong, the Ports of Los Angeles, Long Beach, New York and New

Jersey, the new $7 billion Doha Port project in Qatar and waterfront transshipment facilities for oil and liquid natural gas.•

Highways, Bridges and Tunnels. Projects include interstate, primary and secondary urban and rural highway systems and bridge projects. For example, we have provided engineering services for the SH-130 Toll Road (49-mile "greenfield" highway project) in Austin, Texas, the Sydney Orbital Bypass (39 kilometer highway) in Sydney, Australia and the Padma bridge (5.58 kilometer span) crossing the Padma River in Bangladesh.

•

Aviation. Projects include landside terminal and airside facilities and runways as well as taxiways. For example, we have provided program management services to a number of major U.S. airports, including O'Hare International in Chicago, Los Angeles International, John F. Kennedy and La Guardia in New York City, Reagan National and Dulles International in Washington, D.C., and Miami International. We also have provided services to airports in Hong Kong, London, Cyprus and Qatar.

Facilities.•

Government. Projects include our emergency response services for the Department of Homeland Security, including the Federal Emergency Management Agency and engineering and program management services for agencies of the Department of Defense. We also provide architectural and engineering services for several national laboratories, including the laboratories at Hanford, Washington and Los Alamos, New Mexico.

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Industrial. Projects include industrial facilities for a variety of niche end markets including manufacturing, distribution, aviation, aerospace, communications, media, pharmaceuticals, renewable energy, chemical, and food and beverage facilities.

•

Urban Master Planning/Design. Projects include design services, landscape architecture, general policy consulting and environmental planning projects for a variety of government, institutional and private sector clients. For example, we have provided planning and consulting services for the Olympic Games sites in Atlanta, Sydney, Beijing, Salt Lake City and London. We are providing strategic planning and master planning services for new cities and major mixed use developments in China, Southeast Asia, the Middle East, North Africa, the United Kingdom and the United States.

•

Commercial and Leisure Facilities. Projects include corporate headquarters, high-rise office towers, historic buildings, leisure, sports and entertainment facilities, hospitals and healthcare facilities and corporate campuses. For example, we provided electronic security programming and installation services for the renovation of Soldier Field in Chicago, construction management for the renovation of Dodger Stadium in Los Angeles, design services for Barclays Center Arena in Brooklyn and building services, engineering, architectural lighting, advanced modeling, infrastructure and utilities engineering and advanced security for the headquarters of the British Broadcasting Company in London.

•

Institutional. Projects include engineering services for college and university campuses, including the new Kennedy-King College in Chicago, Illinois. We also have undertaken assignments for Oxford University in the United Kingdom, Pomona College and Loyola Marymount University in California.

•

Healthcare. Projects include design services for the Mayo Clinic Gonda Building in Rochester, Minnesota, University Hospital in Dubai Healthcare City and the Samsung Cancer Center in Seoul, Korea. We also have undertaken assignments for the new Veterans Affairs Medical Center in Orlando, Florida, and the Minneapolis campus of Children's Hospitals and Clinics of Minnesota.

Environmental.•
Water and Wastewater. Projects include treatment facilities as well as supply, distribution and collection systems, stormwater management, desalinization, and other water re-use technologies for metropolitan governments. We have provided services to the Metropolitan Water Reclamation District of Greater Chicago's Calumet and Stickney wastewater treatment plants, two of the largest such plants in the world. Currently we are working with New York City on the Bowery Bay facility reconstruction, and have had a major role in Hong Kong's Harbor Area Treatment Scheme for Victoria Harbor.

•
Environmental Management. Projects include remediation, waste handling, testing and monitoring of environmental conditions and environmental construction management for private sector clients. For example, we have provided environmental remediation, restoration of damaged wetlands, and services associated with reduction of greenhouse gas emissions for large multinational corporations, and we also have provided permitting services for pipeline projects for major energy companies.

•
Water Resources. Projects include regional-scale floodplain mapping and analysis for public agencies, along with the analysis and development of protected groundwater resources for companies in the bottled water industry.

Energy/Power.•
Demand Side Management. Projects include energy efficient systems for public K-12 schools and universities, health care facilities, and courthouses and other public buildings, as well as energy conservation systems for utilities.

•
Transmission and Distribution. Projects include power stations and electric transmissions and distribution and co-generation systems, including enhanced electrical power generation in Stung Treng, Cambodia. These projects utilize a wide range of services that include consulting, forecasting and surveying to detailed engineering design and construction management.

•
Alternative/Renewable Energy. Projects include production facilities such as ethanol plants, wind farms and micro hydropower and geothermal subsections of regional power grids. We typically provide site selection and permitting, engineering, procurement and construction management and related services.

•
Hydropower/Dams. Projects include hydroelectric power stations, dams, spillways, and flood control systems including the Song Ba Ha Hydropower Project in Vietnam, the Pine Brook Dam in Boulder County, Colorado and the Peribonka Hydroelectric Power Plant in Quebec, Canada.

Our Management Support Services Segment

Through our MSS segment, we offer program and facilities management and maintenance, training, logistics, consulting, technical assistance and systems integration services, primarily for agencies of the U.S. government.

We provide a wide array of services in our MSS segment, both directly and through joint ventures or similar partner arrangements, including:

Installation, Operations and Maintenance. Projects include Department of Defense and Department of Energy installations where we provide comprehensive services for the operation and maintenance of complex government installations, including military bases, test ranges and equipment. We have undertaken assignments in this category in the Middle East and the United States. We also provide services for the operations and maintenance of the Department of Energy's Nevada Test Site.

Logistics and Field Services. Projects include logistics support services for a number of Department of Defense agencies and defense prime contractors focused on developing and managing integrated supply and distribution networks. We oversee warehousing, packaging, delivery and traffic management for the distribution of government equipment and materials.

Training. Projects include training applications in live, virtual and simulation training environments. We have conducted training at the U.S. Army's Center for Security Training in Maryland for law enforcement and military personnel. We have also supported the training of international police officers and peacekeepers for deployment in various locations around the world in the areas of maintaining electronics and communications equipment.

Systems Support. Projects cover a diverse set of operational and support systems for the maintenance, operation and modernization of Department of Defense and Department of Energy installations. Our services in this area range from information technology and communications to life cycle optimization and engineering, including environmental management services. Through our joint venture operations at the Nevada Test Site and the Combat Support Services operation in Kuwait, our teams are responsible for facility and infrastructure support for critical missions of the U.S. government in its nonproliferation efforts, emergency response readiness, and force support and sustainment. Enterprise network operations and information systems support, including remote location engineering and operation in classified environments, are also specialized services we provide.

Technical Personnel Placement. Projects include the placement of personnel in key functional areas of military and other government agencies, as these entities continue to outsource critical services to commercial entities. We provide systems, processes and personnel in support of the Department of Justice's management of forfeited assets recovered by law enforcement agencies. We also support the Department of State in its enforcement programs by recruiting, training and supporting police officers for international and homeland security missions.

Field Services. Projects include maintaining, modifying and overhauling ground vehicles, armored carriers and associated support equipment both within and outside of the United States under contracts with the Department of Defense. We also maintain and repair telecommunications systems for military and civilian entities.

Our Clients

Our clients consist primarily of national, state, regional and local governments, public and private institutions and major corporations. The following table sets forth our total revenue attributable to these categories of clients for each of the periods indicated:

	Year Ended September 30, (dollars in thousands)					
	2009	%	2008	%	2007	%
U.S. Federal Government						
PTS	$ 572,212	9%	$ 329,333	6%	$ 279,530	7%
MSS	1,061,777	17%	866,811	17%	818,587	19%
U.S. State and Local Governments	1,327,079	22%	1,051,234	20%	949,870	22%
Non-U.S. Governments	1,388,575	23%	1,085,886	21%	556,893	13%
Subtotal Governments	4,349,643	71%	3,333,264	64%	2,604,880	61%
Private Entities (worldwide)	1,769,822	29%	1,861,418	36%	1,632,390	39%
Total	$ 6,119,465	100%	$ 5,194,682	100%	$ 4,237,270	100%

Other than the U.S. federal government, no single client accounted for 10% or more of our revenue in any of the past five fiscal years. Approximately 26%, 23% and 26% of the Company's revenue was derived through direct contracts with agencies of the U.S. federal government in the years ended September 30, 2009, 2008 and 2007, respectively. One of these contracts accounted for approximately 10%, 10% and 13% of the Company's revenue in the years ended September 30, 2009, 2008 and 2007, respectively. The work attributed to the U.S. federal government includes our work for the Department of Defense, Department of Energy and the Department of Homeland Security.

Contracts

The price provisions of the contracts we undertake can be grouped into two broad categories: cost-reimbursable contracts and fixed-price contracts. The majority of our contracts fall under the category of cost-reimbursable contracts, which we believe are generally less subject to loss than fixed-price contracts. As detailed below, our fixed-price contracts relate primarily to design and construction management contracts where we do not self-perform or take the risk of construction.

Cost-Reimbursable Contracts

Cost-reimbursable contracts consist of two similar contract types, cost-plus and time and material.

Cost-Plus. We enter into two major types of cost-plus contracts:

Cost-Plus Fixed Fee. Under cost-plus fixed fee contracts, we charge clients for our costs, including both direct and indirect costs, plus a fixed negotiated fee. The total estimated cost plus the fixed negotiated fee represents the total contract value. We recognize revenue based on the actual labor and other direct costs incurred, plus the portion of the fixed fee earned to date.

Cost-Plus Fixed Rate. Under cost-plus fixed rate contracts, we charge clients for our direct and indirect costs based upon a negotiated rate. We recognize revenue based on the actual total costs expended and the applicable fixed rate.

Certain cost-plus contracts provide for award fees or a penalty based on performance criteria in lieu of a fixed fee or fixed rate. Other contracts include a base fee component plus a performance-based award fee. In addition, we may share award fees with subcontractors. We record accruals for fee-sharing as fees are earned. We generally recognize revenue to the extent of costs actually incurred plus a proportionate amount of the fee expected to be earned. We take the award fee or penalty on contracts into consideration when estimating revenue and profit rates, and record revenue related to the award fees when there is sufficient information to assess anticipated contract performance. On contracts that represent higher than normal risk or technical difficulty, we may defer all award fees until an award fee letter is received. Once an award fee letter is received, the estimated or accrued fees are adjusted to the actual award amount.

Certain cost-plus contracts provide for incentive fees based on performance against contractual milestones. The amount of the incentive fees varies, depending on whether we achieve above, at, or below target results. We originally recognize revenue on these contracts based upon expected results. These estimates are revised when necessary based upon additional information that becomes available as the contract progresses.

Time and Material. Time and material is common for smaller scale engineering and consulting services. Under these types of contracts, we negotiate hourly billing rates and charge our clients based upon actual hours expended on a project. Unlike cost-plus contracts, however, there is no predetermined fee. In addition, any direct project expenditures are passed through to the client and are reimbursed. These contracts may have a fixed-price element in the form of not-to-exceed or guaranteed maximum price provisions.

For fiscal 2009, 2008 and 2007, cost-reimbursable contracts represented approximately 62% , 63%, and 62% respectively, of our total revenue, consisting of cost-plus contracts and time and material contracts as follows:

	Year Ended September 30,		
	2009	2008	2007
Cost-plus contracts	27%	30%	35%
Time and materials contracts	35	33	27
Total	62%	63%	62%

Fixed-Price Contracts

There are typically two types of fixed-price contracts. The first and more common type, lump-sum, involves performing all of the work under the contract for a specified lump-sum fee. Lump-sum contracts are typically subject to price adjustments if the scope of the project changes or unforeseen conditions arise. The second type, fixed-unit price, involves performing an estimated number of units of work at an agreed price per unit, with the total payment under the contract determined by the actual number of units delivered.

Many of our fixed-price contracts are negotiated and arise in the design of projects with a specified scope. Fixed-price contracts often arise in the areas of construction management and design-build services. Construction management services are typically in the form of general administrative oversight (in which we do not assume responsibility for construction means and methods and which is on a cost-reimbursable basis). Under our design-build projects, we are typically responsible for the design of a facility with the fixed contract price negotiated after we have had the opportunity to secure specific bids from various subcontractors and add a contingency fee.

We typically attempt to mitigate the risks of fixed-price design-build contracts by contracting to complete the projects based on our design as opposed to a third party's design, by not self-performing construction (except for limited environmental tasks), by not guaranteeing new or untested processes or technologies and by working only with experienced subcontractors with sufficient bonding capacity. When public agencies seek a design-build approach for major infrastructure projects, we generally act as a fixed-price design subcontractor to the general construction contractor and do not assume overall project or construction risk.

Some of our fixed-price contracts require us to provide performance bonds or parent company guarantees to assure our clients that their project will be completed in accordance with the terms of the contracts. In such cases, we typically require our primary subcontractors to provide similar bonds and guarantees and to be adequately insured, and we flow down the terms and conditions set forth in our agreement on to our subcontractors.

For fiscal 2009, 2008 and 2007, fixed-price contracts represented approximately 38%, 37% and 38%, respectively, of our total revenue. Less than 10% of our revenue in each of fiscal 2009, 2008 and 2007 was generated from contracts where we have exposure to construction cost overruns. There may be risks associated with completing these projects profitably if we are not able to perform our professional services for the amount of the fixed fee. However, we attempt to mitigate these risks as described above.

Joint Ventures

Some of our larger contracts may operate under joint ventures or other arrangements under which we team with other reputable companies, typically companies with which we have worked for many years. This is often done where the scale of the project dictates such an arrangement or when we want to strengthen either our market position or our technical skills.

Backlog

Backlog is expressed in terms of gross revenue and therefore may include significant estimated amounts of third party, or pass-through costs to subcontractors and other parties. Our total backlog is comprised of contracted backlog and awarded backlog. Our contracted backlog includes revenue we expect to record in the future from signed contracts, and in the case of a public client, where the project has been funded. Our awarded backlog includes revenue we expect to record in the future where we have been awarded the work, but the contractual agreement has not yet been signed. For non-government contracts, our backlog includes future revenue at contract rates, excluding contract renewals or extensions that are at the discretion of the client. For contracts with a not-to-exceed maximum amount, we include revenue from such contracts in backlog to the extent of the remaining estimated amount. We calculate backlog without regard to possible project reductions or expansions or potential cancellations until such changes or cancellations occur. No assurance can be given that we will ultimately realize our full backlog.

The following summarizes contracted and awarded backlog excluding backlog related to businesses which we intend to divest, as discussed in Notes 4 and 5 to the Consolidated Financial Statements (in billions):

	September 30,		
	2009	2008	2007
Contracted backlog:			
PTS segment	$ 4.9	$ 4.2	$ 2.6
MSS segment	0.5	0.6	0.4
Total contracted backlog	$ 5.4	$ 4.8	$ 3.0
Awarded backlog:			
PTS segment	$ 3.7	$ 3.5	$ 2.2
MSS segment	0.4	0.3	0.8
Total awarded backlog	$ 4.1	$ 3.8	$ 3.0
Total backlog:			
PTS segment	$ 8.6	$ 7.7	$ 4.8
MSS segment	0.9	0.9	1.2
Total backlog	$ 9.5	$ 8.6	$ 6.0

Competition

The professional technical and management support services markets we serve are highly fragmented and we compete with a large number of regional, national and international companies. Certain of these competitors have greater financial and other resources than we do. Others are smaller and more specialized, and concentrate their resources in particular areas of expertise. The extent of our competition varies according to the particular markets and geographic area. The degree and type of competition we face is also influenced by the type and scope of a particular project. Our clients make competitive determinations based upon qualifications, experience, reputation and ability to provide the relevant services in a timely, safe and cost-efficient manner.

Seasonality

The fourth quarter of our fiscal year (July 1 to September 30) is typically our strongest quarter. The U.S. federal government has historically authorized more work during the period preceding the end of its fiscal year, September 30. In addition, many U.S. state governments with fiscal years ending on June 30 have historically accelerated spending during the fiscal first quarter when new funding budgets become

available. Within the United States, as well as other parts of the world, we generally benefit from milder weather conditions in our fiscal fourth quarter, which allows for more productivity from our field inspection and other on-site civil services. Our construction and project management services also typically expand during the high construction season of the summer months. The first quarter of our fiscal year (October 1 to December 31) is typically our weakest quarter. The harsher weather conditions impact our ability to complete work in parts of North America and the holiday season schedule affects our productivity during this period.

Insurance and Risk Management

We maintain insurance covering professional liability and claims involving bodily injury and property damage. We consider our present limits of coverage, deductibles, and reserves to be adequate. Wherever possible, we endeavor to eliminate or reduce the risk of loss on a project through the use of quality assurance/control, risk management, workplace safety and similar methods. A majority of our operating subsidiaries are quality certified under ISO 9001:2000 or an equivalent standard, and we plan to continue to obtain certification where applicable. ISO 9001:2000 refers to international quality standards developed by the International Organization for Standardization, or ISO.

Risk management is an integral part of our project management approach for fixed-price contracts and our project execution process. We have a risk management group that reviews and oversees the risk profile of our operations. This group also participates in evaluating risk through internal risk analyses in which our corporate management reviews higher-risk projects, contracts or other business decisions that require corporate approval.

Regulation

We are regulated in a number of fields in which we operate. In the United States, we deal with numerous U.S. government agencies and entities, including branches of the U.S. military, the Department of Defense, the Department of Energy, intelligence agencies and the Nuclear Regulatory Commission. When working with these and other U.S. government agencies and entities, we must comply with laws and regulations relating to the formation, administration and performance of contracts. These laws and regulations, among other things:

- require certification and disclosure of all cost or pricing data in connection with various contract negotiations;

- impose procurement regulations that define allowable and unallowable costs and otherwise govern our right to reimbursement under various cost-based U.S. government contracts; and

- restrict the use and dissemination of information classified for national security purposes and the exportation of certain products and technical data.

Internationally, we are subject to various government laws and regulations (including the U.S. Foreign Corrupt Practices Act, Arms Export Control Act, Proceeds of Crime Act and other similar non-U.S. laws and regulations), local government regulations and procurement policies and practices and varying currency, political and economic risks.

To help ensure compliance with these laws and regulations, all of our employees are required to complete tailored ethics and other compliance training relevant to their position and our operations.

Personnel

Our principal asset is our employees. A large percentage of our employees have technical and professional backgrounds and undergraduate and/or advanced degrees. We believe that we attract and retain talented employees by offering them the opportunity to work on highly visible and technically

challenging projects in a stable work environment. The tables below identify our personnel by segment and geographic region.

Personnel by Segment

	As of September 30,		
	2009	2008	2007
Professional Technical Services	32,800	33,400	22,700
Management Support Services	9,800	9,000	9,000
Corporate	600	600	300
Total	43,200	43,000	32,000

Personnel by Geographic Region

	As of September 30,		
	2009	2008	2007
Americas	19,800	20,000	12,500
Europe	4,200	4,100	3,400
Middle East	11,600	11,100	10,000
Asia/Pacific	7,600	7,800	6,100
Total	43,200	43,000	32,000

Personnel by Segment and Geographic Region

	As of September 30, 2009			
	PTS	MSS	Corporate	Total
Americas	17,300	1,900	600	19,800
Europe	4,200	—	—	4,200
Middle East	3,700	7,900	—	11,600
Asia/Pacific	7,600	—	—	7,600
Total	32,800	9,800	600	43,200

We have a number of personnel with "Top Secret" or "Q" security clearances. Some of our contracts with the U.S. government relate to projects that have elements that are classified for national security reasons. Although most of our contracts are not themselves classified, persons with high security clearances are often required to perform portions of the contracts.

A portion of our employees are employed on a project-by-project basis to meet our contractual obligations, generally in connection with government projects in our MSS segment. We believe our employee relations are good.

Geographic Information

For financial geographic information, please refer to Note 22 to the notes to our consolidated financial statements found elsewhere in this Form 10-K.

Available Information

The reports we file with the Securities and Exchange Commission, including annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and proxy materials, are

available free of charge on our website at*www.aecom.com*. You may read and copy any materials filed with the SEC at the SEC's Public Reference Room at 100 F Street, N.E., Washington, D.C. 20549. Please call the SEC at 1-800-SEC-0330 for further information about the public reference room. The SEC also maintains a web site (*www.sec.gov*) containing reports, proxy, and other information that we file with the SEC. Our Corporate Governance Guidelines and our Code of Ethics are available on our website at *www.aecom.com* under the "Investing" section. Copies of the information identified above may be obtained without charge from us by writing to AECOM Technology Corporation, 555 South Flower Street, Suite 3700, Los Angeles, California 90071, Attention: Corporate Secretary.

ITEM 1A. RISK FACTORS

The Company operates in a changing environment that involves numerous known and unknown risks and uncertainties that could materially adversely affect our operations. The risks described below highlight some of the factors that have affected, and in the future could affect our operations. Additional risks we do not yet know of or that we currently think are immaterial may also affect our business operations. If any of the events or circumstances described in the following risks actually occur, our business, financial condition or results of operations could be materially adversely affected.

We depend on long-term government contracts, some of which are only funded on an annual basis. If appropriations for funding are not made in subsequent years of a multiple-year contract, we may not be able to realize all of our anticipated revenue and profits from that project.

A substantial majority of our revenue is derived from contracts with agencies and departments of national, state and local governments. During fiscal 2009, 2008 and 2007, approximately 71%, 64% and 61%, respectively, of our revenue was derived from contracts with government entities.

Most government contracts are subject to the government's budgetary approval process. Legislatures typically appropriate funds for a given program on a year-by-year basis, even though contract performance may take more than one year. As a result, at the beginning of a program, the related contract is only partially funded, and additional funding is normally committed only as appropriations are made in each subsequent fiscal year. These appropriations, and the timing of payment of appropriated amounts, may be influenced by, among other things, the state of the economy, competing priorities for appropriation, changes in administration or control of legislatures and the timing and amount of tax receipts and the overall level of government expenditures. If appropriations are not made in subsequent years on our government contracts, then we will not realize all of our potential revenue and profit from that contract.

For instance, a significant portion of historical funding for state and local transportation projects has come from the U.S. federal government through its "SAFETEA-LU" infrastructure funding program and predecessor programs. This $286 billion program covers federal fiscal years 2004-2009. Approximately 79% of the SAFETEA-LU funding is for highway programs, 18.5% is for transit programs and 2.5% is for other programs such as motor carrier safety, national highway traffic safety and research. A key uncertainty in the outlook for federal transportation funding in the United States is the future viability of the Highway Trust Fund, which has experienced shortfalls due to a decrease in the federal gas tax receipts that fund it. In September 2008, the President signed HR 6532, a bill to amend the Internal Revenue Code to restore the Highway Trust Fund balance, transferring funds from the general Treasury to the Highway Trust Fund to provide for the funding of authorized federal transportation priorities through the end of fiscal year 2009. This raises concerns about the future funding structure for federal highway programs, particularly after SAFETEA-LU expires on December 18, 2009.

Governmental agencies may modify, curtail or terminate our contracts at any time prior to their completion and, if we do not replace them, we may suffer a decline in revenue.

Most government contracts may be modified, curtailed or terminated by the government either at its convenience or upon the default of the contractor. If the government terminates a contract at its convenience, then we typically are able to recover only costs incurred or committed, settlement expenses and profit on work completed prior to termination, which could prevent us from recognizing all of our potential revenue and profits from that contract. If the government terminates the contract due to our default, we could be liable for excess costs incurred by the government in obtaining services from another source.

Demand for our services is cyclical and may be vulnerable to sudden economic downturns and reductions in government and private industry spending. If the economy remains depressed or further weakens, our revenue and profitability could be adversely affected.

Demand for our services is cyclical and may be vulnerable to sudden economic downturns and reductions in government and private industry spending, which may result in clients delaying, curtailing or canceling proposed and existing projects. Due to the continuing economic downturn in the U.S. and international markets and severe tightening of the global credit markets, some of our clients may face considerable budget shortfalls that may limit their overall demand for our services. In addition, our clients may find it more difficult to raise capital in the future to fund their projects due to uncertainty in the municipal and general credit markets. Also, the global demand for commodities has increased raw material costs, which will cause our clients' projects to increase in overall cost and may result in the more rapid depletion of the funds that are available to our clients to spend on projects.

Because of an overall weakening economy, our clients may demand more favorable pricing or other terms while their ability to pay our invoices or to pay them in a timely manner may be adversely affected. Our government clients may face budget deficits that prohibit them from funding proposed and existing projects. If the economy continues to weaken and/or government spending is reduced, our revenue and profitability could be adversely affected.

Our contracts with governmental agencies are subject to audit, which could result in adjustments to reimbursable contract costs or, if we are charged with wrongdoing, possible temporary or permanent suspension from participating in government programs.

Our books and records are subject to audit by the various governmental agencies we serve and their representatives. These audits can result in adjustments to the amount of contract costs we believe are reimbursable by the agencies and the amount of our overhead costs allocated to the agencies. In addition, if one of our subsidiaries is charged with wrongdoing as a result of an audit, that subsidiary, and possibly our company as a whole, could be temporarily suspended or could be prohibited from bidding on and receiving future government contracts for a period of time. Furthermore, as a large government contractor, we are subject to an increased risk of investigations, criminal prosecution, civil fraud, whistleblower lawsuits and other legal actions and liabilities to which purely private sector companies are not, the results of which could adversely impact our business.

A delay in the completion of the budget process of government agencies could delay procurement of our services and have an adverse effect on our future revenue.

In years when the U.S. government does not complete its budget process before the end of its fiscal year on September 30, government operations are typically funded pursuant to a "continuing resolution" that authorizes agencies of the U.S. government to continue to operate, but does not authorize new spending initiatives. When the U.S. government operates under a continuing resolution, government agencies may delay the procurement of services, which could reduce our future revenue. Delays in the budgetary processes of states or other jurisdictions may similarly have adverse effects on our future revenue.

Our business and operating results could be adversely affected by losses under fixed-price contracts.

Fixed-price contracts require us to either perform all work under the contract for a specified lump-sum or to perform an estimated number of units of work at an agreed price per unit, with the total payment determined by the actual number of units performed. In fiscal 2009, approximately 38% of our revenue was recognized under fixed-price contracts. Fixed-price contracts are more frequently used outside of the United States and, thus, the exposures resulting from fixed-price contracts may increase as we increase our business operations outside of the United States. Fixed-price contracts expose us to a

number of risks not inherent in cost-plus and time and material contracts, including underestimation of costs, ambiguities in specifications, unforeseen costs or difficulties, problems with new technologies, delays beyond our control, failures of subcontractors to perform and economic or other changes that may occur during the contract period. Losses under fixed- price contracts could be substantial and adversely impact our results of operations.

We conduct a portion of our operations through joint venture entities, over which we may have limited control.

Approximately 20% of our fiscal 2009 revenue was derived from our operations through joint ventures or similar partnership arrangements, where control may be shared with unaffiliated third parties. As with most joint venture arrangements, differences in views among the joint venture participants may result in delayed decisions or disputes. We also cannot control the actions of our joint venture partners, and we typically have joint and several liability with our joint venture partners under the applicable contracts for joint venture projects. These factors could potentially adversely impact the business and operations of a joint venture and, in turn, our business and operations.

Operating through joint ventures in which we are minority holders results in us having limited control over many decisions made with respect to projects and internal controls relating to projects. Of the joint ventures noted above, approximately 8% of our fiscal 2009 revenue was derived from our unconsolidated joint ventures where we generally do not have control of the joint venture. These joint ventures may not be subject to the same requirements regarding internal controls and internal control over financial reporting that we follow. As a result, internal control problems may arise with respect to these joint ventures, which could have a material adverse effect on our financial condition and results of operations.

Misconduct by our employees or consultants or our failure to comply with laws or regulations applicable to our business could cause us to lose customers or lose our ability to contract with government agencies.

As a government contractor, misconduct, fraud or other improper activities caused by our employees' or consultants' failure to comply with laws or regulations could have a significant negative impact on our business and reputation. Such misconduct could include the failure to comply with federal procurement regulations, regulations regarding the protection of classified information, legislation regarding the pricing of labor and other costs in government contracts, regulations on lobbying or similar activities, and anti-corruption, export control and other applicable laws or regulations. Our failure to comply with applicable laws or regulations, misconduct by any of our employees or consultants or our failure to make timely and accurate certifications to government agencies regarding misconduct or potential misconduct could subject us to fines and penalties, loss of security clearance, cancellation of contracts and suspension or debarment from contracting with government agencies, any of which may adversely affect our business.

Our defined benefit plans have significant deficits that could grow in the future and cause us to incur additional costs.

We have defined benefit pension plans for employees in the United States, United Kingdom, Australia, Ireland, Canada and Philippines. At September 30, 2009, our defined benefit pension plans had an aggregate deficit (the excess of projected benefit obligations over the fair value of plan assets) of approximately $132.5 million. In the future, our pension deficits may increase or decrease depending on changes in the levels of interest rates, pension plan performance and other factors. Because the current economic environment has resulted in declining investment returns and interest rates, we may be required to make additional cash contributions to our pension plans and recognize further increases in our net pension cost to satisfy our funding requirements. If we are forced or elect to make up all or a portion of the deficit for unfunded benefit plans, our results of operations could be materially and adversely affected.

Our operations worldwide expose us to legal, political and economic risks in different countries as well as currency exchange rate fluctuations that could harm our business and financial results.

During fiscal 2009, revenue attributable to our services provided outside of the United States was approximately 54% of our total revenue. There are risks inherent in doing business internationally, including:

- imposition of governmental controls and changes in laws, regulations or policies;
- political and economic instability;
- civil unrest, acts of terrorism, force majeure, war, or other armed conflict;
- changes in U.S. and other national government trade policies affecting the markets for our services;
- changes in regulatory practices, tariffs and taxes;
- potential non-compliance with a wide variety of laws and regulations, including anti-corruption, export control and anti-boycott laws and similar non-U.S. laws and regulations;
- changes in labor conditions;
- logistical and communication challenges; and
- currency exchange rate fluctuations, devaluations and other conversion restrictions.

Any of these factors could have a material adverse effect on our business, results of operations or financial condition.

We operate in many different jurisdictions and we could be adversely affected by violations of the U.S. Foreign Corrupt Practices Act and similar worldwide anti-corruption laws.

The U.S. Foreign Corrupt Practices Act (FCPA) and similar worldwide anti-corruption laws generally prohibit companies and their intermediaries from making improper payments to non-U.S. officials for the purpose of obtaining or retaining business. Our internal policies mandate compliance with these anti-corruption laws. We operate in many parts of the world that have experienced governmental corruption to some degree, and in certain circumstances, strict compliance with anti-corruption laws may conflict with local customs and practices. Despite our training and compliance programs, we cannot assure you that our internal control policies and procedures always will protect us from reckless or criminal acts committed by our employees or agents. Our continued expansion outside the U.S., including in developing countries, could increase the risk of such violations in the future. Violations of these laws, or allegations of such violations, could disrupt our business and result in a material adverse effect on our results of operations or financial condition.

We work in international locations where there are high security risks, which could result in harm to our employees and contractors or material costs to us.

Some of our services are performed in high-risk locations, such as Iraq and Afghanistan, where the country or location is suffering from political, social or economic problems, or war or civil unrest. In those locations where we have employees or operations, we may incur material costs to maintain the safety of our personnel. Despite these precautions, the safety of our personnel in these locations may continue to be at risk. Acts of terrorism and threats of armed conflicts in or around various areas in which we operate could limit or disrupt markets and our operations, including disruptions resulting from the evacuation of personnel, cancellation of contracts, or the loss of key employees and contractors or assets.

Failure to successfully execute our acquisition strategy may inhibit our growth.

We have grown in part as a result of our acquisitions over the last several years, and we expect continued growth in the form of additional acquisitions and expansion into new markets. If we are unable to pursue suitable acquisition opportunities, as a result of global economic uncertainty or other factors, our growth may be inhibited. We cannot assure you that suitable acquisitions or investment opportunities will continue to be identified or that any of these transactions can be consummated on favorable terms or at all. Any future acquisitions will involve various inherent risks, such as:

- our ability to accurately assess the value, strengths, weaknesses, liabilities and potential profitability of acquisition candidates;
- the potential loss of key personnel of an acquired business;
- increased burdens on our staff and on our administrative, internal control and operating systems, which may hinder our legal and regulatory compliance activities;
- post-acquisition integration challenges; and
- post-acquisition deterioration in an acquired business that could result in lower or negative earnings contribution and/or goodwill impairment charges.

Furthermore, during the acquisition process and thereafter, our management may need to assume significant transaction-related responsibilities, which may cause them to divert their attention from our existing operations. If our management is unable to successfully integrate acquired companies or implement our growth strategy, our operating results could be harmed. Moreover, we cannot assure you that we will continue to successfully expand or that growth or expansion will result in profitability.

Our ability to grow and to compete in our industry will be harmed if we do not retain the continued services of our key technical and management personnel and identify, hire and retain additional qualified personnel.

There is strong competition for qualified technical and management personnel in the sectors in which we compete. We may not be able to continue to attract and retain qualified technical and management personnel, such as engineers, architects and project managers, who are necessary for the development of our business or to replace qualified personnel. Our planned growth may place increased demands on our resources and will likely require the addition of technical and management personnel and the development of additional expertise by existing personnel. Also, some of our personnel hold security clearances required to obtain government projects; if we were to lose some or all of these personnel, they would be difficult to replace. Loss of the services of, or failure to recruit, key technical and management personnel could limit our ability to complete existing projects successfully and to successfully compete for new projects.

Our revenue and growth prospects may be harmed if we or our employees are unable to obtain the security clearances or other qualifications we and they need to perform services for our customers.

A number of government programs require contractors to have security clearances. Depending on the level of required clearance, security clearances can be difficult and time-consuming to obtain. If we or our employees are unable to obtain or retain necessary security clearances, we may not be able to win new business, and our existing customers could terminate their contracts with us or decide not to renew them. To the extent we cannot obtain or maintain the required security clearances for our employees working on a particular contract, we may not derive the revenue or profit anticipated from such contract.

Our industry is highly competitive and we may be unable to compete effectively, which could result in reduced revenue, profitability and market share.

We are engaged in a highly competitive business. The extent of competition varies with the types of services provided and the locations of the projects. Generally, we compete on the bases of technical and

management capability, personnel qualifications and availability, geographic presence, experience and price. Increased competition may result in our inability to win bids for future projects and loss of revenue, profitability and market share.

If we extend a significant portion of our credit to clients in a specific geographic area or industry, we may experience disproportionately high levels of default if those clients are adversely affected by factors particular to their geographic area or industry.

Our clients include public and private entities that have been, and may continue to be, negatively impacted by the changing landscape in the global economy. While outside of the U.S. federal government no one client accounts for over 10% of our revenue, we face collection risk as a normal part of our business where we perform services and subsequently bill our clients for such services. In the event that we have concentrated credit risk from clients in a specific geographic area or industry, continuing negative trends or a worsening in the financial condition of that specific geographic area or industry could make us susceptible to disproportionately high levels of default by those clients. Such defaults could materially adversely impact our revenues and our results of operations.

Our services expose us to significant risks of liability and our insurance policies may not provide adequate coverage.

Our services involve significant risks of professional and other liabilities that may substantially exceed the fees that we derive from our services. In addition, we sometimes contractually assume liability under indemnification agreements. We cannot predict the magnitude of potential liabilities from the operation of our business.

Our professional liability policies cover only claims made during the term of the policy. Additionally, our insurance policies may not protect us against potential liability due to various exclusions in the policies and self-insured retention amounts. Partially or completely uninsured claims, if successful and of significant magnitude, could have a material adverse affect on our business.

Our backlog of uncompleted projects under contract is subject to unexpected adjustments and cancellations and thus, may not accurately reflect future revenue and profits.

At September 30, 2009, our contracted backlog was approximately $5.4 billion and our awarded backlog was approximately $4.1 billion for a total backlog of $9.5 billion. Our contracted backlog includes revenue we expect to record in the future from signed contracts, and in the case of a public sector client, where the project has been funded. Our awarded backlog includes revenue we expect to record in the future where we have been awarded the work, but the contractual agreement has not yet been signed. We cannot guarantee that future revenue will be realized from either category of backlog or, if realized, will result in profits. Many projects may remain in our backlog for an extended period of time because of the size or long-term nature of the contract. In addition, from time to time projects are delayed, scaled back or cancelled. These types of backlog reductions adversely affect the revenue and profits that we ultimately receive from contracts reflected in our backlog.

We have submitted claims to clients for work we performed beyond the initial scope of some of our contracts. If these clients do not approve these claims, our results of operations could be adversely impacted.

We typically have pending claims submitted under some of our contracts for payment of work performed beyond the initial contractual requirements for which we have already recorded revenue. In general, we cannot guarantee that such claims will be approved in whole, in part, or at all. If these claims are not approved, our revenue may be reduced in future periods.

In conducting our business, we depend on other contractors and subcontractors. If these parties fail to satisfy their obligations to us or other parties, or if we are unable to maintain these relationships, our revenue, profitability and growth prospects could be adversely affected.

We depend on contractors and subcontractors in conducting our business. There is a risk that we may have disputes with our subcontractors arising from, among other things, the quality and timeliness of work performed by the subcontractor, customer concerns about the subcontractor, or our failure to extend existing task orders or issue new task orders under a subcontract. In addition, if any of our subcontractors fail to deliver on a timely basis the agreed-upon supplies and/or perform the agreed-upon services, our ability to fulfill our obligations as a prime contractor may be jeopardized and/or we could be held responsible for such failures.

We also rely on relationships with other contractors when we act as their subcontractor or joint venture partner. Our future revenue and growth prospects could be adversely affected if other contractors eliminate or reduce their subcontracts or joint venture relationships with us, or if a government agency terminates or reduces these other contractors' programs, does not award them new contracts or refuses to pay under a contract. In addition, due to "pay when paid" provisions that are common in subcontracts in certain countries, including the U.S., we could experience delays in receiving payment if the prime contractor experiences payment delays.

Our quarterly operating results may fluctuate significantly.

Our quarterly revenue, expenses and operating results may fluctuate significantly because of a number of factors, including:

- the spending cycle of our public sector clients;
- employee hiring and utilization rates;
- the number and significance of client engagements commenced and completed during a quarter;
- the ability of clients to terminate engagements without penalties;
- the ability of our project managers to accurately estimate the percentage of the project completed;
- delays incurred as a result of weather conditions;
- delays incurred in connection with an engagement;
- the size and scope of engagements;
- the timing and magnitude of expenses incurred for, or savings realized from, corporate initiatives;
- changes in foreign currency rates;
- the seasonality of our business;
- the impairment of goodwill or other intangible assets; and
- general economic and political conditions.

Variations in any of these factors could cause significant fluctuations in our operating results from quarter to quarter.

Systems and information technology interruption could adversely impact our ability to operate.

We rely heavily on computer, information and communications technology and related systems in order to properly operate. From time to time, we experience occasional system interruptions and delays. If we are unable to continually add software and hardware, effectively upgrade our systems and network infrastructure and take other steps to improve the efficiency of and protect our systems, systems operation

could be interrupted or delayed. In addition, our computer and communications systems and operations could be damaged or interrupted by natural disasters, telecommunications failures, acts of war or terrorism, computer viruses, physical or electronic security breaches and similar events or disruptions. Any of these or other events could cause system interruption, delays and loss of critical data, or delay or prevent operations, and adversely affect our operating results.

Failure to adequately protect, maintain, or enforce our rights in our intellectual property may adversely limit our competitive position.

Our success depends, in part, upon our ability to protect our intellectual property. We rely on a combination of intellectual property policies and other contractual arrangements to protect much of our intellectual property where we do not believe that trademark, patent or copyright protection is appropriate or obtainable. Trade secrets are generally difficult to protect. Although our employees are subject to confidentiality obligations, this protection may be inadequate to deter or prevent misappropriation of our confidential information and/or the infringement of our patents and copyrights. Further, we may be unable to detect unauthorized use of our intellectual property or otherwise take appropriate steps to enforce our rights. Failure to adequately protect, maintain, or enforce our intellectual property rights may adversely limit our competitive position.

Our charter documents contain provisions that may delay, defer or prevent a change of control.

Provisions of our certificate of incorporation and bylaws could make it more difficult for a third party to acquire control of us, even if the change in control would be beneficial to stockholders. These provisions include the following:

- division of our Board of Directors into three classes, with each class serving a staggered three-year term;
- removal of directors for cause only;
- ability of our Board of Directors to authorize the issuance of preferred stock in series without stockholder approval;
- two-thirds stockholder vote requirement to approve specified business combinations, which include a sale of substantially all of our assets;
- vesting of exclusive authority in our Board of Directors to determine the size of the board (subject to limited exceptions) and to fill vacancies;
- advance notice requirements for stockholder proposals and nominations for election to our Board of Directors; and
- prohibitions on our stockholders from acting by written consent and limitations on calling special meetings.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

Our corporate offices are located in approximately 74,000 square feet of space at 555 and 515 South Flower Street, Los Angeles, California. Our other offices consist of an aggregate of approximately 6.5 million square feet worldwide. We also maintain smaller administrative or project offices. Virtually all of our offices are leased. See Note 14 of the notes to our consolidated financial statements for information regarding our lease obligations. We believe our current properties are adequate for our business

operations and are not currently underutilized. We may add additional facilities from time to time in the future as the need arises.

ITEM 3. LEGAL PROCEEDINGS

As a government contractor, we are subject to various laws and regulations that are more restrictive than those applicable to non-government contractors. Intense government scrutiny of contractors' compliance with those laws and regulations through audits and investigations is inherent in government contracting, and, from time to time, we receive inquiries, subpoenas, and similar demands related to our ongoing business with government entities. We also conduct internal investigations from time to time to determine if violations of company policy or applicable law have occurred. Violations can result in civil or criminal liability as well as suspension or debarment from eligibility for awards of new government contracts or option renewals.

We are involved in various investigations, claims and lawsuits in the normal conduct of our business. Although the outcome of our legal proceedings cannot be predicted with certainty and no assurances can be provided, in the opinion of our management, based upon current information and discussions with counsel, none of the investigations, claims and lawsuits in which we are involved is expected to have a material adverse effect on our consolidated financial position, results of operations, cash flows or our ability to conduct business. From time to time we establish reserves for litigation when we consider it probable that a loss will occur and the loss is estimable.

ITEM 4. SUBMISSION OF MATTERS TO A VOTE OF SECURITY HOLDERS

None.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF SECURITIES

Our common stock is listed on the New York Stock Exchange (NYSE). According to the records of our transfer agent, there were 1,546 stockholders of record as of November 18, 2009. The following table sets forth the low and high closing sales prices of a share of our common stock during each of the fiscal quarters presented, based upon quotations on the NYSE consolidated reporting system:

	Low Sales Price ($)	High Sales Price ($)
Fiscal 2009:		
First quarter	15.22	32.34
Second quarter	20.30	31.43
Third quarter	25.20	32.00
Fourth quarter	26.20	32.99

	Low Sales Price ($)	High Sales Price ($)
Fiscal 2008:		
First quarter	26.47	37.25
Second quarter	23.01	29.95
Third quarter	25.31	34.13
Fourth quarter	19.79	33.18

Our policy is to use cash flow from operations to fund future growth and pay down debt. Accordingly, we have not paid a cash dividend since our inception and we currently have no plans to pay cash dividends in the foreseeable future. Additionally, our term credit agreement and revolving credit facility restrict our ability to pay cash dividends.

The following table presents certain information about our equity compensation plans as of September 30, 2009:

Plan Category	Column A Number of securities to be issued upon exercise of outstanding options, warrants, and rights	Column B Weighted-average exercise price of outstanding options, warrants, and rights	Column C Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in Column A)
Equity compensation plans not approved by stockholders:	N/A	N/A	N/A
Equity compensation plans approved by stockholders:			
AECOM Technology Corporation 2006 Stock Incentive Plan	3,806,000	$ 16.36	10,297,629
AECOM Technology Corporation Equity Incentive Plan	N/A	N/A	4,189,556
AECOM Technology Corporation Global Stock Program(1)	N/A	N/A	27,069,238
Total	3,806,000	$ 16.36	41,556,423

(1)

The AECOM Technology Corporation Global Stock Program consists of our plans in Australia, Canada, Hong Kong, New Zealand, Singapore, United Arab Emirates/Qatar, and United Kingdom; and for the United States, the Retirement & Savings Plan, Deferred Compensation Plan and Equity Investment Plan.

Unregistered Sale of Securities

During the three-month period ended September 30, 2009, we have issued the following securities that were not registered under the Securities Act:

i. On September 30, 2009, 0.524 shares of our Class C preferred stock were transferred to U.S. Trust for the benefit of our employee stockholders under our Deferred Compensation Plan; and

ii. On September 30, 2009, 247,877 shares of our common stock and shares exchangeable into our common stock on a 1-to-1 basis to the shareholders of privately-held companies in connection with our acquisition of the companies.

We issued the securities identified in paragraph (i) above to our directors, officers, employees and consultants under written compensatory benefit plans in reliance upon Rule 701 under the Securities Act and/or Section 4(2) of the Securities Act as transactions by an issuer not involving any public offering. We issued the securities identified in paragraph (ii) above in reliance upon Section 4(2) of the Securities Act as transactions by an issuer not involving any public offering or Regulation S promulgated under the Securities Act as sales occurring outside of the United States.

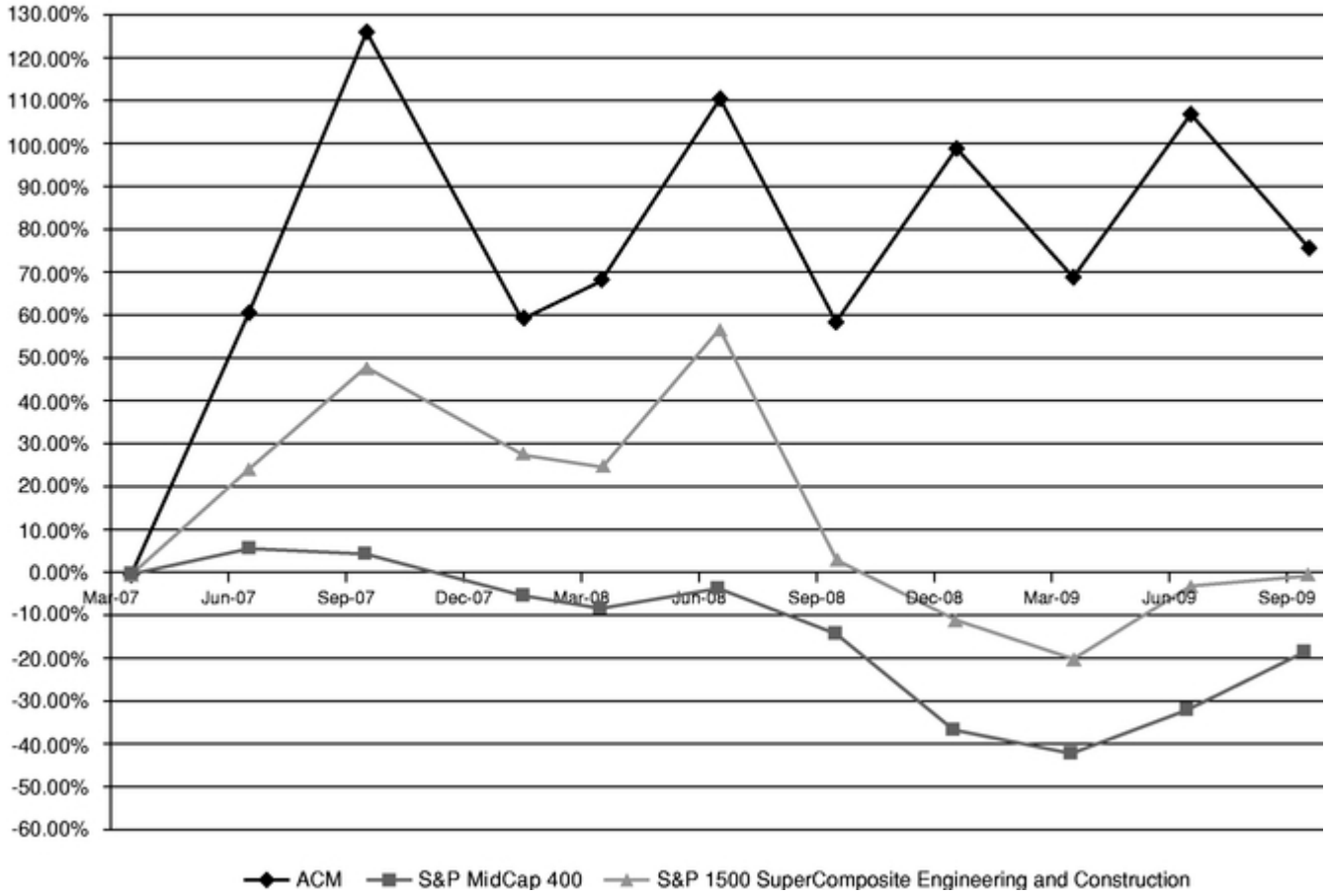
Performance Measurement Comparison(1)

The following chart compares the percentage change of AECOM stock with that of the S&P MidCap 400 and the S&P 1500 SuperComposite Engineering and Construction indices from March 31, 2007 to September 30, 2009. We believe the S&P MidCap 400, on which we are listed, is an appropriate independent broad market index, since it measures the performance of similar mid-sized companies in numerous sectors. In addition, we believe the S&P 1500 SuperComposite Engineering and Construction

Index is an appropriate published industry index since it measures the performance of engineering and construction companies.

Comparison of Percentage Change

March 1, 2007—September 30, 2009



End-of-Month Prices by Quarter

	Mar. 31, 2007	June 30, 2007	Sept. 30, 2007	Dec. 31, 2007	Mar. 31, 2008	June 30, 2008	Sept. 30, 2008	Dec. 31, 2008	Mar. 31, 2009	June 30, 2009	Sept. 30, 2009
AECOM(2)	15.40	24.81	34.93	28.57	26.01	32.53	24.44	30.73	26.08	32.00	27.14
S&P MidCap 400	848.47	895.51	885.06	858.20	779.51	819.00	727.29	538.28	489.00	578.14	691.02
S&P 1500 Super Composite Engineering and Construction	141.40	176.08	209.65	215.20	176.98	222.13	145.96	126.35	113.38	137.70	140.92

(1)

This section is not "soliciting material," is not deemed "filed" with the SEC and is not incorporated by reference in any of our filings under the Securities Act or Exchange Act whether made before or after the date hereof and irrespective of any general incorporation language in any such filing.

(2)
AECOM stock was registered under Section 12(g) of the Exchange Act but not freely traded from March 29, 2007, through May 9, 2007. Its valuation during that time was performed by an independent, third-party appraiser. The end-of-month price as of March 31, 2007 reflects the 2-for-1 stock split effected in the form of a 100% stock dividend effective May 4, 2007. Our common stock began trading on the NYSE on May 10, 2007.

ITEM 6. SELECTED FINANCIAL DATA

SELECTED CONSOLIDATED FINANCIAL DATA

You should read the following selected consolidated financial data along with "Management's Discussion and Analysis of Financial Condition and Results of Operations" and our consolidated financial statements and the accompanying notes, which are included in this Form 10-K. We derived the selected consolidated financial data from our audited consolidated financial statements.

	Year Ended September 30,				
	2009	2008	2007	2006	2005
	(in millions, except share data)				
Consolidated Statement of Income Data:					
Revenue	$ 6,119	$ 5,195	$ 4,237	$ 3,421	$ 2,395
Cost of revenue	5,768	4,908	4,039	3,278	2,278
Gross profit	351	287	198	143	117
Equity in earnings of joint ventures	23	22	12	6	2
General and administrative expenses	87	70	54	46	21
Income from operations	287	239	156	103	98
Minority interest share of earnings	14	14	16	14	8
Gain on the sale of equity investment	—	—	11	—	—
Other income (expense)	2	(3)	—	—	—
Interest (expense) income—net	(11)	1	(3)	(10)	(7)
Income from continuing operations before income tax expense	264	223	148	79	83
Income tax expense	77	77	48	25	29
Income from continuing operations	187	146	100	54	54
Discontinued operations, net of tax	3	1	—	—	—
Net income	$ 190	$ 147	$ 100	$ 54	$ 54
Net income allocation:					
Preferred stock dividend	$ —	$ —	$ —	$ 2	$ 6
Net income available for common stockholders	190	147	100	52	48
Net income	$ 190	$ 147	$ 100	$ 54	$ 54
Earnings per share from continuing operations:					
Basic	$ 1.73	$ 1.44	$ 1.37	$ 0.94	$ 0.93
Diluted	$ 1.70	$ 1.41	$ 1.15	$ 0.74	$ 0.84
Weighted average shares outstanding (in thousands):					
Basic	108,003	101,456	73,091	54,856	51,880
Diluted	109,706	104,215	87,537	72,658	63,978

	Year Ended September 30,				
	2009	2008	2007	2006	2005
	(in millions, except employee data)				
Other Data:					
Depreciation and amortization	$ 84	$ 63	$ 45	$ 40	$ 20
Amortization expense of acquired intangible assets[1]	26	18	12	15	3
Capital expenditures	63	69	43	32	31
Contracted backlog	5,356	4,811	3,043	2,480	1,980
Number of full-time and part-time employees	43,200	43,000	32,000	27,300	22,000

[1] Included in depreciation and amortization above.

	As of September 30,				
	2009	2008	2007	2006	2005
	(in millions)				
Consolidated Balance Sheet Data:					
Cash and cash equivalents	$ 291	$ 197	$ 217	$ 128	$ 54
Working capital	658	664	598	201	171
Total assets	3,790	3,596	2,492	1,826	1,425
Long-term debt excluding current portion	142	366	39	123	216
Redeemable preferred and common stock and stock units, net of notes receivable	—	—	—	970	661
Stockholders' equity/(deficit)	1,730	1,423	1,278	(291)	(240)

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

You should read the following discussion in conjunction with our consolidated financial statements and the related notes included in this report. In addition to historical consolidated financial information, the following discussion contains forward-looking statements that reflect our plans, estimates and beliefs. You should not place undue reliance on these forward-looking statements. Our actual results could differ materially. Factors that could cause or contribute to these differences include those discussed below and elsewhere in this report, particularly in "Risk Factors."

Overview

We are a leading global provider of professional technical and management support services for commercial and government clients around the world. We provide our services in a broad range of end markets and strategic geographic markets through a global network of operating offices and approximately 42,600 employees and staff employed in the field on projects.

Our business focuses primarily on providing fee-based professional technical and support services and therefore our business is labor and not capital intensive. We derive income from our ability to generate revenue and collect cash from our clients through the billing of our employees' time spent on client projects and our ability to manage our costs. We report our business through two segments: Professional Technical Services (PTS) and Management Support Services (MSS).

Our PTS segment delivers planning, consulting, architecture and engineering design, and program and construction management services to institutional, commercial and government clients worldwide in end markets such as the transportation, facilities, environmental and energy markets. PTS revenue is primarily derived

from fees from services that we provide, as opposed to pass-through fees from subcontractors and other direct costs. Revenue for our PTS segment for the year ended September 30, 2009 was $5.0 billion.

Our MSS segment provides facilities management and maintenance, training, logistics, consulting, technical assistance and systems integration services, primarily for agencies of the U.S. government. MSS revenue typically includes a significant amount of pass-through fees from subcontractors and other direct costs. Revenue for our MSS segment for the year ended September 30, 2009 was $1.1 billion.

Our revenue is dependent on our ability to attract and retain qualified and productive employees, identify business opportunities, allocate our labor resources to profitable markets, secure new contracts and renew existing client agreements. Moreover, as a professional services company, maintaining the high quality of the work generated by our employees is integral to our revenue generation.

Our costs consist primarily of the compensation we pay to our employees, including salaries, fringe benefits, the costs of hiring subcontractors and other project-related expenses, and sales, general and administrative costs.

Components of Income and Expense

Our management analyzes the results of our operations using several non-GAAP measures. A significant portion of our revenue relates to services provided by subcontractors and other non-employees that we categorize as other direct costs. Those costs are typically paid to service providers upon our receipt of payment from the client. We segregate other direct costs from revenue resulting in a measurement that we refer to as "revenue, net of other direct costs," which is a measure of work performed by AECOM employees. We have included information on revenue, net of other direct costs, as we believe that it is useful to view our revenue exclusive of costs associated with external service providers.

The following table presents, for the periods indicated, a presentation of the non-GAAP financial measures reconciled to the closest GAAP measure:

	Year Ended September 30,				
	2009	2008	2007	2006	2005
			(in millions)		
Other Financial Data:					
Revenue	$ 6,119	$ 5,195	$ 4,237	$ 3,421	$ 2,395
Other direct costs*	2,300	1,905	1,832	1,521	933
Revenue, net of other direct costs*	3,819	3,290	2,405	1,900	1,462
Cost of revenue, net of other direct costs*	3,468	3,003	2,207	1,757	1,345
Gross profit	351	287	198	143	117
Equity in earnings of joint ventures	23	22	12	6	2
General and administrative expenses	87	70	54	46	21
Income from operations	$ 287	$ 239	$ 156	$ 103	$ 98
Reconciliation of Cost of Revenue:					
Other direct costs	$ 2,300	$ 1,905	$ 1,832	$ 1,521	$ 933
Cost of revenue, net of other direct costs	3,468	3,003	2,207	1,757	1,345
Cost of revenue	$ 5,768	$ 4,908	$ 4,039	$ 3,278	$ 2,278

* Non-GAAP measure

Other Direct Costs

In the course of providing its services, the Company routinely subcontracts for services and incurs other direct costs on behalf of its clients. These costs are passed through to clients and, in accordance with industry practice and generally accepted accounting principles, are included in the Company's revenue and cost of revenue. Since subcontractor services and other direct costs can change significantly from project to project and period to period, changes in revenue may not accurately reflect business trends.

Revenue, Net of Other Direct Costs

Our discussion and analysis of our financial condition and results of operations uses revenue, net of other direct costs as a point of reference. Revenue, net of other direct costs is a non-GAAP measure and may not be comparable to similarly titled items reported by other companies.

Cost of Revenue, Net of Other Direct Costs

Cost of revenue, net of other direct costs reflects the cost of our own personnel (including fringe benefits and overhead expense) associated with revenue, net of other direct costs.

Equity in Earnings of Joint Ventures

Equity in earnings of joint ventures includes our portion of fees charged by unconsolidated joint ventures in which we participate to clients for services performed by us and other joint venture partners along with earnings we receive from investments in unconsolidated joint ventures.

Amortization Expense of Acquired Intangible Assets

Included in our cost of revenue, net of other direct costs is amortization of acquired intangible assets. We have ascribed value to identifiable intangible assets other than goodwill in our purchase price allocations for companies we have acquired. These assets include but are not limited to backlog and customer lists. To the extent we ascribe value to identifiable intangible assets that have finite lives, we amortize those values over the estimated useful lives of the assets. Such amortization expense, although non-cash in the period expensed, directly impacts our results of operations.

It is difficult to predict with any precision the amount of expense we may record relating to acquired intangible assets. As backlog is typically the shortest lived intangible asset in our business, we would expect to see higher amortization expense in the first 12 to 18 months (the typical backlog amortization period) after an acquisition has been consummated.

General and Administrative Expenses

General and administrative expenses include corporate overhead expenses, including personnel, occupancy, and administrative expenses.

Income Tax Expense

Income tax expense varies as a function of income before income tax expense and permanent non-tax deductible expenses. Acquisitions have a material effect on our income tax expense. We anticipate continuing our acquisition strategy and, as such, we anticipate that there will be variability in our effective tax rate from quarter to quarter and year to year, especially to the extent that our permanent differences increase or decrease.

Acquisitions

One of our key strategies is to focus on acquisitions of companies that complement our range of services and/or expand our geographic presence.

The aggregate value of consideration for our acquisitions consummated during the year ended September 30, 2009 was $63 million.

The aggregate value of all consideration for our acquisitions consummated during the year ended September 30, 2008 was $632 million, the largest of which were:

- *Tecsult*—During the quarter ended March 31, 2008, we completed the acquisition of Tecsult Inc., a Montreal, Canada-based engineering services firm, with particular strengths in hydroelectric power and developing country infrastructure engineering.

- *Boyle*—During the quarter ended June 30, 2008, we completed the acquisition of Boyle Engineering Corporation, a California-based engineering services firm that focuses on the environmental market.

- *Earth Tech*—During the quarter ended September 30, 2008, we acquired substantially all of Earth Tech, Inc., a California-based environmental engineering and government services company, from Tyco International, Ltd.

All of our acquisitions have been accounted for as purchases and the results of operations of the acquired companies have been included in our consolidated results since the dates of the acquisitions.

Critical Accounting Policies

Our financial statements are presented in accordance with GAAP. Highlighted below are the accounting policies that management considers significant to understanding the operations of our business.

Revenue Recognition

The Company generally utilizes a cost-to-cost approach in applying the percentage-of-completion method of revenue recognition, under which revenue is earned in proportion to total costs incurred, divided by total costs expected to be incurred. Recognition of revenue and profit under this method is dependent upon a number of factors, including the accuracy of a variety of estimates, including engineering progress, materials quantities, the achievement of milestones, penalty provisions, labor productivity and cost estimates. Due to uncertainties inherent in the estimation process, it is possible that actual completion costs may vary from estimates. If estimated total costs on contracts indicate a loss, the Company recognizes that estimated loss in the period the estimated loss first becomes known.

Claims Recognition

Claims are amounts in excess of the agreed contract price (or amounts not included in the original contract price) that we seek to collect from customers or others for delays, errors in specifications and designs, contract terminations, change orders in dispute or unapproved as to both scope and price or other causes of unanticipated additional costs. The Company records contract revenue related to claims only if it is probable that the claim will result in additional contract revenue and if the amount can be reliably estimated. In such cases, the Company records revenue only to the extent that contract costs relating to the claim have been incurred. The amounts recorded, if material, are disclosed in the notes to the financial statements. Costs attributable to claims are treated as costs of contract performance as incurred.

Unbilled Accounts Receivable and Billings in Excess of Costs on Uncompleted Contracts

Unbilled accounts receivable represents the contract revenue recognized to date using the percentage-of-completion accounting method but not yet invoiced to the client due to contract terms or the timing of the accounting invoicing cycle.

Billings in excess of costs on uncompleted contracts represent the billings to date, as allowed under the terms of a contract, but not yet recognized as contract revenue using the percentage-of-completion accounting method.

Government Contract Matters—The Company's federal government and certain state and local agency contracts are subject to, among other regulations, regulations issued under the Federal Acquisition Regulations (FAR). These regulations can limit the recovery of certain specified indirect costs on contracts and subjects the Company to ongoing multiple audits by government agencies such as the Defense Contract Audit Agency (DCAA). In addition, most of the Company's federal and state and local contracts are subject to termination at the discretion of the client.

Audits by the DCAA and other agencies consist of reviews of the Company's overhead rates, operating systems and cost proposals to ensure that the Company accounted for such costs in accordance with the Cost Accounting Standards of the FAR (CAS). If the DCAA determines the Company has not accounted for such costs consistent with CAS, the DCAA may disallow these costs. Historically, the Company has not had any material cost disallowances by the DCAA as a result of audit. However, there can be no assurance that audits by the DCAA or other governmental agencies will not result in material cost disallowances in the future.

Allowance for Doubtful Accounts—The Company records its accounts receivable net of an allowance for doubtful accounts. This allowance for doubtful accounts is estimated based on management's evaluation of the contracts involved and the financial condition of its clients. The factors the Company considers in its contract evaluations include, but are not limited to:

- Client type—federal or state and local government or commercial client;
- Historical contract performance;
- Historical collection and delinquency trends;
- Client credit worthiness; and
- General economic conditions.

Investments in Unconsolidated Joint Ventures

The Company has non-controlling interests in joint ventures accounted for under the equity method. Fees received for and the associated costs of services performed by the Company and billed to joint ventures with respect to work done by the Company for third-party customers are recorded as revenues and costs of the Company in the period in which such services are rendered. In certain joint ventures, a fee is added to the respective billings from the Company and the other joint venture partners on the amounts billed to the third-party customers. These fees result in earnings to the joint venture and are split with each of the joint venture partners and paid to the joint venture partners upon collection from the third-party customer. The Company records its allocated share of these fees as equity in earnings of joint ventures.

Income Taxes

Valuation Allowance. Deferred income taxes are provided on the liability method whereby deferred tax assets and liabilities are established for the difference between the financial reporting and income tax basis of assets and liabilities, as well as operating loss and tax credit carry forwards. Deferred tax assets and

liabilities are adjusted for the effects of changes in tax laws and rates on the date of enactment of such changes to laws and rates.

Deferred tax assets are reduced by a valuation allowance when, in our opinion, it is more likely than not that some portion or all of the deferred tax assets may not be realized. Whether a deferred tax asset may be realized requires considerable judgment by us. In considering the need for a valuation allowance, we consider the future reversal of existing temporary differences, future taxable income exclusive of reversing temporary differences and carry forwards, taxable income in carry-back years if carry-back is permitted under tax law, and prudent and feasible tax planning strategies that would normally be taken by management, in the absence of the desire to realize the deferred tax asset. Whether a deferred tax asset will ultimately be realized is also dependent on varying factors, including, but not limited to, changes in tax laws and audits by tax jurisdictions in which we operate.

We review the need for a valuation allowance at least quarterly. If we determine we will not realize all or part of our deferred tax asset in the future, we will record an additional valuation allowance. Conversely, if a valuation allowance exists and we determine that the ultimate realizability of all or part of the net deferred tax asset is more likely than not to be realized, then the amount of the valuation allowance will be reduced. This adjustment will increase or decrease income tax expense in the period of such determination.

Undistributed Non-U.S. Earnings. The results of our operations outside of the United States are consolidated by us for financial reporting; however, earnings from investments in non-U.S. operations are included in domestic U.S. taxable income only when actually or constructively received. No deferred taxes have been provided on the undistributed earnings of non-U.S. operations of approximately $318.2 million because we plan to permanently reinvest these earnings overseas. If we were to repatriate these earnings, additional taxes would be due at that time. However, these additional U.S. taxes may be offset in part by the use of foreign tax credits.

Goodwill and Acquired Intangible Assets

Goodwill represents the excess amounts paid over the fair value of net assets acquired in mergers and acquisitions. In order to determine the amount of goodwill resulting from a merger or acquisition, the Company performs an assessment to determine the value of the acquired company's tangible and identifiable intangible assets and liabilities. In its assessment, the Company determines whether identifiable intangible assets exist, which typically include backlog and customer relationships.

Statement of Financial Accounting Standards (SFAS) No. 142, later codified in Accounting Standards Codification (ASC) 350-10, "*Goodwill and Other Intangible Assets* ", requires that the Company perform an impairment test of its goodwill at least annually for each reporting unit of the Company. We have multiple reporting units, as defined under SFAS No. 142. A reporting unit is defined as an operating segment or one level below an operating segment. Our impairment tests are performed at the operating segment level as they represent our reporting units. See also Note 22.

The impairment test is a two-step process. During the first step, we estimate the fair value of the reporting unit and compare that amount to the carrying value of that reporting unit. In the event the fair value of the reporting unit is determined to be less than the carrying value, a second step is required. The second step requires us to perform a hypothetical purchase allocation for that reporting unit and to compare the resulting current implied fair value of the goodwill to the current carrying value of the goodwill for that reporting unit. In the event that the current implied fair value of the goodwill is less than the carrying value, an impairment charge is recognized.

During the fourth quarter of fiscal 2009, we conducted our annual impairment test. The impairment evaluation process is an income-based approach that utilizes discounted cash flows to determine the fair values of reporting units. Material assumptions used in the impairment analysis included the weighted average cost of capital (WACC) percent and terminal growth rates. As a result of the impairment analysis,

the Company determined that goodwill was not impaired for the year ended September 30, 2009. A 1% change in the WACC rate represents a $700 million change to the fair value of the Company's reporting units. A 1% change in the terminal growth rate represents a $400 million change to the fair value of the Company's reporting units. Neither of these changes individually would have resulted in the conclusion that goodwill was impaired at September 30, 2009.

Pension Plans

The Company accounts for its defined benefit pension plans in accordance with SFAS No. 87, later codified in ASC 715-10, "*Employers' Accounting for Pensions* ," as amended (SFAS 87). As permitted by SFAS 87, changes in retirement plan obligations and assets set aside to pay benefits are not recognized as they occur but are recognized over subsequent periods. In September 2006, the FASB issued SFAS No. 158, later codified in ASC 715-10, " *Employers' Accounting for Defined Benefit Pension and Other Postretirement Plans* " (SFAS 158). This statement amends SFAS 87 and requires that the funded status of plans, measured as the difference between plan assets at fair value and the pension benefit obligations, be recognized in the statement of financial position and that various items be recognized in other comprehensive income before they are recognized in periodic pension expense. The statement was adopted by the Company in 2007 and resulted in a $20.8 million after-tax charge to accumulated other comprehensive loss, which reduced shareholders' equity.

A number of assumptions are necessary to determine our pension liabilities and net periodic costs. These liabilities and net periodic costs are sensitive to changes in those assumptions. The assumptions include discount rates, long-term rates of return on plan assets and inflation levels limited to the United Kingdom and are generally determined based on the current economic environment in each host country at the end of each respective annual reporting period. The Company evaluates the funded status of each of its retirement plans using these current assumptions and determines the appropriate funding level considering applicable regulatory requirements, tax deductibility, reporting considerations and other factors. Based upon current assumptions, the Company expects to fund approximately $21.4 million for the fiscal year 2010. If the discount rate was reduced by 25 basis points, plan liabilities would increase by approximately $25 million. If the discount rate and return on plan assets were reduced by 25 basis points, plan expense would increase by approximately $1.3 million and $1.4 million, respectively. If inflation increased by 25 basis points, plan liabilities in the United Kingdom would increase by approximately $18 million and plan expense would increase by approximately $2.3 million.

At each measurement date, all assumptions are reviewed and adjusted as appropriate. With respect to establishing the return on assets assumption, the Company considers the long term capital market expectations for each asset class held as an investment by the various pension plans. In addition to expected returns for each asset class, the Company takes into account standard deviation of returns and correlation between asset classes. This is necessary in order to generate a distribution of possible returns which reflects diversification of assets. Based on this information, a distribution of possible returns is generated based on the plan's target asset allocation.

Capital market expectations for determining the long term rate of return on assets are based on forward-looking assumptions which reflect a 20-year view of the capital markets. In establishing those capital market assumptions and expectations, the Company relies on the assistance of its actuary and its investment consultant. The Company and Trustees review whether changes to the various plans' target asset allocations are appropriate. A change in the plans' target asset allocations would likely result in a change in the expected return on asset assumptions. In assessing a plan's asset allocation strategy, the Company and Trustees considers factors such as the structure of the plan's liabilities, the plan's funded status, and the impact of the asset allocation to the volatility of the plan's funded status, so that the overall risk level resulting from the Company's defined benefit plans is appropriate within the Company's risk management strategy.

Between September 30, 2008 and September 30, 2009, the aggregate worldwide pension deficit grew from $116.3 million to an estimated $132.5 million. This increase in unfunded liabilities is primarily driven by losses in equity markets worldwide. Although funding rules are subject to local laws and regulations and vary by location, the Company expects to reduce this deficit over a period of 7 to 10 years. If the various plans do not experience future investment gains to reduce this shortfall, the deficit will be funded by Company contributions.

Accrued Professional Liability Costs

We carry professional liability insurance policies or self-insure for our initial layer of professional liability claims under our professional liability insurance policies and for a deductible for each claim even after exceeding the self-insured retention. We accrue for our portion of the estimated ultimate liability for the estimated potential incurred losses. We establish our estimate of loss for each potential claim in consultation with legal counsel handling the specific matters and based on historic trends taking into account recent events. We also use an outside actuarial firm to assist us in estimating our future claims exposure. It is possible that our estimate of loss may be revised based on the actual or revised estimate of liability of the claims.

Foreign Currency Translation—The Company's functional currency is the U.S. dollar. Results of operations for foreign entities are translated to U.S. dollars using the average exchange rates during the period. Assets and liabilities for foreign entities are translated using the exchange rates in effect as of the date of the balance sheet. Resulting translation adjustments are recorded as a foreign currency translation adjustment into other accumulated comprehensive income/(loss) in stockholders' equity.

The Company uses forward exchange contracts from time to time to mitigate foreign currency risk. The Company limits exposure to foreign currency fluctuations in most of its contracts through provisions that require client payments in currencies corresponding to the currency in which costs are incurred. As a result of this natural hedge, the Company generally does not need to hedge foreign currency cash flows for contract work performed. The functional currency of all significant foreign operations is the respective local currency.

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Fiscal year ended September 30, 2009 compared to the fiscal year ended September 30, 2008

Consolidated Results

	Twelve Months Ended		Change	
	September 30, 2009	September 30, 2008	$	%
	($ in thousands)			
Revenue	$ 6,119,465	$ 5,194,682	$ 924,783	17.8%
Other direct costs	2,300,496	1,905,174	395,322	20.8
Revenue, net of other direct costs	3,818,969	3,289,508	529,461	16.1
Cost of revenue, net of other direct costs	3,467,766	3,002,610	465,156	15.5
Gross profit	351,203	286,898	64,305	22.4
Equity in earnings of joint ventures	22,557	22,191	366	1.6
General and administrative expense	86,894	70,582	16,312	23.1
Income from operations	286,866	238,507	48,359	20.3
Minority interest in share of earnings	14,182	13,390	792	5.9
Other income (expense)	1,713	(3,438)	5,151	*
Interest (expense) income—net	(10,691)	1,336	(12,027)	*
Income before income tax expense	263,706	223,015	40,691	18.2
Income tax expense	77,002	76,493	509	0.7
Income from continuing operations	186,704	146,522	40,182	27.4
Discontinued operations, net of tax	2,992	704	2,288	325.0
Net income	$ 189,696	$ 147,226	$ 42,470	28.8%

*

Not meaningful

The following table presents the percentage relationship of certain items to revenue, net of other direct costs:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
Revenue, net of other direct costs	100.0%	100.0%
Cost of revenue, net of other direct costs	90.8	91.3
Gross profit	9.2	8.7
Equity in earnings of joint ventures	0.6	0.7
General and administrative expense	2.3	2.1
Income from operations	7.5	7.3

Minority interest in share of earnings	0.4	0.4
Other income (expense)	—	(0.1)
Interest (expense) income—net	(0.2)	—
Income before income tax expense	6.9	6.8
Income tax expense	2.0	2.3
Income from continuing operations	4.9	4.5
Discontinued operations, net of tax	0.1	—
Net income	5.0%	4.5%

Revenue

Our revenue for the year ended September 30, 2009 increased $924.8 million, or 17.8%, to $6.1 billion as compared to $5.2 billion for the corresponding period last year. Of this increase, $20.9 million, or 2.3%, was provided by companies acquired in the past twelve months. Excluding the revenue provided by companies acquired in the past twelve months, revenue increased $903.9 million, or 17.4%, over the year ended September 30, 2008.

The increase in revenue, excluding acquired companies, was primarily attributable to the inclusion of Earth Tech, acquired on July 25, 2008, for the full fiscal year 2009 resulting in an increase of $680.6 million from the prior year, as well as a $195.0 million, or 22.5%, increase in our MSS segment as described below. The increase was further attributable to strong demand for our engineering and program management services on infrastructure projects in the United States, United Arab Emirates, Libya, Hong Kong, Canada, and Australia which experienced a combined increase of approximately $391 million excluding the effects of weaker foreign currencies as compared to their values against the U.S. dollar in the prior year. These increases were partially offset by a $131.1 million decline in our commercial facilities business and weaker foreign currencies (primarily the British pound, Australian dollar, and Canadian dollar) of approximately $270 million.

Revenue, Net of Other Direct Costs

Our revenue, net of other direct costs for the year ended September 30, 2009 increased $529.5 million, or 16.1%, to $3.8 billion as compared to $3.3 billion for the corresponding period last year. Of this increase, $18.7 million, or 3.5%, was provided by companies acquired in the past twelve months. Excluding revenue, net of other direct costs provided by acquired companies, revenue, net of other direct costs increased $510.8 million, or 15.5%, over fiscal 2008.

The increase in revenue, net of other direct costs, excluding revenue net of other direct costs provided by acquired companies, was primarily due to the changes in revenue noted above.

Gross Profit

Our gross profit for the year ended September 30, 2009 increased $64.3 million, or 22.4%, to $351.2 million, as compared to $286.9 million for the corresponding period last year. Of this increase, $2.2 million, or 3.4%, was provided by companies acquired in the past twelve months. Excluding gross profit provided by acquired companies, gross profit increased $62.1 million, or 21.7%, over the year ended September 30, 2008, consistent with the increase in revenue, net of other direct costs. For the year ended September 30, 2009, gross profit as a percentage of revenue, net of other direct costs, increased to 9.2% from 8.7% in the year ended September 30, 2008.

Excluding acquired companies, the increases in gross profit and gross profit, as a percentage of revenue, net of other direct costs were primarily attributable to the increase in revenue, reduced overhead realized and improved project performance in our PTS segment.

Equity in Earnings of Joint Ventures

Our equity in earnings of joint ventures for the year ended September 30, 2009 increased $0.4 million, or 1.6%, to $22.6 million as compared to $22.2 million for the corresponding period last year.

The increase was primarily attributable to increased volume in a joint venture providing engineering and design services at an airport in the United Arab Emirates and a joint venture for technical services for the United States Department of Energy at the Nevada Test Site, partially offset by the acquisition in September 2008 of the majority partner's interest in a joint venture in the Middle East that provides consulting services.

General and Administrative Expenses

Our general and administrative expenses for the year ended September 30, 2009 increased $16.3 million, or 23.1%, to $86.9 million as compared to $70.6 million for the corresponding period last year. As a percentage of revenue, net of other direct costs, general and administrative expenses increased slightly from 2.1% in the year ended September 30, 2008 to 2.3% in the year ended September 30, 2009.

The increase in general and administrative expenses was primarily attributable to costs associated with the support and integration of Earth Tech and other recent acquisitions. The increase in general and administrative expenses was also due to increased staffing and other expenses related to the growth in our business noted above, and continued investments to support our strategic initiatives.

Other Income / Expense

Our other income for the year ended September 30, 2009 was $1.7 million compared to other expense of $3.4 million for September 30, 2008.

Other income and expense is primarily comprised of net gains and losses on investments we hold to offset our exposure related to employees' investments in a deferred compensation plan.

Interest Income / Expense—Net

Our net interest expense for the year ended September 30, 2009 was $10.7 million as compared to $1.3 million of net interest income for the year ended September 30, 2008.

The change in net interest expense as compared to the net interest income last year is primarily due to higher borrowings and lower investment balances associated with the funding of acquisitions, primarily Earth Tech, completed in fiscal 2008.

Income Tax Expense

Our income tax expense for the year ended September 30, 2009 increased $0.5 million, or 0.7%, to $77.0 million as compared to $76.5 million for the year ended September 30, 2008. The effective tax rate was 29.2% and 34.3% for the years ended September 30, 2009 and 2008, respectively.

The decrease in the effective tax rate was primarily attributable to a $5.9 million reduction in the reserve for uncertain tax positions for the fiscal year ended September 30, 2009 as compared to a $20.2 million increase for the fiscal year ended September 30, 2008. The decrease in the reserve for uncertain tax positions for the fiscal year ended September 30, 2009 is due to reductions of $11.5 million related to the finalization of a multi-year R&E income tax credit study and $4.5 million due to the lapse of various statutes of limitation partially offset by a net $10.1 million current year increase for additional unrecognized tax benefits.

Net Income

The factors described above resulted in net income of $189.7 million in the year ended September 30, 2009, as compared to net income of $147.2 million in the year ended September 30, 2008.

Results of Operations by Reportable Segment

Professional Technical Services

	Fiscal Year Ended		Change	
	September 30, 2009	September 30, 2008	$	%
	($ in thousands)			
Revenue	$ 5,057,688	$ 4,327,871	$ 729,817	16.9%
Other direct costs	1,492,207	1,194,140	298,067	25.0
Revenue, net of other direct costs	3,565,481	3,133,731	431,750	13.8
Cost of revenue, net of other direct costs	3,252,533	2,872,117	380,416	13.2
Gross profit	$ 312,948	$ 261,614	$ 51,334	19.6%

The following table presents the percentage relationship of certain items to revenue, net of other direct costs:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
Revenue, net of other direct costs	100.0%	100.0%
Cost of revenue, net of other direct costs	91.2	91.7
Gross profit	8.8%	8.3%

Revenue

Revenue for our PTS segment for the year ended September 30, 2009 increased $729.8 million, or 16.9%, to $5.0 billion as compared to $4.3 billion for the prior year. Of this increase, $20.9 million, or 2.9%, was provided by companies acquired in the past twelve months. Excluding revenue provided by acquired companies, revenue increased $708.9 million, or 16.4%, over the year ended September 30, 2008.

The increase in revenue, excluding acquired companies, was primarily driven by the inclusion of Earth Tech, acquired on July 25, 2008, for the full fiscal 2009 resulting in an increase of $680.6 million. Additionally, strong demand for our engineering and program management services on infrastructure projects in the United States, United Arab Emirates, Hong Kong, Libya, Canada, and Australia resulted in a $391 million increase excluding the effects of weaker foreign currencies as compared to their values against the U.S. dollar in the prior year. Increased services provided in these markets were partially offset by weaker foreign currencies (primarily the British pound, Australian dollar, and Canadian dollar) and a decline in our commercial facilities business as previously discussed.

Revenue, Net of Other Direct Costs

Revenue, net of other direct costs for our PTS segment for the year ended September 30, 2009 increased $431.8 million, or 13.8%, to $3.6 billion as compared to $3.1 billion for the corresponding period last year. Of this increase, $18.7 million, or 4.3%, was provided by companies acquired in the past twelve months. Excluding revenue, net of other direct costs provided by acquired companies, revenue, net of other direct costs increased $413.1 million, or 13.2%, over the year ended September 30, 2008.

The increase in revenue, net of other direct costs was primarily due to the changes in revenue noted above.

Gross Profit

Gross profit for our PTS segment for the year ended September 30, 2009 increased $51.3 million, or 19.6%, to $312.9 million as compared to $261.6 million for the corresponding period last year. Of this

increase, $2.2 million, or 4.3%, was provided by companies acquired in the past twelve months. Excluding gross profit provided by acquired companies, gross profit increased $49.1 million, or 18.8%, consistent with the increase in revenue, net of other direct costs. As a percentage of revenue, net of other direct costs, gross profit increased to 8.8% of revenue, net of other direct costs in the year ended September 30, 2009 from 8.3% in the corresponding period last year.

Excluding acquired companies, these increases in gross profit and gross profit, as a percentage of revenue, net of other direct costs, were primarily attributable to reduced overhead resulting from our continuing cost efficiency initiatives and improved project performance.

Management Support Services

	Fiscal Year Ended		Change	
	September 30, 2009	September 30, 2008	$	%
	($ in thousands)			
Revenue	$ 1,061,777	$ 866,811	$ 194,966	22.5%
Other direct costs	808,289	711,034	97,255	13.7
Revenue, net of other direct costs	253,488	155,777	97,711	62.7
Cost of revenue, net of other direct costs	215,233	130,493	84,740	64.9
Gross profit	$ 38,255	$ 25,284	$ 12,971	51.3%

The following table presents the percentage relationship of certain items to revenue, net of other direct costs:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
Revenue, net of other direct costs	100.0%	100.0%
Cost of revenue, net of other direct costs	84.9	83.8
Gross profit	15.1%	16.2%

Revenue

Revenue for our MSS segment for the year ended September 30, 2009 increased $195.0 million, or 22.5%, to $1.1 billion as compared to $866.8 million for the corresponding period last year, none of which was provided by companies acquired in the past twelve months.

The increase was primarily attributable to new task orders on our Contract Field Teams project with the United States Air Force, and a higher volume of activity on our Taji National Depot and Combat Support projects for the United States Army in the Middle East. Revenue growth from these projects was approximately $267.4 million partially offset by a reduction in volume in our global maintenance and supply services business and the completion in the third quarter of fiscal 2009 of a base operations contract at a military facility in the United States.

Revenue, Net of Other Direct Costs

Revenue, net of other direct costs for our MSS segment for the year ended September 30, 2009 increased $97.7 million, or 62.7%, to $253.5 million as compared to $155.8 million for the corresponding period last year.

The increase was primarily attributable to an increase in our services and personnel resulting from task orders received on our Contract Field Teams project that commenced in October 2008 and increased

activity on our Taji National Depot project. Revenue, net of other direct costs from these projects increased approximately $104.0 million.

The higher percentage growth in revenue, net of other direct costs as compared to revenue was the result of the increase in task orders on the Contract Field Teams project which has a significantly greater portion of self-performed work as compared to other projects in the MSS segment.

Gross Profit

Gross profit for our MSS segment for the year ended September 30, 2009 increased $13.0 million, or 51.3%, to $38.3 million as compared to $25.3 million for the corresponding period last year. As a percentage of revenue, net of other direct costs, gross profit decreased to 15.1% in the year ended September 30, 2009 from 16.2% in the corresponding period last year.

The decrease in gross profit, as a percentage of revenue, net of other direct costs was primarily due to the growth in revenue, net of other direct costs for the Contract Field Teams project noted above, which has a relatively lower margin than other MSS projects.

Fiscal year ended September 30, 2008 compared to the fiscal year ended September 30, 2007

Consolidated Results

	Twelve Months Ended		Change	
	September 30, 2008	September 30, 2007	$	%
	($ in thousands)			
Revenue	$ 5,194,682	$ 4,237,270	$ 957,412	22.6%
Other direct costs	1,905,174	1,832,001	73,173	4.0
Revenue, net of other direct costs	3,289,508	2,405,269	884,239	36.8
Cost of revenue, net of other direct costs	3,002,610	2,207,316	795,294	36.0
Gross profit	286,898	197,953	88,945	44.9
Equity in earnings of joint ventures	22,191	11,828	10,363	87.6
General and administrative expense	70,582	53,842	16,740	31.1
Income from operations	238,507	155,939	82,568	52.9
Minority interest in share of earnings	13,390	16,404	(3,014)	(18.4)
Gain on sale of equity investment	—	11,286	(11,286)	(100.0)
Other expense	(3,438)	—	(3,438)	—
Interest income (expense)—net	1,336	(3,321)	4,657	(140.2)
Income before income tax expense	223,015	147,500	75,515	51.2
Income tax expense	76,493	47,203	29,290	62.1
Income from continuing operations	146,522	100,297	46,225	46.1
Discontinued operations, net of tax	704	—	704	—
Net income	$ 147,226	$ 100,297	$ 46,929	46.8%

The following table presents the percentage relationship of certain items to revenue, net of other direct costs:

	Fiscal Year Ended	
	September 30, 2008	September 30, 2007
Revenue, net of other direct costs	100.0%	100.0%
Cost of revenue, net of other direct costs	91.3	91.8
Gross profit	8.7	8.2
Equity in earnings of joint ventures	0.7	0.5
General and administrative expense	2.1	2.2
Income from operations	7.3	6.5
Minority interest in share of earnings	0.4	0.7
Gain on sale of equity investment	—	0.5
Other expense	(0.1)	—
Interest income (expense)—net	—	(0.2)
Income before income tax expense	6.8	6.1
Income tax expense	2.3	1.9
Income from continuing operations	4.5	4.2
Discontinued operations, net of tax	—	—
Net income	4.5%	4.2%

Revenue

Our revenue for the year ended September 30, 2008 increased $957.4 million, or 22.6%, to $5.2 billion as compared to $4.2 billion for the corresponding period in fiscal 2007. Of this increase, $424.3 million, or 44.3%, was provided by companies acquired in the past twelve months. Excluding the revenue provided by acquired companies, revenue increased $533.1 million, or 12.6%, over fiscal 2007. This increase was primarily attributable to greater volumes of work performed in our environmental management services business in all of our geographic markets, continued strength in our engineering design services in the United Arab Emirates, higher government spending for highway and transit infrastructure projects in Australia and an increase in demand for work performed in our planning and urban design business. Increased demand in these markets was partially offset by a decline in our design/build services business due to the completion of a significant facility project in the fourth quarter of fiscal 2007.

Revenue, Net of Other Direct Costs

Our revenue, net of other direct costs for the year ended September 30, 2008 increased $884.2 million, or 36.8%, to $3.3 billion as compared to $2.4 billion for the corresponding period in fiscal 2007. Of this increase, $301.4 million, or 34.1%, was provided by companies acquired in the past twelve months. Excluding revenue, net of other direct costs provided by acquired companies, revenue, net of other direct costs increased $582.8 million, or 24.2%, over fiscal 2007. The increase was primarily due to strong demand in the markets noted above, resulting in increased project staffing. The larger percentage increases in revenue, net of other direct costs, compared to the increase in revenue during the same period resulted from the decline in our design/build services business in the United States which contains a proportionately higher component of subcontractor costs.

Gross Profit

Our gross profit for the year ended September 30, 2008 increased $88.9 million, or 44.9%, to $286.9 million, as compared to $198.0 million for the corresponding period in fiscal 2007. Of this increase, $20.2 million, or 22.7%, was provided by companies acquired in the past twelve months. Excluding gross profit provided by acquired companies, gross profit increased $68.7 million, or 34.7%, over the year ended

September 30, 2007, consistent with the increase in revenue, net of other direct costs. For the year ended September 30, 2008, gross profit as a percentage of revenue, net of other direct costs, increased to 8.7% from 8.2% in fiscal 2007. The increase was primarily due to greater demand for services in higher margin end markets including our world-wide environmental management services business, and our engineering design business in the United Arab Emirates.

Equity in Earnings of Joint Ventures

Our equity in earnings of joint ventures for the year ended September 30, 2008 increased $10.4 million, or 87.6%, to $22.2 million as compared to $11.8 million for the corresponding period in fiscal 2007. The increase was primarily attributable to $3.4 million contributed by the acquisitions of Earth Tech and Tecsult, increased joint venture activity in the Middle East, and improved performance in a European joint venture that was in its initial phase in the prior year.

General and Administrative Expenses

Our general and administrative expenses for the year ended September 30, 2008 increased $16.8 million, or 31.1%, to $70.6 million as compared to $53.8 million for the corresponding period in fiscal 2007. Of this increase, $3.0 million, or 17.9%, was incurred by companies acquired in the past twelve months. The increase was primarily attributable to the growth in revenue noted above, continued investments to support strategic initiatives and expenses incurred related to our becoming a public reporting company in March 2007, including compliance efforts related to our initial implementation of the requirements of Section 404 the Sarbanes-Oxley Act of 2002, relating to internal controls over financial reporting. As a percentage of revenue, net of other direct costs, general and administrative expenses decreased slightly from 2.2% in fiscal 2007 to 2.1% in the year ended September 30, 2008.

Gain on Sale of Equity Investment

In December 2006, we sold our minority interest in an equity investment in the United Kingdom for 7.5 million GBP, or approximately $14.7 million. As a result, we recorded a gain on the sale of $11.3 million for the year ended September 30, 2007.

Interest Income / Expense—Net

Our interest income for the year ended September 30, 2008 was $1.3 million as compared to $3.3 million of net interest expense for the corresponding period in fiscal 2007. The increase in net interest income was primarily attributable to higher investment balances and lower borrowings resulting from the use of proceeds received in our initial public offering completed in May 2007, partially offset by debt incurred in connection with the purchase of Earth Tech in the quarter ended September 30, 2008.

Income Tax Expense

Our income tax expense for the year ended September 30, 2008 increased $29.3 million, or 62.1%, to $76.5 million as compared to $47.2 million for fiscal 2007. The effective tax rate was 34.3% and 32.0% for the years ended September 30, 2008 and 2007, respectively. The increase in the effective tax rate was due to proportionately less income in low tax jurisdictions and the increase in the reserve for uncertain income tax positions.

Net Income

The factors described above resulted in net income of $147.2 million in the year ended September 30, 2008, as compared to net income of $100.3 million in fiscal 2007.

Results of Operations by Reportable Segment

Professional Technical Services

	Fiscal Year Ended		Change	
	September 30, 2008	September 30, 2007	$	%
	($ in thousands)			
Revenue	$ 4,327,871	$ 3,418,683	$ 909,188	26.6%
Other direct costs	1,194,140	1,122,967	71,173	6.3
Revenue, net of other direct costs	3,133,731	2,295,716	838,015	36.5
Cost of revenue, net of other direct costs	2,872,117	2,117,271	754,846	35.7
Gross profit	$ 261,614	$ 178,445	$ 83,169	46.6%

The following table presents the percentage relationship of certain items to revenue, net of other direct costs:

	Fiscal Year Ended	
	September 30, 2008	September 30, 2007
Revenue, net of other direct costs	100.0%	100.0%
Cost of revenue, net of other direct costs	91.7	92.2
Gross profit	8.3%	7.8%

Revenue

Revenue for our PTS segment for the year ended September 30, 2008 increased $909.2 million, or 26.6%, to $4.3 billion as compared to $3.4 billion for the corresponding period in fiscal 2007. Of this increase, $424.3 million, or 46.7%, was provided by companies acquired in the past twelve months. Excluding revenue provided by acquired companies, revenue increased $484.9 million, or 14.2%, over fiscal 2007. The increase was primarily attributable to an increase in demand for our environmental management services in all of our geographic markets, continued strength in our engineering design services in the United Arab Emirates, higher government spending for highway and transit infrastructure projects in Australia, greater volumes of work performed in our planning and urban design business, and the start up of program management services on our Libya Housing and Infrastructure Board project. Increased demand in these markets was partially offset by a decline in our design/build services business in the United States due to the completion of a significant educational facility project in the fourth quarter of fiscal 2007.

Revenue, Net of Other Direct Costs

Revenue, net of other direct costs for our PTS segment for the year ended September 30, 2008 increased $838.0 million, or 36.5%, to $3.1 billion as compared to $2.3 billion for the corresponding period in fiscal 2007. Of this increase, $301.4 million, or 36.0%, was provided by companies acquired in the past twelve months. Excluding revenue, net of other direct costs provided by acquired companies, revenue, net of other direct costs increased $536.6 million, or 23.4%, over fiscal 2007. This increase was primarily attributable to the factors mentioned above.

Gross Profit

Gross profit for our PTS segment for the year ended September 30, 2008 increased $83.2 million, or 46.6%, to $261.6 million as compared to $178.4 million for the corresponding period in fiscal 2007. Of this increase, $17.2 million, or 20.7%, was provided by companies acquired in the past twelve months. Excluding gross profit provided by acquired companies, gross profit increased $66.0 million, or 37.0%, consistent with the increase in revenue, net of other direct costs. As a percentage of revenue, net of other direct costs, gross profit increased to 8.3% of revenue, net of other direct costs in the year ended September 30, 2008 from 7.8% in the corresponding period in fiscal 2007 primarily due to greater demand for services in higher margin end markets including our world-wide environmental management services business and our engineering design business in the United Arab Emirates.

Management Support Services

	Fiscal Year Ended		Change	
	September 30, 2008	September 30, 2007	$	%
	($ in thousands)			
Revenue	$ 866,811	$ 818,587	$ 48,224	5.9%
Other direct costs	711,034	709,034	2,000	0.3
Revenue, net of other direct costs	155,777	109,553	46,224	42.2
Cost of revenue, net of other direct costs	130,493	90,045	40,448	44.9
Gross profit	$ 25,284	$ 19,508	$ 5,776	29.6%

The following table presents the percentage relationship of certain items to revenue, net of other direct costs:

	Fiscal Year Ended	
	September 30, 2008	September 30, 2007
Revenue, net of other direct costs	100.0%	100.0%
Cost of revenue, net of other direct costs	83.8	82.2
Gross profit	16.2%	17.8%

Revenue

Revenue for our MSS segment for the year ended September 30, 2008 increased $48.2 million, or 5.9%, to $866.8 million as compared to $818.6 million for the corresponding period in fiscal 2007, none of which was provided by companies acquired in the past twelve months. This increase was primarily attributable to a higher volume of task orders received related to our global maintenance and depot services projects for the U.S. government in the Middle East.

Revenue, Net of Other Direct Costs

Revenue, net of other direct costs for our MSS segment for the year ended September 30, 2008 increased $46.2 million, or 42.2%, to $155.8 million as compared to $109.6 million for the corresponding period in fiscal 2007. The increase was primarily attributable to an increase in our personnel associated with additional task orders received in support of United States government activities in the Middle East, and the successful negotiation of certain modifications on our combat support project.

Gross Profit

Gross profit for our MSS segment for the year ended September 30, 2008 increased $5.8 million, or 29.6%, to $25.3 million as compared to $19.5 million for the corresponding period in fiscal 2007. This increase in gross profit was primarily due to the increase in revenue, net of other direct costs, partially offset by a $5.8 million reduction in accrued award fees on a U.S. government project pending final negotiation of such fees.

As a percentage of revenue, net of other direct costs, gross profit decreased to 16.2% in the year ended September 30, 2008 from 17.8% in the corresponding period in fiscal 2007. This decrease was due to the $5.8 million reduction in award fees noted above.

Seasonality

The fourth quarter of our fiscal year (July 1 to September 30) is typically our strongest quarter. The U.S. federal government tends to authorize more work during the period preceding the end of its fiscal year, September 30. In addition, many U.S. state governments with fiscal years ending on June 30 tend to accelerate spending during the fiscal first quarter when new funding budgets become available. Within a number of parts of the world in which we operate, we generally benefit from milder weather conditions in our fiscal fourth quarter, which allows for more productivity from our field inspection and other on-site civil services. Our construction and project management services also typically expand during the high construction season of the summer months. The first quarter of our fiscal year (October 1 to December 31) is typically our weakest quarter. The harsher weather conditions impact our ability to complete work in parts of North America and the holiday season schedule affects our productivity during this period. For these reasons, coupled with the number and significance of client contracts commenced and completed during a particular period, as well as the timing of expenses incurred for corporate initiatives, it is not unusual for us to experience seasonal changes or fluctuations in our quarterly operating results.

Liquidity and Capital Resources

Cash Flows

Our principal source of liquidity is cash flows from operations, and our principal uses of cash are for operating expenses, capital expenditures, working capital requirements, acquisitions, and repayment of debt. We believe our anticipated sources of liquidity including operating cash flows, existing cash and cash equivalents, and borrowing capacity under our revolving credit facility will be sufficient to meet our projected cash requirements for at least the next 12 months.

At September 30, 2009, cash and cash equivalents were $290.8 million, an increase of $93.7 million, or 47.5%, from $197.1 million at September 30, 2008. This increase was primarily attributable to cash provided by operating activities and proceeds from the issuance of common stock, offset by repayments of borrowings.

Net cash provided by operating activities was $218.3 million for the year ended September 30, 2009, an increase of $60.5 million, or 38.3%, from $157.8 million for the year ended September 30, 2008. This increase was primarily attributable to a $42.5 million increase in net income, a $21.4 million increase in depreciation and amortization, and lower days receivables outstanding.

Net cash used in investing activities was $14.3 million for the year ended September 30, 2009, a decrease of $507.0 million, or 97.3%, from the net cash used in investing activities of $521.3 million in the year ended September 30, 2008. For the year ended September 30, 2009, net cash used in business combinations was $35.7 million as compared to $656.9 million for the year ended September 30, 2008. The change was primarily due to fewer business acquisitions in fiscal 2009 compared to fiscal 2008. Also, the business acquisitions in 2009 were smaller in size than some of the significant acquisitions we made in fiscal 2008 such as Earth Tech.

Net cash used in financing activities was $110.7 million for the year ended September 30, 2009, compared with cash provided by financing activities of $346.7 million in the year ended September 30, 2008. In the year ended September 30, 2009, we repaid $210 million of borrowings under our unsecured revolving credit facility. In March 2009, we sold 4.6 million shares of common stock in a public offering at a price per share of $20.20, for proceeds of $91.4 million, net of underwriters' discounts and offering costs. These proceeds were primarily used to repay borrowings on our unsecured revolving credit facility. In the year ended September 30, 2008, proceeds from borrowings of $333.4 million were primarily used to fund business acquisitions discussed above.

In May 2007, we completed the initial public offering of 40.4 million shares of our common stock, which included the exercise of the underwriters' over-allotment option to purchase 5.3 million shares, at $20.00 per share. Of the total shares sold in the offering, 15.3 million were sold by stockholders of the Company. Proceeds to the Company, net of underwriting discounts, commissions, and other offering-related costs, were $468.3 million, of which $75.4 million was used to fund elections by employees to diversify their holdings of AECOM stock units in the Company's deferred compensation plan. In August 2009, the Company filed a shelf registration statement that allows it to sell up to 4,000,000 shares of its common stock. No shares have been sold under the program to date.

Working Capital

Working capital, or current assets less current liabilities, decreased $6.1 million, or 0.9%, to $657.8 million at September 30, 2009 from $663.9 million at September 30, 2008. Net accounts receivable, which includes billed and unbilled costs and fees, net of billings in excess of costs on uncompleted contracts, increased $58.3 million, or 4.3%, to $1.4 billion at September 30, 2009, primarily attributable to the timing of collections of accounts receivable.

Accounts receivable increased 5.8%, or $95.3 million, from September 30, 2008 to September 30, 2009 primarily due to the increase in revenue.

Days Sales Outstanding ("DSO"), including accounts receivable, net of billings in excess of costs on uncompleted contracts, at September 30, 2009, was 78 days compared to the 80 days at September 30, 2008.

In Note 7, Accounts Receivable—Net, the Company provides a comparative analysis of the various components of accounts receivable. Substantially all unbilled receivables as of September 30, 2009 and 2008 are expected to be billed and collected within twelve months of such date.

The Company records unbilled receivables related to claims only if it is probable that the claim will result in additional contract revenue and if the amount can be reliably estimated. In such cases, the Company records revenue only to the extent that contract costs relating to the claim have been incurred. As of September 30, 2009 and 2008, the Company had no significant net receivables related to contract claims. The Company accrues award fees in unbilled receivables only when there is sufficient information to assess contract performance. On contracts that represent higher than normal risk or technical difficulty, the Company may defer all award fees until an award fee letter is received.

Because our revenue depends to a great extent on billable labor hours, most of our charges are invoiced following the end of the month in which the hours were worked, the majority usually within 15 days. Other direct costs are normally billed along with labor hours. However, as opposed to salary costs, which are generally paid on either a bi-weekly or monthly basis, other direct costs are generally not paid until we receive payment (in some cases in the form of advances) from our customers.

Borrowings and Lines of Credit

Debt consisted of the following:

	September 30, 2009	September 30, 2008
	(in thousands)	
Unsecured revolving credit facility	$ 100,000	$ 310,000
Senior notes	—	8,333
Unsecured term credit agreement	21,196	25,985
Secured notes	26,633	27,332
Other debt	23,380	26,359
Total debt	171,209	398,009
Less: Current portion of debt and short-term borrowings	(29,107)	(32,035)
Long-term debt, less current portion	$ 142,102	$ 365,974

The following table presents, in thousands, scheduled maturities of our debt:

Year Ending September 30,	
2010	29,107
2011	17,039
2012	100,852
2013	905
2014	961
Thereafter	22,345
Total	$ 171,209

Unsecured Revolving Credit Facility

We have an unsecured revolving credit facility with a syndicate of banks to support our working capital and acquisition needs. The borrowing capacity under our unsecured revolving credit facility is $600 million, and pursuant to the terms of the associated credit agreement, has an expiration date of August 31, 2012. We may also, at our option, request an increase in the commitments under the facility up to a total of $750 million, subject to lender approval. The credit agreement contains customary representations and warranties, affirmative and negative covenants and events of default and includes a sub-limit for financial and commercial standby letters of credit. We may borrow, at our option, at either (a) a base rate (the greater of the federal funds rate plus 0.50% or the bank's reference rate), or (b) an offshore, or LIBOR, rate plus a margin which ranges from 0.50% to 1.38%. In addition to these borrowing rates, there is a commitment fee which ranges from 0.10% to 0.25% on any unused commitment. At September 30, 2009 and 2008, $100.0 and $310.0 million, respectively, was outstanding under our credit facility. At September 30, 2009 and 2008, outstanding standby letters of credit totaled $29.9 million and $26.7 million, respectively, under our credit facility. At September 30, 2009, we had $470.1 million available for borrowing under the credit facility. Our debt agreements contain certain negative covenants relating to the Company's net worth and leverage, based on outstanding borrowings (including financial letters of credit) and earnings before interest, taxes, depreciation, and amortization. At September 30, 2009, the Company was in compliance with these covenants. Additionally, we could have drawn upon the remaining $470.1 million available under the credit facility.

Our interest rate swap agreements with financial institutions fix the variable interest rates of $100.0 million of the outstanding debt under the Company's revolving credit facility. We applied cash flow hedge accounting to the interest rate swap agreements in accordance with SFAS No. 133, later codified in

ASC 815-20, "*Accounting for Derivative Instruments and Hedging Activities*." Accordingly, the derivatives are recorded as assets or liabilities at fair value and the effective portion of changes in the fair value of the derivative, as measured quarterly, are reported in other comprehensive income. The change in fair value related to the derivatives included in other comprehensive income/(loss) for the year ended September 30, 2009 and 2008 was $(0.8) million and $(0.3) million, respectively. Based on the swaps' expiration dates, the total $(1.1) million recorded in accumulated other comprehensive income at September 30, 2009 will be recorded as interest expense over the next twelve months. The fixed rates and the related expiration dates of the outstanding swap agreements are as follows:

Notional Amount (in thousands)	Fixed Rate	Expiration Date
$50,000	3.0%	February 2010
$50,000	3.2%	August 2010

Our average effective interest rate on borrowings under the revolving credit facility, including the effects of the swaps, during the year ended September 30, 2009 and 2008 was 3.1% and 4.5%, respectively.

Unsecured Term Credit Agreement

In September 2006, through certain wholly-owned subsidiaries, we entered into an unsecured term credit agreement with a syndicate of banks to facilitate dividend repatriations under Section 965 of the American Jobs Creation Act of 2004, which provided for a limited time opportunity to repatriate non-U.S. earnings to the U.S. at a 5.25% tax rate. The term credit agreement provides for a $65.0 million, five-year term loan among four subsidiary borrowers and one subsidiary guarantor. In order to obtain favorable pricing, we also provided a parent company guarantee. The terms and conditions of the term credit agreement are similar to those contained in our revolving credit facility.

Secured Notes

Secured notes are notes payable to a bank, collateralized by real properties, which we assumed in connection with our acquisition of Boyle Engineering Corporation. These notes payable bear interest at 6.04% and mature in December 2028.

Other Debt

Other debt consists primarily of bank overdrafts. In addition to the revolving credit facility discussed above, at September 30, 2009, we had $157.2 million of unsecured credit facilities primarily used to cover periodic overdrafts and letters of credit, of which, $105.7 million was utilized for outstanding letters of credit.

Commitments and Contingencies

Other than normal property and equipment additions and replacements, expenditures to further the implementation of our Enterprise Resource Planning (ERP) system, commitments under our incentive compensation programs, repurchases of shares of our common stock, and acquisitions from time to time, we currently do not have any significant capital expenditures or outlays planned except as described below. However, as we acquire additional businesses in the future or if we embark on other capital-intensive initiatives, additional working capital may be required.

Under our unsecured revolving credit facility and other facilities discussed in Other Debt above, as of September 30, 2009, there was approximately $135.7 million outstanding under standby letters of credit issued primarily in connection with general and professional liability insurance programs and for contract performance guarantees. In addition, in some instances we guarantee that a project, when complete, will achieve specified performance standards. If the project subsequently fails to meet guaranteed performance

standards, we may either incur significant additional costs or be held responsible for the costs incurred by the client to achieve the required performance standards.

We recognized on our balance sheet the funded status (measured as the difference between the fair value of plan assets and the projected benefit obligation) of the Company's pension plans. We currently expect to contribute $16.9 million to our non-U.S. plans in fiscal 2010. We do not have a required minimum contribution for our domestic plans; however, we may make additional discretionary contributions. We currently expect to contribute $4.5 million to our domestic plans in the fiscal 2010. In the future, such pension funding may increase or decrease depending on changes in the levels of interest rates, pension plan performance and other factors.

Contractual Commitments

The following summarizes our contractual obligations and commercial commitments as of September 30, 2009:

Contractual Obligations and Commitments	Total	Less than One Year	One to Three Years	Three to Five Years	More than Five Years
			(in thousands)		
Debt	$ 171,209	$ 29,107	$ 117,891	$ 1,866	$ 22,345
Interest on debt	24,811	4,057	6,914	2,817	11,023
Operating leases	738,011	161,499	245,678	169,730	161,104
Other	37,233	31,344	3,759	1,347	783
Pension obligations	371,498	22,482	48,946	55,352	244,718
Total contractual obligations and commitments	$ 1,342,762	$ 248,489	$ 423,188	$ 231,112	$ 439,973

Recently Issued Accounting Pronouncements

In October 2009, the FASB issued Accounting Standards Update No. 2009-13 "*Multiple-Deliverable Revenue Arrangements—a consensus of the FASB Emerging Issues Task Force* " (ASU 2009-13) which updates Topic 605, Revenue Recognition, of the Codification. ASU 2009-13 provides another alternative for determining the selling price of deliverables and will allow companies to allocate arrangement consideration in multiple deliverable arrangements in a manner that better reflects the transaction's economics and could result in earlier revenue recognition. ASU 2009-13 is effective for the Company prospectively for revenue arrangements entered into or materially modified on or after October 1, 2010; however, early adoption is permitted. The Company is currently evaluating the impact of adopting ASU 2009-13 on its financial statements.

In June 2009, the FASB issued SFAS No. 167, later codified in ASC 810-10-05, "*Amendments to FASB Interpretation No. 46(R)*" (SFAS 167). SFAS 167 amends FIN 46(R) and requires a company to perform an analysis to determine whether its variable interests give it a controlling financial interest in a variable interest entity. This analysis requires a company to assess whether it has the power to direct the activities of the variable interest entity and if it has the obligation to absorb losses or the right to receive benefits that could potentially be significant to the variable interest entity. SFAS 167 requires an ongoing reassessment of whether a company is the primary beneficiary of a variable interest entity, eliminates the quantitative approach previously required for determining the primary beneficiary of a variable interest entity and significantly enhances disclosures. SFAS 167 may be applied retrospectively in previously issued financial statements with a cumulative-effect adjustment to retained earnings as of the beginning of the first year restated. SFAS 167 is effective for the Company in its fiscal year ending September 30, 2010. The Company is currently evaluating the impact that the adoption of SFAS 167 will have on its financial statements.

In December 2008, the FASB issued FSP FAS 132R-1, later codified in ASC 715-20-65, "*Employers' Disclosures about Postretirement Benefit Plan Assets* " (FSP FAS 132R-1). FSP FAS 132R-1 amends SFAS No. 132, " *Employers' Disclosures about Pensions and Other Postretirement Benefits* ," to provide guidance on an employer's disclosures about plan assets of a defined benefit pension or other postretirement plan. The additional disclosure requirements include expanded disclosure about an entity's investment policies and strategies, the categories of plan assets, concentrations of credit risk and fair value measurements of plan assets. FSP FAS 132R-1 is effective for the Company in its fiscal year ending September 30, 2010. The Company will amend its disclosures accordingly beginning with the financial statements included in its fiscal year 2010 Form 10-K.

In December 2007, the FASB issued SFAS No. 160, later codified in ASC 810-10, "*Noncontrolling Interests in Consolidated Financial Statements, an amendment of ARB No. 51* " (SFAS 160). SFAS 160 requires all entities to report noncontrolling interests in subsidiaries as a separate component of equity in the consolidated financial statements. SFAS 160 establishes a single method of accounting for changes in a parent's ownership interest in a subsidiary that do not result in deconsolidation. Under SFAS 160, companies will no longer recognize a gain or loss on partial disposals of a subsidiary where control is retained. In addition, in partial acquisitions, where control is obtained, the acquiring company will recognize and measure at fair value 100 percent of the assets and liabilities, including goodwill, as if the entire target company had been acquired. SFAS 160 is effective for the Company's fiscal year ending September 30, 2010. The Company is currently evaluating the impact of SFAS 160 on its financial statements.

In December 2007, the FASB issued SFAS No. 141 (revised 2007), later codified in ASC 805-10, "*Business Combinations*" (SFAS 141R). SFAS 141R significantly changes the way companies account for business combinations and will generally require more assets acquired and liabilities assumed to be measured at their acquisition-date fair value. Under SFAS 141R, legal fees and other transaction-related costs are expensed as incurred and are no longer included in goodwill as a cost of acquiring the business. SFAS 141R also requires, among other things, acquirers to estimate the acquisition-date fair value of any contingent consideration and to recognize any subsequent changes in the fair value of contingent consideration in earnings. In addition, restructuring costs the acquirer expected, but was not obligated to incur, will be recognized separately from the business acquisition. This accounting standard is effective for the Company's fiscal year ending September 30, 2010. The Company is currently evaluating the impact of SFAS 141R on its financial statements.

In November 2007, the FASB issued EITF Issue No. 07-1, later codified in ASC 808-10, "*Accounting for Collaborative Arrangements*" (EITF 07-1). EITF 07-1 applies to participants in collaborative arrangements that are conducted without the creation of a separate legal entity for the arrangement. EITF 07-1 is effective for the Company's fiscal year beginning October 1, 2009, and the effects of applying the consensus should be reported as a change in accounting principle through retrospective application to all prior periods presented for all arrangements in place at the effective date unless it is impracticable. The Company does not expect EITF 07-1 to have a material impact on its financial statements.

Off-Balance Sheet Arrangements

We enter into various joint venture arrangements to provide architectural, engineering, program management, construction management and operations and maintenance services. The ownership percentage of these joint ventures is typically representative of the work to be performed or the amount of risk assumed by each joint venture partner. Some of these joint ventures are considered variable interest entities under Financial Accounting Standards Board (FASB) Financial Interpretation No. 46 (revised December 2003), later codified in ASC 810-10, " *Consolidation of Variable Interest Entities* " (FIN 46R). We have consolidated all joint ventures for which we are the primary beneficiary. For all others, the Company's portion of the earnings is recorded in equity in earnings of joint ventures. See Note 9 to the consolidated financial statements. We do not believe that we have any off-balance sheet arrangements that have or are

reasonably likely to have a current or future effect on our financial condition, changes in financial condition, revenues or expenses, results of operations, liquidity, capital expenditures or capital resources that would be material to investors.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

We are exposed to market risk, primarily related to foreign currency exchange rates and interest rate exposure of our debt obligations that bear interest based on floating rates. We actively monitor these exposures. Our objective is to reduce, where we deem appropriate to do so, fluctuations in earnings and cash flows associated with changes in foreign exchange rates and interest rates. In the past, we have entered into derivative financial instruments, such as forward contracts and interest rate hedge contracts. It is our policy and practice to use derivative financial instruments only to the extent necessary to manage our exposures. We do not use derivative financial instruments for trading purposes.

Foreign Exchange Rates

We are exposed to foreign currency exchange rate risk resulting from our operations outside of the U.S. We do not comprehensively hedge our exposure to currency rate changes; however, our exposure to foreign currency fluctuations is limited in that most of our contracts require client payments to be in currencies corresponding to the currency in which costs are incurred. As a result, we typically do not need to hedge foreign currency cash flows for contract work performed. The functional currency of our significant foreign operations is the local currency.

Interest Rates

Our senior revolving credit facility and certain other debt obligations are subject to variable rate interest which could be adversely affected by an increase in interest rates. As of September 30, 2009 and 2008, we had $121.2 and $336.0 million, respectively, outstanding borrowings under our credit facility and our term credit agreement. Interest on amounts borrowed under the credit facility and our term credit agreement is subject to adjustment based on certain levels of financial performance. For borrowings at offshore rates, the applicable margin added can range from 0.50% to 1.38%. For the year ended September 30, 2009, our weighted average borrowings on our senior credit facility were $234.2 million. If short term floating interest rates were to increase or decrease by 1%, our annual interest expense could have increased or decreased by $2.3 million. We invest our cash in a variety of financial instruments, consisting principally of money market securities or other highly liquid, short-term securities that are subject to minimal credit and market risk.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

AECOM Technology Corporation
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September 30, 2009

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Report of Independent Registered Public Accounting Firm

The Board of Directors and Stockholders of
AECOM Technology Corporation

We have audited the accompanying consolidated balance sheets of AECOM Technology Corporation and subsidiaries (the "Company") as of September 30, 2009 and 2008, and the related consolidated statements of income, stockholders' equity, and cash flows for each of the three years in the period ended September 30, 2009. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the consolidated financial position of AECOM Technology Corporation and subsidiaries at September 30, 2009 and 2008, and the consolidated results of their operations and their cash flows for each of the three years in the period ended September 30, 2009, in conformity with U.S. generally accepted accounting principles.

As discussed in Note 19 to the consolidated financial statements, on October 1, 2007, the Company adopted Statement of Financial Accounting Standards Board Interpretation No. 48, later codified in ASC 740-10 and ASC 805-740, "Accounting for Uncertainty in Income Taxes—an Interpretation of FASB Statement No. 109". Also, as discussed in Note 1, during the fiscal year ended September 30, 2007, the Company changed its method of accounting for defined benefit pension and other post retirement plans in accordance with Statement of Financial Accounting Standards No. 158, later codified in ASC 715-20, "Employers' Accounting for Defined Benefit Pension and Other Postretirement Plans—an amendment of FASB Statement No. 87, 88, 106 and 132(R)". In the first quarter of fiscal 2009, the Company adopted the measurement provision of ASC 715-20, which resulted in the Company changing its measurement date for pension and other postretirement plans from June 30 to September 30.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States), AECOM Technology Corporation's internal control over financial reporting as of September 30, 2009, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission and our report dated November 27, 2009 expressed an unqualified opinion thereon.

/s/ ERNST & YOUNG LLP
Los Angeles, California
November 27, 2009

Report of Independent Registered Public Accounting Firm

The Board of Directors and Stockholders of
AECOM Technology Corporation

We have audited AECOM Technology Corporation's (the "Company") internal control over financial reporting as of September 30, 2009, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (the "COSO criteria"). AECOM Technology Corporation's management is responsible for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit.

We conducted our audit in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

In our opinion, AECOM Technology Corporation maintained, in all material respects, effective internal control over financial reporting as of September 30, 2009, based on the COSO criteria.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States), the consolidated balance sheets of AECOM Technology Corporation and subsidiaries as of September 30, 2009 and 2008, and the related consolidated statements of income, stockholders' equity, and cash flows for each of the three years in the period ended September 30, 2009 and our report dated November 27, 2009 expressed an unqualified opinion thereon.

/s/ ERNST & YOUNG LLP
Los Angeles, California
November 27, 2009

AECOM Technology Corporation

Consolidated Balance Sheets

(in thousands, except share data)

	September 30, 2009	September 30, 2008
ASSETS		
CURRENT ASSETS:		
Cash and cash equivalents	$ 263,489	$ 173,471
Cash in consolidated joint ventures	27,288	23,651
Total cash and cash equivalents	290,777	197,122
Marketable securities	—	81,449
Accounts receivable—net	1,732,959	1,637,614
Prepaid expenses and other current assets	82,195	74,543
Current assets held for sale	74,527	93,403
Income taxes receivable	—	1,599
Deferred tax assets—net	34,077	30,620
TOTAL CURRENT ASSETS	2,214,535	2,116,350
PROPERTY AND EQUIPMENT—NET	228,835	223,217
DEFERRED TAX ASSETS—NET	91,139	45,886
INVESTMENTS IN UNCONSOLIDATED JOINT VENTURES	34,505	46,432
GOODWILL	1,062,919	949,089
INTANGIBLE ASSETS—NET	61,979	80,297
OTHER NON-CURRENT ASSETS	95,969	134,919
TOTAL ASSETS	$ 3,789,881	$ 3,596,190
LIABILITIES AND STOCKHOLDERS' EQUITY		
CURRENT LIABILITIES:		
Short-term debt	$ 13,268	$ 7,898
Accounts payable	401,239	397,063
Accrued expenses and other current liabilities	722,531	643,693
Billings in excess of costs on uncompleted contracts	333,952	296,910
Income taxes payable	19,585	18,944
Current liabilities held for sale	50,325	63,834
Current portion of long-term debt	15,839	24,137
TOTAL CURRENT LIABILITIES	1,556,739	1,452,479
OTHER LONG-TERM LIABILITIES	336,635	334,694
LONG-TERM DEBT	142,102	365,974
TOTAL LIABILITIES	2,035,476	2,153,147
MINORITY INTEREST	24,687	20,050
STOCKHOLDERS' EQUITY:		
Convertible preferred stock—authorized, 7,799,780; issued and outstanding, 25,130 and 26,423 shares as of September 30, 2009 and 2008; respectively, $100 liquidation preference value	2,513	2,642
Common stock—authorized, 150,000,000 shares of $0.01 par value; issued and outstanding, 110,890,075 and 102,983,378 shares, as of September 30, 2009 and 2008, respectively	1,109	1,030
Preferred stock, Class C—authorized, 200 shares; issued and outstanding, 56 and 69 shares as of September 30, 2009 and 2008, respectively; no par value, $1.00 liquidation preference value	—	—
Preferred stock, Class E—authorized, 20 shares; issued and outstanding, 5 and 10 shares as of September 30, 2009 and 2008, respectively; no par value, $1.00 liquidation preference value	—	—
Additional paid-in capital	1,458,326	1,309,493
Accumulated other comprehensive loss	(146,575)	(111,549)
Retained earnings	414,345	221,377
TOTAL STOCKHOLDERS' EQUITY	1,729,718	1,422,993
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	$ 3,789,881	$ 3,596,190

See accompanying Notes to Consolidated Financial Statements.

AECOM Technology Corporation

Consolidated Statements of Income

(in thousands, except per share data)

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
Revenue	$ 6,119,465	$ 5,194,682	$ 4,237,270
Cost of revenue	5,768,262	4,907,784	4,039,317
Gross profit	351,203	286,898	197,953
Equity in earnings of joint ventures	22,557	22,191	11,828
General and administrative expenses	86,894	70,582	53,842
Income from operations	286,866	238,507	155,939
Minority interest in share of earnings	14,182	13,390	16,404
Gain on sale of equity investment	—	—	11,286
Other income (expense)	1,713	(3,438)	—
Interest (expense) income, net	(10,691)	1,336	(3,321)
Income from continuing operations before income tax expense	263,706	223,015	147,500
Income tax expense	77,002	76,493	47,203
Income from continuing operations	186,704	146,522	100,297
Discontinued operations, net of tax	2,992	704	—
Net income	$ 189,696	$ 147,226	$ 100,297
Net income allocation:			
Preferred stock dividend	$ 139	$ 168	$ 249
Net income available for common stockholders	189,557	147,058	100,048
Net income	$ 189,696	$ 147,226	$ 100,297
Net income per share:			
Basic			
Continuing operations	$ 1.73	$ 1.44	$ 1.37
Discontinued operations	0.03	0.01	—
	$ 1.76	$ 1.45	$ 1.37
Diluted			
Continuing operations	$ 1.70	$ 1.41	$ 1.15
Discontinued operations	0.03	—	—
	$ 1.73	$ 1.41	$ 1.15
Weighted average shares outstanding:			
Basic	108,003	101,456	73,091
Diluted	109,706	104,215	87,537

See accompanying Notes to Consolidated Financial Statements.

AECOM Technology Corporation

Consolidated Statements of Stockholders' Equity

(in thousands)

	Convertible Preferred Stock	Common Stock	Additional Paid-In Capital	Accumulated Other Comprehensive Income (Loss)	Retained Earnings	Total
BALANCE AT OCTOBER 1, 2006	$ —	$ —	$ (254,225)	$ (36,669)	$ —	$ (290,894)
Comprehensive income:						
Net income			25,520		74,777	100,297
Foreign currency translation adjustments				15,020		15,020
Defined benefit minimum pension liability adjustment				(4,562)		(4,562)
Total comprehensive income						$ 110,755
Proceeds from the issuance of common stock in initial public offering, net of $4.0 million of issuance costs		199	392,667			392,866
Conversion of preferred stock		187	234,813			235,000
Reclassification of common and preferred stock units	5,012	664	816,952			822,628
Issuance of stock		33	65,232			65,265
Repurchases of stock	(283)	(63)	(50,464)			(50,810)
Preferred stock dividend	249		(35)		(214)	—
Proceeds from exercise of options		4	3,005			3,009
Tax benefit from exercise of options			7,225			7,225
Stock based compensation		13	24,953			24,966
Repayment of stockholder notes		(46)	(14,254)			(14,300)
Tax effect related to deferred compensation plan			(27,225)			(27,225)
BALANCE AT SEPTEMBER 30, 2007	4,978	991	1,224,164	(26,211)	74,563	1,278,485
Comprehensive income:						
Net income					147,226	147,226
Foreign currency translation adjustments				(45,369)		(45,369)
Defined benefit minimum pension liability adjustment				(39,670)		(39,670)
Swap valuation				(299)		(299)
Total comprehensive income						$ 61,888
Issuance of stock		12	33,008			33,020
Repurchases of stock	(2,504)	(10)	(11,423)			(13,937)
Preferred stock dividend	168				(168)	—
Proceeds from exercise of options		8	19,040			19,048
Tax benefit from exercise of stock options			20,586			20,586
Stock based compensation		29	24,118			24,147
Cumulative effect of adoption of accounting principle (Note 19)					(244)	(244)
BALANCE AT SEPTEMBER 30, 2008	2,642	1,030	1,309,493	(111,549)	221,377	1,422,993
Comprehensive income:						
Net income					189,696	189,696
Foreign currency translation adjustments				(14,538)		(14,538)
Defined benefit minimum pension liability adjustment				(19,658)	503	(19,155)
Swap valuation				(830)		(830)
Total comprehensive income						$ 155,173
Cumulative effect of adoption of accounting principle (Note 10)					2,908	2,908
Proceeds from the issuance of stock in secondary public offering, net of $0.6 million of offering costs		46	91,387			91,433
Deferred compensation plan participants' diversification			(29,120)			(29,120)
Issuance of stock		16	39,462			39,478
Repurchases of stock	(268)	(14)	(13,211)			(13,493)
Preferred stock dividend	139				(139)	—
Proceeds from exercise of options		23	19,383			19,406
Tax benefit from exercise of stock options			14,969			14,969
Stock based compensation		8	25,963			25,971
BALANCE AT SEPTEMBER 30, 2009	$ 2,513	$ 1,109	$ 1,458,326	$ (146,575)	$ 414,345	$ 1,729,718

See accompanying Notes to Consolidated Financial Statements.

AECOM Technology Corporation

Consolidated Statements of Cash Flows

(in thousands)

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
CASH FLOWS FROM OPERATING ACTIVITIES:			
Net income	$ 189,696	$ 147,226	$ 100,297
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization	84,117	62,752	45,126
Equity in earnings of unconsolidated joint ventures	(22,557)	(22,191)	(11,828)
Distribution of earnings from unconsolidated joint ventures	18,689	20,162	10,912
Non-cash stock compensation	25,971	24,147	24,966
Excess tax benefit from share based payment	(14,969)	(20,586)	(7,225)
Write-off of deferred financing costs and make-whole premium	—	—	3,166
Interest income on notes from stockholders	—	—	(754)
Other non-cash expense (income)	1,300	—	(2,010)
Foreign currency translation	(17,692)	(16,989)	14,625
Deferred income tax (benefit) expense	(3,210)	(34,470)	15,667
Gain on sale of equity investment	—	—	(11,286)
Changes in operating assets and liabilities, net of effects of acquisitions:			
Accounts receivable	(67,853)	(150,932)	(114,548)
Prepaid expenses and other assets	(15,887)	33,100	1,022
Accounts payable	(8,064)	36,113	(51,154)
Accrued expenses and other current liabilities	375	50,606	88,403
Billings in excess of costs on uncompleted contracts	35,542	46,910	42,410
Other long-term liabilities	(2,241)	(33,844)	(19,017)
Income taxes payable	12,534	14,091	8,691
Net cash provided by operating activities from continuing operations	215,751	156,095	137,463
Net cash provided by operating activities from discontinued operations	2,580	1,732	—
Net cash provided by	218,331	157,827	137,463

operating activities			
CASH FLOWS FROM INVESTING ACTIVITIES:			
Payments for business acquisitions, net of cash acquired	(35,719)	(656,920)	(158,742)
Proceeds from sales of businesses	—	90,020	—
Purchases of investments securities	—	(9,900)	(357,288)
Sales of investment securities	81,449	129,234	156,505
Net investment in unconsolidated affiliates	2,904	(4,653)	(1,704)
Payments for capital expenditures	(62,924)	(69,387)	(43,203)
Proceeds from sale of equity investment	—	—	14,683
Proceeds from sale of property and equipment	—	301	225
Net cash used in investing activities	(14,290)	(521,305)	(389,524)

AECOM Technology Corporation

Consolidated Statements of Cash Flows (Continued)

(in thousands)

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
CASH FLOWS FROM FINANCING ACTIVITIES:			
Net proceeds from issuance of common stock	91,433	—	468,280
Proceeds from borrowings under credit agreements	6,740	333,350	197,579
Repayments of borrowings under long-term debt	(239,368)	(21,265)	(287,084)
Funding of deferred compensation plan rabbi trust	—	—	(75,413)
Proceeds from issuance of common and preferred stock and units	9,586	9,171	55,146
Proceeds from exercise of stock options	19,406	19,048	3,009
Payments to repurchase common stock and common stock units	(13,493)	(13,937)	(50,076)
Proceeds from payment of notes receivable from stockholders	—	—	22,663
Payment of debt prepayment premium	—	—	(3,166)
Excess tax benefit from share based payment	14,969	20,586	7,225
FIN 48 adjustment	—	(244)	—
Net cash (used in) provided by financing activities	(110,727)	346,709	338,163
EFFECT OF EXCHANGE RATE CHANGES ON CASH	341	(3,020)	2,939
NET INCREASE (DECREASE) IN CASH AND CASH EQUIVALENTS	93,655	(19,789)	89,041
CASH AND CASH EQUIVALENTS AT BEGINNING OF YEAR	197,122	216,911	127,870
CASH AND CASH EQUIVALENTS AT END OF YEAR	$ 290,777	$ 197,122	$ 216,911
SUPPLEMENTAL CASH FLOW INFORMATION:			

Retirement of fully depreciated equipment (non-cash)	$ 16,279	$ 16,506	$ 16,676
Deferred compensation plan participants' diversification (non-cash)	$ 29,120	—	—
Equity issued for acquisitions (non-cash)	$ 16,946	$ 23,849	$ 10,119
Equity issued to settle liabilities (non-cash)	$ 12,946	—	—
Interest paid	$ 15,848	$ 9,474	$ 7,751
Income taxes paid, net of refunds received	$ 68,410	$ 60,717	$ 36,345

See accompanying Notes to Consolidated Financial Statements.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Significant Accounting Policies

Organization—AECOM Technology Corporation and its consolidated subsidiaries (Company) provide professional technical and management support services for commercial and government clients around the world. These services encompass a variety of technical disciplines, including consulting, planning, architectural and engineering design, and program and construction management for a broad range of projects. These services are applied to a number of areas and industries, including transportation infrastructure; research, testing and defense facilities; water, wastewater and other environmental programs; land development; security and communication systems; institutional, mining, industrial and commercial and energy-related facilities. The Company also provides operations and maintenance services to governmental agencies throughout the U.S. and abroad.

Fiscal Year—The Company reports results of operations based on 52 or 53-week periods ending on the Friday nearest September 30. For clarity of presentation, all periods are presented as if the year ended on September 30. Fiscal years 2009, 2008, and 2007 contained 52, 53, and 52 weeks and ended on October 2, October 3, and September 28, respectively. As discussed in Note 4, the Company acquired Earth Tech in July 2008. Due to different fiscal period-ends for the Company and Earth Tech, Earth Tech's results for the fiscal year beginning September 27, 2008 have been combined with the Company's results for the fiscal year beginning October 4, 2008. The use of the different fiscal period for Earth Tech did not have a material impact on the Company's results of operations.

Use of Estimates—The preparation of financial statements in conformity with accounting principles generally accepted in the United States (GAAP) requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. The more significant estimates affecting amounts reported in the consolidated financial statements relate to revenues under long-term contracts and self-insurance accruals. Actual results could differ from those estimates.

Principles of Consolidation and Presentation—The consolidated financial statements include the accounts of all majority-owned subsidiaries and material joint ventures in which the Company is the primary beneficiary. All inter-company accounts have been eliminated in consolidation. Also see Note 9 regarding joint ventures.

Revenue Recognition—The Company generally utilizes a cost-to-cost approach in applying the percentage-of-completion method of revenue recognition. Under this approach revenue is earned in proportion to total costs incurred, divided by total costs expected to be incurred. Recognition of revenue and profit is dependent upon a number of factors including, the accuracy of a variety of estimates made at the balance sheet date, engineering progress, materials quantities, the achievement of milestones, penalty provisions, labor productivity and cost estimates made at the balance sheet date. Due to uncertainties inherent in the estimation process, actual completion costs may vary from estimates. If estimated total costs on contracts indicate a loss, the Company recognizes that estimated loss in the period the estimated loss first becomes known.

In the course of providing its services, the Company routinely subcontracts for services and incurs other direct costs on behalf of its clients. These costs are passed through to clients and, in accordance with industry practice and GAAP, are included in the Company's revenue and cost of revenue. Because subcontractor services and other direct costs can change significantly from project to project and period to

1. Significant Accounting Policies (Continued)

period, changes in revenue may not be indicative of business trends. These other direct costs for the years ended September 30, 2009, 2008, and 2007 were $2.3, $1.9 and $1.8 billion, respectively.

Cost-Plus Contracts. The Company enters into two major types of cost-plus contracts:

Cost-Plus Fixed Fee. Under cost-plus fixed fee contracts, the Company charges clients for its costs, including both direct and indirect costs, plus a fixed negotiated fee. The total estimated cost plus the fixed negotiated fee represents the total contract value. The Company recognizes revenue based on the actual labor and other direct costs incurred, plus the portion of the fixed fee it has earned to date.

Cost-Plus Fixed Rate. Under the Company's cost-plus fixed rate contracts, the Company charges clients for its direct and indirect costs based upon a negotiated rate. The Company recognizes revenue based on the actual total costs it has expended and the applicable fixed rate.

Certain cost-plus contracts provide for award fees or a penalty based on performance criteria in lieu of a fixed fee or fixed rate. Other contracts include a base fee component plus a performance-based award fee. In addition, the Company may share award fees with subcontractors. The Company records accruals for fee-sharing as fees are earned. The Company generally recognizes revenue to the extent of costs actually incurred plus a proportionate amount of the fee expected to be earned. The Company takes the award fee or penalty on contracts into consideration when estimating revenue and profit rates, and it records revenue related to the award fees when there is sufficient information to assess anticipated contract performance. On contracts that represent higher than normal risk or technical difficulty, the Company may defer all award fees until an award fee letter is received. Once an award fee letter is received, the estimated or accrued fees are adjusted to the actual award amount.

Certain cost-plus contracts provide for incentive fees based on performance against contractual milestones. The amount of the incentive fees varies, depending on whether the Company achieves above, at, or below target results. The Company originally recognizes revenue on these contracts based upon expected results. These estimates are revised when necessary based upon additional information that becomes available as the contract progresses.

Time-and-Materials Contracts.

Time-and-Materials. Under time-and-materials contracts, the Company negotiates hourly billing rates and charges its clients based on the actual time that it expends on a project. In addition, clients reimburse the Company for its actual out-of-pocket costs of materials and other direct incidental expenditures that it incurs in connection with its performance under the contract. Profit margins on time-and-materials contracts fluctuate based on actual labor and overhead costs that it directly charges or allocates to contracts compared to negotiated billing rates. Many of the Company's time-and-materials contracts are subject to maximum contract values and, accordingly, revenue relating to these contracts is recognized as if these contracts were a fixed-price contract.

Fixed-Price Contracts.

Firm Fixed-Price. Fixed-price contracting is the predominant contracting method outside of the United States. There are typically two types of fixed-price contracts. The first and more common type, lump-sum, involves performing all of the work under the contract for a specified lump-sum fee. Lump-sum contracts are typically subject to price adjustments if the scope of the project changes or unforeseen

1. Significant Accounting Policies (Continued)

conditions arise. The second type, fixed-unit price, involves performing an estimated number of units of work at an agreed price per unit, with the total payment under the contract determined by the actual number of units delivered. The Company recognizes revenue on firm fixed-price contracts using the percentage-of-completion method described above. Prior to completion, recognized profit margins on any firm fixed-price contract depend on the accuracy of the Company's estimates and will increase to the extent that its actual costs are below the estimated amounts. Conversely, if the Company's costs exceed these estimates, its profit margins will decrease and the Company may realize a loss on a project. The Company recognizes anticipated losses on contracts in the period in which they become evident.

Service-Related Contracts.

Service-Related. Service-related contracts, including operations and maintenance services and a variety of technical assistance services, are accounted for over the period of performance, in proportion to the costs of performance.

Contract Claims—The Company records contract revenue related to claims only if it is probable that the claim will result in additional contract revenue and if the amount can be reliably estimated. In such cases, the Company records revenue only to the extent that contract costs relating to the claim have been incurred. As of September 30, 2009 and 2008, the Company had no significant net receivables related to contract claims.

Government Contract Matters—The Company's federal government and certain state and local agency contracts are subject to, among other regulations, regulations issued under the Federal Acquisition Regulations (FAR). These regulations can limit the recovery of certain specified indirect costs on contracts and subjects the Company to ongoing multiple audits by government agencies such as the Defense Contract Audit Agency (DCAA). In addition, most of the Company's federal and state and local contracts are subject to termination at the discretion of the client.

Audits by the DCAA and other agencies consist of reviews of the Company's overhead rates, operating systems and cost proposals to ensure that the Company accounted for such costs in accordance with the Cost Accounting Standards of the FAR (CAS). If the DCAA determines the Company has not accounted for such costs consistent with CAS, the DCAA may disallow these costs. Historically, the Company has not had any material cost disallowances by the DCAA as a result of audit. However, there can be no assurance that audits by the DCAA or other governmental agencies will not result in material cost disallowances in the future.

Cash and Cash Equivalents—The Company's cash equivalents include highly liquid investments which have an initial maturity of 90 days or less.

Allowance for Doubtful Accounts—The Company records its accounts receivable net of an allowance for doubtful accounts. This allowance for doubtful accounts is estimated based on management's evaluation of the contracts involved and the financial condition of its clients. The factors the Company considers in its contract evaluations include, but are not limited to:

- Client type—federal or state and local government or commercial client;

- Historical contract performance;

- Historical collection and delinquency trends;

1. Significant Accounting Policies (Continued)

- Client credit worthiness; and

- General economic conditions.

Fair Value of Financial Instruments—The carrying amounts of cash and cash equivalents, accounts receivable and accounts payable approximate fair value because of the short maturities of these instruments. The carrying amount of the revolving credit facility approximates fair value because the interest rates are based upon variable reference rates. See also Notes 11 and 12.

Property and Equipment—Property and equipment are recorded at cost and are depreciated over their estimated useful lives using the straight-line method. Expenditures for maintenance and repairs are expensed as incurred. Typically, estimated useful lives range from three to ten years for equipment, furniture and fixtures. Leasehold improvements are amortized on a straight-line basis over the shorter of their estimated useful lives or the remaining terms of the underlying lease agreement.

Long-lived Assets—Long-lived assets to be held and used are reviewed for impairment whenever events or circumstances indicate that the assets may be impaired. For assets to be held and used, impairment losses are recognized based upon the excess of the asset's carrying amount over the fair value of the asset. For long-lived assets to be disposed, impairment losses are recognized at the lower of the carrying amount or fair value less cost to sell.

Goodwill and Acquired Intangible Assets—Goodwill represents the excess amounts paid over the fair value of net assets acquired in mergers and acquisitions. In order to determine the amount of goodwill resulting from a merger or acquisition, the Company performs an assessment to determine the value of the acquired company's tangible and identifiable intangible assets and liabilities. In its assessment, the Company determines whether identifiable intangible assets exist, which typically include backlog and customer relationships.

Statement of Financial Accounting Standards (SFAS) No. 142, later codified in Accounting Standards Codification (ASC) 350-10, "*Goodwill and Other Intangible Assets* ," (SFAS 142) requires that the Company perform an impairment test of its goodwill at least annually for each reporting unit of the Company. A reporting unit is defined as an operating segment or one level below an operating segment. Our impairment tests are performed at the operating segment level as they represent our reporting units. See also Note 22.

The impairment test is a two-step process. During the first step, the Company estimates the fair value of the reporting unit and compares that amount to the carrying value of that reporting unit. In the event the fair value of the reporting unit is determined to be less than the carrying value, a second step is required. The second step requires the Company to perform a hypothetical purchase allocation for that reporting unit and to compare the resulting current implied fair value of the goodwill to the current carrying value of the goodwill for that reporting unit. In the event that the current implied fair value of the goodwill is less than the carrying value, an impairment charge is recognized.

During the fourth quarter of fiscal 2009, the Company conducted its annual impairment test. The impairment evaluation process is an income-based approach that utilizes discounted cash flows to determine the fair values of reporting units. Material assumptions used in the impairment analysis included the weighted average cost of capital (WACC) percent and terminal growth rates. As a result of the

1. Significant Accounting Policies (Continued)

impairment analysis, the Company determined that goodwill was not impaired for the year ended September 30, 2009.

Pension Plans—The Company has certain defined benefit pension plans. The Company calculates the market-related value of assets, which is used to determine the return-on-assets component of annual pension expense and the cumulative net unrecognized gain or loss subject to amortization. This calculation reflects the Company's anticipated long-term rate of return and amortization of the difference between the actual return (including capital, dividends, and interest) and the expected return over a five-year period. Cumulative net unrecognized gains or losses that exceed 10% of the greater of the projected benefit obligation or the market related value of plan assets are subject to amortization.

Insurance Reserves—The Company maintains insurance for business risks. Insurance coverage contains various retention and deductible amounts for which the Company accrues a liability based upon reported claims and an actuarially determined estimated liability for certain claims incurred but not reported. It is the Company's policy not to accrue for any potential legal expense to be incurred in defending the Company's position. The Company believes that its accruals for estimated liabilities associated with professional and other liabilities are sufficient and any excess liability beyond the accrual is not expected to have a material adverse effect on the Company's results of operations or financial position.

Foreign Currency Translation—The Company's functional currency is the U.S. dollar. Results of operations for foreign entities are translated to U.S. dollars using the average exchange rates during the period. Assets and liabilities for foreign entities are translated using the exchange rates in effect as of the date of the balance sheet. Resulting translation adjustments are recorded as a foreign currency translation adjustment into other accumulated comprehensive income/(loss) in stockholders' equity.

The Company uses forward exchange contracts from time to time to mitigate foreign currency risk. The Company limits exposure to foreign currency fluctuations in most of its contracts through provisions that require client payments in currencies corresponding to the currency in which costs are incurred. As a result of this natural hedge, the Company generally does not need to hedge foreign currency cash flows for contract work performed. The functional currency of all significant foreign operations is the respective local currency.

Income Taxes—The Company files a consolidated federal income tax return and combined / consolidated state tax returns and separate company state tax returns. The Company accounts for certain income and expense items differently for financial reporting and income tax purposes. Deferred tax assets and liabilities are determined based on the difference between the financial statement and tax basis of assets and liabilities, applying enacted statutory tax rates in effect for the year in which the differences are expected to reverse. In determining the need for a valuation allowance, management reviews both positive and negative evidence, including current and historical results of operations, future income projections, and potential tax planning strategies. Based upon management's assessment of all available evidence, the Company has concluded that it is more likely than not that the deferred tax assets, net of valuation allowance, will be realized.

Recently Issued Accounting Pronouncements—In October 2009, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update No. 2009-13 " *Multiple-Deliverable Revenue Arrangements—a consensus of the FASB Emerging Issues Task Force* " (ASU 2009-13) which updates ASC Topic 605, " *Revenue Recognition.* " ASU 2009-13 provides another alternative for determining the selling

1. Significant Accounting Policies (Continued)

price of deliverables and will allow companies to allocate arrangement consideration in multiple deliverable arrangements in a manner that better reflects the transaction's economics and could result in earlier revenue recognition. ASU 2009-13 is effective for the Company prospectively for revenue arrangements entered into or materially modified on or after October 1, 2010; however, early adoption is permitted. The Company is currently evaluating the impact of adopting ASU 2009-13 on its financial statements.

In June 2009, the FASB issued SFAS No. 167, later codified in ASC 810-10-05, "*Amendments to FASB Interpretation No. 46(R)*" (SFAS 167). SFAS 167 amends FIN 46(R) and requires a company to perform an analysis to determine whether its variable interests give it a controlling financial interest in a variable interest entity. This analysis requires a company to assess whether it has the power to direct the activities of the variable interest entity and if it has the obligation to absorb losses or the right to receive benefits that could potentially be significant to the variable interest entity. SFAS 167 requires an ongoing reassessment of whether a company is the primary beneficiary of a variable interest entity, eliminates the quantitative approach previously required for determining the primary beneficiary of a variable interest entity and significantly enhances disclosures. SFAS 167 may be applied retrospectively in previously issued financial statements with a cumulative-effect adjustment to retained earnings as of the beginning of the first year restated. SFAS 167 is effective for the Company in its fiscal year ending September 30, 2011. The Company is currently evaluating the impact that the adoption of SFAS 167 will have on its financial statements.

In December 2008, the FASB issued FSP FAS 132R-1, later codified in ASC 715-20-65, "*Employers' Disclosures about Postretirement Benefit Plan Assets* " (FSP FAS 132R-1). FSP FAS 132R-1 amends SFAS No. 132, " *Employers' Disclosures about Pensions and Other Postretirement Benefits* ," to provide guidance on an employer's disclosures about plan assets of a defined benefit pension or other postretirement plan. The additional disclosure requirements include expanded disclosure about an entity's investment policies and strategies, the categories of plan assets, concentrations of credit risk and fair value measurements of plan assets. FSP FAS 132R-1 is effective for the Company in its fiscal year ending September 30, 2010. The Company will amend its disclosures accordingly beginning with the financial statements included in its fiscal year 2010 Form 10-K.

In December 2007, the FASB issued SFAS No. 160, later codified in ASC 810-10, "*Noncontrolling Interests in Consolidated Financial Statements, an amendment of ARB No. 51* " (SFAS 160). SFAS 160 requires all entities to report noncontrolling interests in subsidiaries as a separate component of equity in the consolidated financial statements. SFAS 160 establishes a single method of accounting for changes in a parent's ownership interest in a subsidiary that do not result in deconsolidation. Under SFAS 160, companies will no longer recognize a gain or loss on partial disposals of a subsidiary where control is retained. In addition, in partial acquisitions, where control is obtained, the acquiring company will recognize and measure at fair value 100 percent of the assets and liabilities, including goodwill, as if the entire target company had been acquired. SFAS 160 is effective for the Company's fiscal year ending September 30, 2010. The change will have an impact on the Company's future financial statements and will be applied to all transactions after September 30, 2009.

In December 2007, the FASB issued SFAS No. 141 (revised 2007), later codified in ASC 805-10, "*Business Combinations*" (SFAS 141R). SFAS 141R significantly changes the way companies account for business combinations and will generally require more assets acquired and liabilities assumed to be measured at their acquisition-date fair value. Under SFAS 141R, legal fees and other transaction-related costs are expensed as incurred and are no longer included in goodwill as a cost of acquiring the business.

1. Significant Accounting Policies (Continued)

SFAS 141R also requires, among other things, acquirers to estimate the acquisition-date fair value of any contingent consideration and to recognize any subsequent changes in the fair value of contingent consideration in earnings. In addition, restructuring costs the acquirer expected, but was not obligated to incur, will be recognized separately from the business acquisition. This accounting standard is effective for the Company's fiscal year ending September 30, 2010. The change will have an impact on the Company's future financial statements and will be applied to all transactions after September 30, 2009.

In November 2007, the FASB issued Emerging Issues Task Force (EITF) Issue No. 07-1, later codified in ASC 808-10, "*Accounting for Collaborative Arrangements* " (EITF 07-1). EITF 07-1 applies to participants in collaborative arrangements that are conducted without the creation of a separate legal entity for the arrangement. EITF 07-1 is effective for the Company's fiscal year beginning October 1, 2009, and the effects of applying the consensus should be reported as a change in accounting principle through retrospective application to all prior periods presented for all arrangements in place at the effective date unless it is impracticable. The Company does not expect EITF 07-1 to have a material impact on its financial statements.

2. Public Offerings of Common Stock

In May 2007, the Company completed the initial public offering (IPO) of 40.4 million shares of common stock, which included the exercise of the underwriters' over-allotment option to purchase 5.3 million shares, at $20.00 per share, before underwriting discounts and commissions. Of the total shares sold in the offering, 15.3 million were sold by stockholders of the Company. Proceeds to AECOM, net of underwriting discounts, commissions, and other offering related costs, were approximately $468.3 million, of which $75.4 million was used to fund elections by employees to diversify their holdings in the Company's deferred compensation plan.

Prior to the IPO, redeemable common and preferred stock and stock units were classified outside permanent equity because redemption was not solely within the control of the Company. Effective with the closing of the IPO, $235 million of the Company's redeemable preferred stock class F and G were converted into common stock and stock units and $817 million of redeemable common stock and stock units were classified by the Company into equity. The Company had notes receivable from employees that were paid prior to the closing of the IPO, of which approximately $14.3 million were repaid by the employees in equity consideration.

As noted above, prior to the IPO, redeemable common and preferred stock and stock units were classified outside permanent equity because redemption was not solely within the control of the Company. As a result of this treatment, the Company had recorded a deferred tax allowance which was reversed with the closing of the IPO impacting equity by $27.2 million in fiscal 2007.

In March 2009, the Company sold 4.6 million shares of its common stock in a public offering at a price per share of $20.20, for proceeds of approximately $91.4 million, net of underwriters' discounts and offering costs.

In August 2009, the Company filed a shelf registration statement that allows it to sell up to 4,000,000 shares of its common stock. No shares have been sold under the program to date.

3. Adoption of New Accounting Pronouncements

In June 2009, the FASB issued SFAS 168, "*The FASB Accounting Standards Codification and the Hierarchy of Generally Accepted Accounting Principles—a replacement of FASB Statement No. 162* " (SFAS 168). SFAS 168 establishes the FASB Accounting Standards Codification (ASC) as the single source of authoritative GAAP recognized by the FASB to be applied by nongovernmental entities. Rules and interpretive releases of the SEC under authority of federal securities laws are also sources of authoritative U.S. GAAP for SEC registrants. Its adoption did not have a material impact on the Company's financial statements.

In June 2009, the FASB issued SFAS No. 165, later codified in ASC 855-10, "*Subsequent Events*" (SFAS 165). Prior to SFAS 165, the authoritative guidance for subsequent events was previously addressed only in U.S. auditing standards. SFAS 165 establishes general standards of accounting for and disclosure of events that occur after the balance sheet date but before financial statements are issued or are available to be issued and requires the Company to disclose the date through which it has evaluated subsequent events and whether that was the date the financial statements were issued or available to be issued. SFAS 165 does not apply to subsequent events or transactions that are within the scope of other applicable GAAP that provide different guidance on the accounting treatment for subsequent events or transactions. SFAS 165 became effective for the Company on June 30, 2009 and its adoption did not have a material impact on the Company's consolidated financial statements.

In April 2009, the FASB issued FASB Staff Position No. 107-1 and APB Opinion No. 28-1 (FSP 107-1 and APB 28-1), later codified in ASC 825-10-65-1, " *Interim Disclosures about Fair Value of Financial Instruments* ." FSP 107-1 and APB 28-1 require fair value disclosures in both interim, as well as annual, financial statements in order to provide more timely information about the effects of current market conditions on financial instruments. FSP 107-1 and APB 28-1 became effective for the Company in the quarter ended June 30, 2009, and their adoption did not have a material impact on the Company's consolidated financial statements.

In March 2008, the FASB issued SFAS No. 161, later codified in ASC 815-10,*"Disclosures about Derivative Instruments and Hedging Activities,"* (SFAS 161), which is intended to improve financial reporting of derivative instruments and hedging activities by requiring enhanced disclosures to enable investors to better understand the effects of such instruments and activities on an entity's financial position, financial performance and cash flows. SFAS 161 was effective for the Company beginning on January 1, 2009. The adoption of SFAS 161 did not have a material impact on the Company's consolidated financial statements.

As of September 30, 2007, the Company adopted certain provisions of SFAS No. 158, later codified in ASC 715-20, "*Employers' Accounting for Defined Benefit Pension and Other Postretirement Plans* " (SFAS 158). SFAS 158 has an additional requirement to measure plan assets and benefit obligations as of the date of the employer's fiscal year-end, effective for the Company's fiscal year ending September 30, 2009. In the first quarter of fiscal 2009, the Company changed its measurement date for the defined benefit pension plans to correspond to its fiscal year-end and recorded a charge to beginning retained earnings of $2.9 million, net of tax, for the impact of the cumulative difference in the Company's pension expense between the two measurement dates.

In February 2007, the FASB issued SFAS No. 159, later codified in ASC 825-10,*"The Fair Value Option for Financial Assets and Financial Liabilities* " (SFAS 159). SFAS 159 allows entities to voluntarily choose to measure certain financial assets and liabilities at fair value (fair value option). The fair value option may be elected on an instrument-by-instrument basis and is irrevocable, unless a new election date occurs as described under SFAS 159. If the fair value option is elected for an instrument, SFAS 159

3. Adoption of New Accounting Pronouncements (Continued)

specifies that unrealized gains and losses for that instrument be reported in earnings at each subsequent reporting date. SFAS 159 was effective for the Company on October 1, 2008. The Company did not apply the fair value option to any of its outstanding instruments and, therefore, SFAS 159 did not have an impact on the Company's consolidated financial statements.

4. Business Acquisitions, Goodwill, and Intangible Assets

On July 25, 2008, the Company completed the acquisition of the Earth Tech business unit of Tyco International Ltd. (Earth Tech), pursuant to a Purchase Agreement (Purchase Agreement) dated as of February 11, 2008, by and among the Company, Tyco International Finance, S.A. (Tyco) and other seller parties thereto. Earth Tech provides a broad range of technical and consulting services, including architecture, engineering, and design and build services to water/wastewater, environmental, transportation, and facilities clients globally. The Company acquired Earth Tech to increase its global presence, particularly in the Americas, Europe and Australia. This acquisition also strengthened the Company's water and wastewater business, while augmenting its leadership position in the environmental, facilities and transportation sectors. The total purchase price for Earth Tech, net of proceeds from non-strategic Earth Tech businesses sold to date of $112 million, as described in Note 5 below, was approximately $347 million, in cash. This total purchase price does not include the proceeds from the planned divestitures of certain Earth Tech assets being held for sale. See also Note 5. No gain or loss resulted from the sales of Earth Tech operations since they were sold for amounts that materially approximated their fair values at the acquisition date. Goodwill related to Earth Tech is partially due to the fact that the values inherent in professional services businesses are largely attributable to existing human capital.

The table below presents summarized unaudited pro forma operating results assuming that the Company had acquired Earth Tech at the beginning of the fiscal year ended September 30, 2008 (in thousands, except per share data). Other acquisitions completed during the periods presented were not material.

	Pro Forma	
	Fiscal Year Ended September 30, 2008	
Revenue	$	6,000,000
Income from continuing operations	$	143,000
Net income	$	143,000
Earnings per share from continuing operations:		
Basic	$	1.41
Diluted	$	1.37
Weighted average shares outstanding:		
Basic		101,456
Diluted		104,215

The Company completed 3, 14 and 11 business acquisitions during the years ended September 30, 2009, 2008 and 2007, respectively. Significant acquisitions included Earth Tech, Boyle Engineering Corporation, and Tecsult, Inc. during the year ended September 30, 2008 and Hayes, Seay, Mattern & Mattern, Inc. (HSMM) during the year ended September 30, 2007. Boyle Engineering Corporation is a

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

4. Business Acquisitions, Goodwill, and Intangible Assets (Continued)

Newport Beach, California based engineering services firm that specializes in the water and wastewater markets. Tecsult, Inc. is an international engineering firm based in Montreal, Canada, that serves clients in a variety of markets, including energy, transportation, facilities and environmental. HSMM is a Roanoke, Virginia based architectural and engineering firm. The aggregate value of all consideration for acquisitions consummated during the years ended September 30, 2009, 2008 and 2007 were $63 million, $632 million and $184 million, respectively. The following table summarizes the estimated fair values of the assets acquired and liabilities assumed, as of the acquisition dates, from acquisitions consummated during the fiscal years presented:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
		(in thousands)	
Cash acquired	$ 23,245	$ 41,169	$ 10,353
Other current assets	36,351	455,931	74,745
Goodwill	46,096	355,527	125,725
Intangible assets	7,503	68,000	25,146
Other non-current assets	1,648	249,873	18,177
Current liabilities	(51,421)	(346,400)	(67,378)
Non-current liabilities	(436)	(192,100)	(2,713)
Net assets acquired	$ 62,986	$ 632,000	$ 184,055

Included in the table above, are the following assets acquired and liabilities assumed of Earth Tech, as of the acquisition date:

	Fiscal Year Ended
	September 30, 2008
Cash acquired	$ 18,300
Other current assets	380,700
Goodwill	169,414
Intangible assets	35,107
Other non-current assets	133,300
Current liabilities	(315,000)
Non-current liabilities	(91,421)
Net assets acquired	$ 330,400

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

4. Business Acquisitions, Goodwill, and Intangible Assets (Continued)

Acquired intangible assets above includes the following:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
		(in thousands)	
Backlog	$ 2,865	$ 37,409	$ 12,484
Customer relationships	4,638	29,671	11,798
Trademarks/trade-names	—	920	864
Total Intangible Assets	$ 7,503	$ 68,000	$ 25,146

Consideration for acquisitions above includes the following:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
		(in thousands)	
Cash paid, net of $0.0, $90.0, and $0.0 million proceeds from sales of businesses	$ 40,072	$ 608,151	$ 173,936
Promissory notes	5,968	—	—
Equity issued	16,946	23,849	10,119
Total consideration	$ 62,986	$ 632,000	$ 184,055

All of the acquisitions were accounted for under the purchase method of accounting. As such, the purchase consideration of each acquired company was allocated to acquired tangible and intangible assets and liabilities based upon their fair values. The excess of the purchase consideration over the fair value of the net tangible and identifiable intangible assets acquired was recorded as goodwill. The results of operations of each company acquired have been included in the Company's financial statements from the date of acquisition.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

4. Business Acquisitions, Goodwill, and Intangible Assets (Continued)

The changes in the carrying value of goodwill by reportable segment for the fiscal years ended September 30, 2009, 2008 and 2007 were as follows:

	Fiscal Year 2009				
	September 30, 2008	Goodwill Additions	Post-Acquisition Adjustments	Foreign Currency Translation	September 30, 2009
			(in thousands)		
Reporting Unit:					
Professional Technical Services	$ 946,263	$ 46,096	$ 68,895	$ (1,161)	$ 1,060,093
Management Support Services	2,826	—	—	—	2,826
Total	$ 949,089	$ 46,096	$ 68,895	$ (1,161)	$ 1,062,919

	Fiscal Year 2008				
	September 30, 2007	Goodwill Additions	Post-Acquisition Adjustments	Foreign Currency Translation	September 30, 2008
			(in thousands)		
Reporting Unit:					
Professional Technical Services	$ 583,807	$ 355,527	$ 24,876	$ (17,947)	$ 946,263
Management Support Services	8,426	—	(5,600)	—	2,826
Total	$ 592,233	$ 355,527	$ 19,276	$ (17,947)	$ 949,089

	Fiscal Year 2007				
	September 30, 2006	Goodwill Additions	Post-Acquisition Adjustments	Foreign Currency Translation	September 30, 2007
			(in thousands)		
Reporting Unit:					
Professional Technical Services	$ 457,575	$ 125,725	$ 507	$ —	$ 583,807
Management Support Services	8,933	—	(507)	—	8,426
Total	$ 466,508	$ 125,725	$ —	$ —	$ 592,233

The foreign currency translation amounts relates to the impact of foreign currency adjustments in accordance with ASC 830-10, "*Foreign Currency Translation* ."

Post-acquisition adjustments to goodwill, as presented below, include additional consideration paid for businesses as a result of finalizing working capital adjustments pursuant to the applicable purchase agreement. Adjustments to deferred tax (assets) liabilities reflect the estimated net deferred tax established in purchase accounting. Such deferred taxes are primarily associated with the step-up to fair value of intangible assets. Project related adjustments primarily reflect the Company's process to fair value the projects and establish appropriate liabilities in connection with legal reserves. In addition, in connection with the Earth Tech acquisition, the Company has completed plans for workforce reductions and facility closures. The Company expects that significant changes to the plans are not likely and that the remaining actions required by the plans will be substantially complete by the second quarter of the fiscal year ending September 30, 2010. Actions required by plans relating to the other significant acquisitions

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

4. Business Acquisitions, Goodwill, and Intangible Assets (Continued)

listed above, Boyle Engineering Corporation and Tecsult, Inc., have been completed. The following table presents post-acquisition adjustments recorded in the current year:

	Post-Acquisition Adjustments		
	Earth Tech	Other Acquisitions	Total
		(in millions)	
Working capital adjustment	$ 43.2	$ (0.7)	$ 42.5
Deferred tax (assets) liabilities	(30.7)	1.1	(29.6)
Project related accruals	20.7	1.8	22.5
Severance	10.4	0.2	10.6
Facilities	22.1	1.3	23.4
Intangible assets	(6.7)	6.2	(0.5)
Total	$ 59.0	$ 9.9	$ 68.9

The following table summarizes activity relating to severance and facility purchase accounting liabilities during the year ended September 30, 2009:

	Twelve Months Ended September 30, 2009		
	Severance Costs	Facility Costs	Total
		(in millions)	
Purchase accounting liabilities, beginning of the period	$ —	$ —	$ —
Liabilities established during the period	10.6	29.3	39.9
Liabilities utilized during the period	(8.9)	(3.0)	(11.9)
Purchase accounting liabilities, end of the period	$ 1.7	$ 26.3	$ 28.0

The gross amounts and accumulated amortization of the Company's acquired identifiable intangible assets with finite useful lives as of September 30, 2009 and 2008, included in intangible assets—net in the accompanying Consolidated Balance Sheets, were as follows:

	September 30, 2009		September 30, 2008		
	Gross Amount	Accumulated Amortization	Gross Amount	Accumulated Amortization	Amortization Period (years)
		(in thousands)			
Backlog	$ 63,137	$ 55,021	$ 65,639	$ 36,001	0.8 - 1.5
Customer relationships	69,999	16,136	59,649	8,990	10
Total	$ 133,136	$ 71,157	$ 125,288	$ 44,991	

At the time of acquisition, the Company estimates the amount of the identifiable intangible assets acquired based upon the Company's history with other similar acquisitions and with historical valuations and the facts and circumstances available at the time. The Company determines the value of the identifiable intangible assets as soon as information is available, but not more than 12 months from the date of acquisition.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

4. Business Acquisitions, Goodwill, and Intangible Assets (Continued)

For the years ended September 30, 2009, 2008 and 2007, the Company's amortization expense for acquired intangible assets with finite useful lives was $26.2 million, $17.7 million, and $12.4 million, respectively. The following table presents, in thousands, estimated future amortization expense for acquired intangibles:

Year Ending September 30,		
2010	$	13,257
2011		7,493
2012		7,014
2013		7,014
2014		7,014
Thereafter		20,187
Total	$	61,979

5. Discontinued Operations

As part of the July 2008 acquisition of Earth Tech into its Professional Technical Services segment, the Company acquired certain non-strategic businesses that it has divested and intends to divest. Concurrent with the close of the purchase of Earth Tech, the Company divested Earth Tech's Water & Power Technologies and North American Contract Operations businesses and Earth Tech's Mexican operations. Additionally, the Company divested Earth Tech's Swedish business in September 2008. In May 2009, the Company received the consents and legal ownership of the U.K. businesses, and has divested and intends to divest certain of the assets (UK Assets) of the U.K. businesses. In addition to non-strategic contracts in the U.S. and Canada, the remaining UK Assets have been segregated from continuing operations and presented as discontinued operations and/or as assets and liabilities held for sale in the accompanying financial statements. The results in discontinued operations have also been adjusted for the Irish business previously identified as discontinued operations and subsequently retained. The net impact of the changes to discontinued operations to the Consolidated Statement of Income for the year ended September 30, 2008 was a $0.3 million reclassification from income from discontinued operations, net of tax to income from continuing operations. Also, as a result of these changes to discontinued operations, on the Consolidated Balance Sheet, the Company reclassified $17.6 million of assets to assets held for sale, and $4.2 million from liabilities held for sale to liabilities as of September 30, 2008.

The following table summarizes the reclassification of the consolidated balance sheet for discontinued operations as of September 30, 2008:

	September 30, 2008			
	As previously classified	Certain UK Assets	Subsequently Retained Business	As reclassified
	(in millions)			
Current assets held for sale	$ 75.8	$ 87.3	$ (69.7)	$ 93.4
Current liabilities held for sale	(68.0)	(62.3)	66.5	(63.8)
Net assets held for sale	$ 7.8	$ 25.0	$ (3.2)	$ 29.6

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

5. Discontinued Operations (Continued)

For the year ended September 30, 2009 and 2008, the summarized results of the discontinued operations, included in the Company's results of operations, are as follows:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
	(in millions)	
Revenue	$ 72.9	$ 21.5
Earnings before income taxes	3.4	0.8
Income tax expense	0.4	0.1
Earnings from discontinued operations, net of tax	$ 3.0	$ 0.7

6. Marketable Securities

From time to time, the Company invests its excess cash in financial instruments. Marketable securities as of September 30, 2008 consist of auction rate securities. Auction rate securities held by the Company are primarily AAA rated long-term debt obligations secured by student loans and have interest rates which are reset every 7 to 35 days. At September 30, 2008, $81.4 million in auction rate securities were classified within current assets. In November 2008, the Company liquidated its holdings in these auction rate securities for their par value, plus accrued interest, in cash.

7. Accounts Receivable—Net

Net accounts receivable consisted of the following:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
	(in thousands)	
Billed	$ 992,444	$ 955,722
Unbilled	785,783	714,971
Contract retentions	55,203	49,641
Total accounts receivable—gross	1,833,430	1,720,334
Allowance for doubtful accounts	(100,471)	(82,720)
Total accounts receivable—net	$ 1,732,959	$ 1,637,614

Billed accounts receivable represent amounts billed to clients that have yet to be collected. Unbilled accounts receivable represent revenue recognized but not yet billed pursuant to contract terms or accounts billed after the period end. Substantially all unbilled receivables as of September 30, 2009 and 2008 are expected to be billed and collected within twelve months of such date. Contract retentions represent amounts invoiced to clients where payments have been withheld pending the completion of certain milestones, other contractual conditions or upon the completion of the project. These retention agreements vary from project to project and could be outstanding for several months or years.

Allowances for doubtful accounts have been determined through specific identification of amounts considered to be uncollectible and potential write-offs, plus a non-specific allowance for other amounts for which some potential loss has been determined to be probable based on current and past experience.

7. Accounts Receivable—Net (Continued)

Other than the U.S. government, no single client accounted for more than 10% of the Company's outstanding receivables at September 30, 2009 or 2008.

8. Property and Equipment

Property and equipment, at cost, consists of the following:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	Useful Lives (years)
	(in thousands)		
Building and land	$ 36,573	$ 36,900	27
Leasehold improvements	125,807	100,574	2 - 12
Computer systems and equipment	188,248	154,331	3 - 7
Furniture and fixtures	72,530	66,683	5 - 10
Automobiles	4,676	8,251	3 - 10
Total	427,834	366,739	
Accumulated depreciation and amortization	(198,999)	(143,522)	
Property and equipment, net	$ 228,835	$ 223,217	

Depreciation expense for the fiscal years ended September 30, 2009, 2008 and 2007 was $57.5 million, $44.6 million and $32.5 million, respectively. Included in depreciation expense is amortization expense of capitalized software costs for fiscal years ended September 30, 2009, 2008 and 2007 of $4.7 million, $4.0 million and $4.2 million, respectively. Unamortized capitalized software costs at September 30, 2009, 2008 and 2007 were $19.0 million, $18.3 million and $21.4 million, respectively.

Depreciation and amortization are provided using primarily the straight-line method over the estimated useful lives of the assets, or in the case of leasehold improvements and capitalized leases, the lesser of the remaining life of the lease or its estimated useful life.

9. Joint Ventures and Variable Interest Entities

Investments in Unconsolidated Joint Ventures

The Company's unconsolidated joint ventures provide architecture, engineering, program management, construction management and operations and maintenance services. Joint ventures, the combination of two or more partners, are generally formed for a specific project. Management of the joint venture is typically controlled by a joint venture executive committee, comprised of a representative from each joint venture partner with equal voting rights, irrespective of the ownership percentage. The ownership percentage is typically representative of the work to be performed or the amount of risk assumed by each joint venture partner. The executive committee provides management oversight and assigns work efforts to the joint venture partners.

The majority of the Company's unconsolidated joint ventures have no employees and minimal operating expenses. For these joint ventures, the Company's own employees perform work for the joint venture, which is then billed to a third-party customer by the joint venture. These joint ventures function as pass through entities to bill the third-party customer. The Company includes the services performed for

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

9. Joint Ventures and Variable Interest Entities (Continued)

these joint ventures, and the costs associated with these services, in the Company's results of operations. In certain joint ventures where a fee is added by the joint venture to client billings, the Company's portion of that fee is recorded in equity in earnings of joint ventures.

The Company also has unconsolidated joint ventures that have their own employees and operating expenses and to which the Company generally makes a capital contribution. These joint ventures generally provide operations and maintenance services for governmental facilities. The Company accounts for these joint ventures using the equity method.

Summary financial information of the unconsolidated joint ventures is as follows:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
	(in thousands) (unaudited)		
Financial position:			
Current assets	$ 215,108	$ 233,422	$ 168,369
Current liabilities	(145,135)	(146,079)	(106,249)
Working capital	69,973	87,343	62,120
Non-current assets	6,475	5,384	5,691
Non-current liabilities	(2,722)	(1,865)	(2,858)
Joint ventures' equity	$ 73,726	$ 90,862	$ 64,953

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
	(in thousands)		
The Company's investment in joint ventures	$ 34,505	$ 46,432	$ 23,551
Joint ventures':			
Total revenues	$ 1,488,952	$ 1,162,517	$ 2,652,299
Cost of revenues	1,433,087	1,107,360	2,532,998
The Company's equity in earnings of joint ventures			
Pass through joint ventures	$ 2,477	$ 1,935	$ 2,476
Other joint ventures	20,080	20,256	9,352
Total	$ 22,557	$ 22,191	$ 11,828

Consolidated Entities

At September 30, 2009, the total assets and liabilities of variable interest entities where the Company was the primary beneficiary were $250.9 million and $130.0 million, respectively, as compared to total assets of $289.9 million and total liabilities of $200.0 million at September 30, 2008.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Pension Plans

Pension Plans—In the U.S., the Company sponsors a Defined Benefit Pension Plan (the Pension Plan) which covers substantially all permanent employees hired as of March 1, 1998, subject to eligibility and vesting requirements, and required contributions from participating employees through March 31, 1998. Benefits under this plan generally are based on the employee's years of creditable service and compensation. Effective April 1, 2004, the Company set a maximum on the amount of compensation used to determine pension benefits based on the highest calendar year of compensation earned in the 10 completed calendar years from 1994 through 2003, or the relevant IRS annual compensation limit, $200,000, whichever is lower. Outside the U.S., the Company sponsors various pension plans which are appropriate to the country in which the Company operates, some of which are government mandated.

In the first quarter of fiscal 2009, the Company changed its measurement date for the defined benefit pension plans to correspond to its fiscal year-end and recorded a charge to beginning retained earnings of $2.9 million, net of tax, for the impact of the cumulative difference in the Company's pension expense between the two measurement dates.

The following tables provide reconciliations of the changes in the U.S. and international plans' benefit obligations, reconciliations of the changes in the fair value of assets for the years ending September 30, and reconciliations of the funded status as of September 30 of each year.

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
	(in thousands)					
Change in benefit obligation:						
Benefit obligation at beginning of year	$ 129,232	$ 430,075	$ 125,804	$ 357,100	$ 122,979	$ 321,767
Adjustment for FAS 158 measurement date provision	958	3,177	N/A	N/A	N/A	N/A
Service cost	1,848	4,755	2,252	4,278	2,603	4,774
Participant contributions	868	2,504	883	2,776	453	3,093
Interest cost	8,585	22,024	7,644	19,149	7,503	17,750
Benefits paid	(8,519)	(13,563)	(6,905)	(19,522)	(9,362)	(11,089)
Actuarial (gain) loss	18,978	(23,281)	(7,527)	22,388	1,628	(4,610)
Curtailment (gain) loss	—	—	—	—	—	984
Plan settlements	(3,458)	—	(2,954)	—	—	—
Net transfer in/(out)/acquisitions	—	7,549	10,035	88,273	—	—
Foreign currency translation loss (gain)	—	(38,822)	—	(44,367)	—	24,431
Benefit obligation at end of year	$ 148,492	$ 394,418	$ 129,232	$ 430,075	$ 125,804	$ 357,100

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Pension Plans (Continued)

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
	(in thousands)					
Change in plan assets						
Fair value of plan assets at beginning of year	$ 94,460	$ 335,419	$ 98,914	$ 315,316	$ 89,375	$ 239,238
Adjustment for FAS 158 measurement date provision	(1,585)	(3,703)	N/A	N/A	N/A	N/A
Actual return on plan assets	(11,055)	(3,207)	(8,949)	(7,803)	15,147	23,672
Employer contributions	9,575	35,806	3,791	15,584	3,301	40,681
Participant contributions	868	2,504	883	2,776	453	3,093
Benefits paid	(8,519)	(13,563)	(6,905)	(19,522)	(9,362)	(11,089)
Plan settlements	(3,458)	—	(2,954)	—	—	—
Net transfer in/(out)/acquisitions	—	5,246	9,680	64,436	—	—
Foreign currency translation (loss) gain	—	(28,385)	—	(35,368)	—	19,721
Fair value of plan assets at end of year	$ 80,286	$ 330,117	$ 94,460	$ 335,419	$ 98,914	$ 315,316

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
	(in thousands)					
Reconciliation of funded status:						
Funded status at end of year	$ (68,206)	$ (64,301)	$ (34,772)	$ (94,656)	$ (26,890)	$ (41,784)
Contribution made after measurement date	N/A	N/A	204	12,908	181	4,323
Net amount recognized at end of year	$ (68,206)	$ (64,301)	$ (34,568)	$ (81,748)	$ (26,709)	$ (37,461)

During the fiscal year ended September 30, 2007, due to the adoption of FAS 158, the Company recognized on its balance sheet a liability equal to the funded status (measured as the excess of the projected benefit obligation over the fair market value of plan assets) for its pension plans. The following table sets forth the amounts recognized in the balance sheet as of September 30, 2009, 2008, and 2007:

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
	(in thousands)					
Amounts recognized in the balance sheet:						
Other non-current assets	$ —	$ 60	$ —	$ —	$ —	$ 1,935
Accrued expenses and other current liabilities	(1,284)	—	(1,588)	(81,748)	(1,184)	—

Other long-term liabilities	(66,922)	(64,361)	(32,980)	—	(25,525)	(39,396)
Net amount recognized in the balance sheet	$ (68,206)	$ (64,301)	$ (34,568)	$ (81,748)	$ (26,709)	$ (37,461)

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Pension Plans (Continued)

The following table details the reconciliation of amounts in the statement of stockholders' equity for the fiscal years ended September 30, 2009, 2008 and 2007:

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
	(in thousands)					
Reconciliation of amounts in statement of stockholders' equity:						
Initial net asset (obligation)	$ —	$	$ —	$ —	$ —	$ —
Prior service credit (cost)	1,933	2,987	2,979	3,766	4,137	4,674
Net gain (loss)	(71,544)	(86,318)	(35,579)	(89,705)	(30,665)	(55,609)
Total recognized in accumulated other comprehensive income (loss)	$ (69,611)	$ (83,331)	$ (32,600)	$ (85,939)	$ (26,528)	$ (50,935)

The following table details the components of net periodic benefit cost for the plans in fiscal years 2009, 2008 and 2007:

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
	(in thousands)					
Components of net periodic benefit cost:						
Service cost	$ 1,848	$ 4,755	$ 2,252	$ 4,278	$ 2,603	$ 4,774
Interest cost	8,585	22,024	7,644	19,149	7,503	17,750
Expected return on plan assets	(7,837)	(22,799)	(7,112)	(20,737)	(6,874)	(16,673)
Amortization of prior service costs	(837)	(312)	(1,158)	(399)	(1,158)	(726)
Recognized actuarial loss	2,433	3,217	3,334	3,128	3,928	3,887
Curtailment/settlement loss	763	—	286	2,566	—	(2,130)
Net periodic benefit cost	$ 4,955	$ 6,885	$ 5,246	$ 7,985	$ 6,002	$ 6,882

The amount, net of applicable deferred income taxes, included in other comprehensive income arising from a change in net prior service cost and net gain/loss was $14.7 million and $(7.3) million in the year ended September 30, 2009 and 2008, respectively.

The table below provides additional year-end information for pension plans with accumulated benefit obligations in excess of plan assets.

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
	(in thousands)					
Projected benefit obligation	$ 148,492	$ 394,418	$ 129,232	$ 430,075	$ 125,804	$ 357,100
Accumulated benefit obligation	$ 145,574	$ 358,306	$ 126,521	$ 395,686	$ 122,378	$ 332,862
Fair value of plan assets	$ 80,286	$ 330,117	$ 94,460	$ 335,419	$ 98,914	$ 315,316

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Pension Plans (Continued)

Funding requirements for each plan are determined based on the local laws of the country where such plan resides. In certain countries, the funding requirements are mandatory while in other countries they are discretionary. We currently expect to contribute $16.9 million to our international plans in fiscal year 2010. We do not have a required minimum contribution for our domestic plans; however, we may make additional discretionary contributions. We currently expect to contribute $4.5 million to our domestic plans in 2010.

The table below provides the expected future benefit payments, in thousands:

Year Ending September 30,	U.S.	Int'l
2010	$ 8,944	$ 13,538
2011	9,680	13,370
2012	9,707	16,189
2013	10,357	17,158
2014	10,762	17,075
2015 - 2019	55,820	188,898

The underlying assumptions for the pension plans are as follows:

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
Weighted-average assumptions to determine benefit obligation:						
Discount rate	5.70%	5.56%	6.91%	5.80 - 5.90%	6.25%	5.25 - 5.50%
Salary increase rate	4.00%	3.92%	4.00%	4.25%	4.00%	4.25%
Weighted-average assumptions to determine net periodic benefit cost:						
Discount rate	6.91%	5.80%	6.25%	5.25 - 5.50%	6.25%	5.25%
Salary increase rate	4.00%	4.63%	4.00%	4.25%	4.00%	4.00%
Expected long-term rate of return on plan assets	8.00%	7.20%	8.00%	6.95 - 7.00%	8.00%	5.00 - 7.00%

Pension costs are determined using the assumptions as of the beginning of the plan year, October 1. The funded status is determined using the assumptions as of the end of the plan year.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Pension Plans (Continued)

The following table summarizes the Company's target allocation for 2009 and pension plan asset allocation, both domestic and international, as of September 30, 2009 and 2008:

			Percentage of Plan Assets as of September 30,			
	Target Allocations		2009		2008	
Asset Category	U.S.	Int'l	U.S.	Int'l	U.S.	Int'l
Domestic equity	45%	20%	40%	20%	54%	25%
International equity	15	27	22	27	15	24
Debt	20	43	22	43	22	40
Cash	—	1	2	2	2	1
Property and other	20	9	14	8	7	10
Total	100%	100%	100%	100%	100%	100%

The Company's policy is to minimize the risk of large losses through diversification in a portfolio of stocks, bonds, and cash equivalents, as appropriate, which may reflect varying rates of return. The percentage of assets allocated to cash is to assure liquidity to meet benefit disbursements and general operating expenses.

To develop the expected long-term rate of return on assets assumption, the Company considered the historical returns and the future expectations for returns for each asset class, as well as the target asset allocation of the pension portfolio and the diversification of the portfolio. This resulted in the selection of an 8.0% and 7.2% weighted-average long-term rate of return on assets assumption for the fiscal year ending September 30, 2009 for U.S. and non-U.S. plans, respectively.

11. Debt

Debt consisted of the following:

	September 30, 2009	September 30, 2008
	(in thousands)	
Unsecured revolving credit facility	$ 100,000	$ 310,000
Senior notes	—	8,333
Unsecured term credit agreement	21,196	25,985
Secured notes	26,633	27,332
Other debt	23,380	26,359
Total debt	171,209	398,009
Less: Current portion of debt and short-term borrowings	(29,107)	(32,035)
Long-term debt, less current portion	$ 142,102	$ 365,974

11. Debt (Continued)

The following table presents, in thousands, scheduled maturities of our debt:

Year Ending September 30,		
2010	$	29,107
2011		17,039
2012		100,852
2013		905
2014		961
Thereafter		22,345
Total	$	171,209

Unsecured Revolving Credit Facility

The Company has an unsecured revolving credit facility with a syndicate of banks to support its working capital and acquisition needs. The borrowing capacity under the unsecured revolving credit facility is $600 million, and pursuant to the terms of the associated credit agreement, has an expiration date of August 31, 2012. The Company may also, at its option, request an increase in the commitments under the facility up to a total of $750 million, subject to lender approval. The credit agreement contains customary representations and warranties, affirmative and negative covenants and events of default and includes a sub-limit for financial and commercial standby letters of credit. The Company may borrow, at its option, at either (a) a base rate (the greater of the federal funds rate plus 0.50% or the bank's reference rate), or (b) an offshore, or LIBOR, rate plus a margin which ranges from 0.50% to 1.38%. In addition to these borrowing rates, there is a commitment fee which ranges from 0.10% to 0.25% on any unused commitment. At September 30, 2009 and 2008, $100.0 and $310.0 million was outstanding under the credit facility. At September 30, 2009 and 2008, outstanding standby letters of credit totaled $29.9 million and $26.7 million, respectively, under the credit facility. At September 30, 2009, the Company had $470.1 million available for borrowing under the credit facility. The Company's debt agreements contain certain negative covenants relating to the Company's net worth and leverage, based on outstanding borrowings (including financial letters of credit) and earnings before interest, taxes, depreciation, and amortization. At September 30, 2009, the Company was in compliance with these covenants. The Company could have drawn upon the remaining $470.1 million available under the credit facility.

Interest Rate Swaps

The Company's interest rate swap agreements with financial institutions fix the variable interest rates of $100.0 million of debt outstanding at September 30, 2009 under the Company's revolving credit facility. The Company applied cash flow hedge accounting for the interest rate swap agreements in accordance with ASC 815-20, " *Accounting for Derivative Instruments and Hedging Activities* ." Accordingly, the derivatives are recorded at fair value as assets or liabilities and the effective portion of changes in the fair value of the derivative, as measured quarterly, are reported in other comprehensive income. The change in fair value related to the derivatives included in other comprehensive income/(loss) for the year ended September 30, 2009 and 2008 was $(0.8) million and $(0.3) million, respectively. Based on the swaps' expiration dates, the total $(1.1) million recorded in accumulated other comprehensive income at

11. Debt (Continued)

September 30, 2009 will be recorded as interest expense over the next twelve months. The fixed rates and the related expiration dates of the outstanding swap agreements are as follows:

Notional Amount (in thousands)	Fixed Rate	Expiration Date
$50,000	3.0%	February 2010
$50,000	3.2%	August 2010

The Company's average effective interest rate on borrowings under the revolving credit facility, including the effects of the swaps, during the year ended September 30, 2009 and 2008 was 3.1% and 4.5%, respectively.

Unsecured Term Credit Agreement

In September 2006, through certain wholly-owned subsidiaries, the Company entered into an unsecured term credit agreement with a syndicate of banks to facilitate dividend repatriations under Section 965 of the American Jobs Creation Act, which provided for a limited time opportunity to repatriate foreign earnings to the U.S. at a 5.25% tax rate. The agreement provided for a $65.0 million, five-year term loan among four subsidiary borrowers and one subsidiary guarantor. In order to obtain favorable pricing, the Company also provided a parent company guarantee. The terms and conditions of the term credit agreement are similar to those contained in the Company's revolving credit facility.

Secured Notes

Secured notes are notes payable to a bank, collateralized by real properties, which were assumed in connection with the acquisition of Boyle Engineering Corporation. These notes payable bear interest at 6.04% and mature in December 2028.

Other debt

Other debt consists primarily of bank overdrafts. In addition to the unsecured revolving credit facility discussed above, at September 30, 2009, the Company had $157.2 million of unsecured credit facilities primarily used to cover periodic overdrafts and letters of credit, of which, $105.7 million was utilized for outstanding letters of credit.

12. Fair Value Measurements

In September 2006, the FASB issued SFAS No. 157, later codified in ASC 820-10, "*Fair Value Measurements*" (SFAS 157), which defines fair value, establishes a framework for measuring fair value in accordance with GAAP, and expands disclosures about fair value measurements. SFAS 157 was effective for the Company on October 1, 2008 for all non-pension financial assets and liabilities and for nonfinancial assets and liabilities recognized or disclosed at fair value in its consolidated financial statements on a recurring basis (at least annually). For pension and all other nonfinancial assets and liabilities, SFAS 157 is effective for the Company on October 1, 2009.

As it relates to its non-pension financial assets and liabilities and for nonfinancial assets and liabilities recognized or disclosed at fair value in the consolidated financial statements on a recurring basis (at least annually), the adoption of SFAS 157 did not have a material impact on the Company's consolidated

12. Fair Value Measurements (Continued)

financial statements. The Company is still in the process of evaluating the impact that SFAS 157 will have on its pension related financial assets and liabilities and its other nonfinancial assets and liabilities.

The following table summarizes the Company's non-pension financial assets and liabilities measured at fair value on a recurring basis (at least annually) as of September 30, 2009 (in millions):

	September 30, 2009	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Deferred compensation plan assets(1)	$ 0.6	$ 0.6	$ —	$ —
Total assets	$ 0.6	$ 0.6	$ —	$ —
Deferred compensation plan liability(1)	$ 92.8	$ —	$ 92.8	$ —
Derivative liabilities(2)	1.9	—	1.9	—
Total liabilities	$ 94.7	$ —	$ 94.7	$ —

(1)

The Company maintains a participant-directed, non-qualified deferred compensation plan structured as a rabbi trust (a trust established to provide a source of funds for the plan on a tax-deferred basis) for eligible highly compensated employees. As of September 30, 2009, the rabbi trust held approximately $0.6 million, or 1% of its investment assets, in marketable securities valued using quoted market prices. The remaining assets, not reflected in this table, of $53.7 million are valued at cash surrender value and not subject to SFAS 157 disclosure. The related deferred compensation liability represents the fair value of the participant deferrals. For additional information about the Company's deferred compensation plan, refer to Note 17.

(2)
The Company calculates derivative liability amounts in accordance with SFAS 133. For additional information about the Company's fair value measurements of these interest rate swap agreements, refer to Notes 1 and 11.

13. Concentration of Credit Risk

Financial instruments which potentially subject the Company to concentrations of credit risk consist principally of temporary cash investments and trade receivables. The Company's cash balances and short-term investments are maintained in accounts held by major banks and financial institutions located primarily in the U.S., Canada, Europe, Australia, Middle East and Hong Kong. If the Company extends a significant portion of its credit to clients in a specific geographic area or industry, the Company may experience disproportionately high levels of default if those clients are adversely affected by factors particular to their geographic area or industry. Concentrations of credit risk with respect to trade receivables are limited due to the large number of customers comprising the Company's customer base, including, in large part, governments, government agencies and quasi-government organizations, and their dispersion across many different industries and geographies. See Note 22 regarding the Company's foreign revenues. In order to mitigate credit risk, the Company continually reviews the credit worthiness of its major private clients.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

14. Leases

The Company and its subsidiaries are lessees in non-cancelable leasing agreements for office buildings and equipment which expire at various dates. The following table presents, in thousands, amounts payable under non-cancelable operating lease commitments during the following fiscal years:

Year Ending September 30,		
2010	$	161,499
2011		136,707
2012		108,971
2013		90,592
2014		79,138
Thereafter		161,104
Total	$	738,011

Included in the above table are commitments totaling $25.0 million related to the sale-leaseback of the Company's Orange, California facility during the year ended September 30, 2006. The sales price of this facility was $20.1 million of which $16.3 million in gain on sale-leaseback was deferred and is being amortized over the 12-year term of the lease.

The Company also has similar non-cancelable leasing agreements that are accounted for as capital lease obligations due to the terms of the underlying leases. At September 30, 2009, the Company had total lease obligations under capital leases of $8.1 million. Rent expense for all leases for the years ended September 30, 2009, 2008, and 2007, was approximately $192.2 million, $163.3 million and $123.3 million, respectively. When the Company is required to restore leased facilities to original condition, provisions are made over the period of the lease.

15. Other Financial Information

Other non-current assets consist of the following:

	Fiscal Year Ended			
	September 30, 2009		September 30, 2008	
	(in millions)			
Deferred compensation plan assets (Note 17)	$	54.3	$	60.0
Other		41.7		74.9
	$	96.0	$	134.9

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

15. Other Financial Information (Continued)

Accrued expenses consist of the following:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
	(in millions)	
Accrued salaries and benefits	$ 323.3	$ 315.4
Accrued contract costs	358.2	285.9
Other accrued expenses	41.0	42.4
	$ 722.5	$ 643.7

Accrued contract costs above include balances related to professional liability accruals of $98.3 million and $84.2 million as of September 30, 2009 and 2008, respectively. Other accrued contract costs primarily relate to costs for services provided by subcontractors and other non-employees.

Other long-term liabilities consist of the following:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
	(in millions)	
Pension liabilities (Note 10)	$ 132.5	$ 116.3
Deferred compensation plan liability (Note 17)	92.8	58.4
Reserve for uncertain tax positions (Note 19)	54.4	57.6
Other	56.9	102.4
	$ 336.6	$ 334.7

The components of accumulated other comprehensive loss are as follows:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
	(in millions)	
Foreign currency translation adjustment	$ (37.7)	$ (23.1)
Defined benefit minimum pension liability adjustment, net of tax	(107.8)	(88.1)
Interest rate swap valuation	(1.1)	(0.3)
	$ (146.6)	$ (111.5)

16. Stockholders' Equity

Common and Preferred Stock Units—Common and Preferred Stock Units (Stock Units) under the DCP may only be redeemed for Common Stock. The holders of Stock Units are not entitled to vote but are entitled to dividends if dividends are declared on Common Stock. In the event of the liquidation of the Company, holders of the Stock Units are entitled to no greater rights than holders of Common Stock.

16. Stockholders' Equity (Continued)

Convertible Preferred Stock—The Restated Certificate of Incorporation of the Company authorizes the issuance of 8,000,000 shares of Preferred Stock, par value $.01 per share (Preferred Stock) and liquidation preference of $100 per share. The holders of Preferred Stock are generally entitled to one vote per share on all matters to be voted on by the Company's stockholders and vote as one class with the Common Stock.

Class C Preferred Stock—The Class C Preferred Stock has no par value and holders are entitled to 100,000 votes per share on all matters to be voted on by the Company's stockholders. The Class C Preferred Stock does not entitle holders to any dividend and has a liquidation and redemption value of $1.00 per share. Shares of Class C Preferred Stock are the voting shares relating to DCP units.

Class E Preferred Stock—The Class E Preferred Stock is limited to an aggregate of 20 shares, has no par value, and has a liquidation preference of $1.00 per share. Holders of these shares are entitled 100,000 votes per share on all matters voted on by holders of Class E Preferred Stock. The Company, with notice, may redeem Class E Preferred Stock by paying the liquidation preference. The holders of Class E Preferred Stock have no conversion rights. All shares of Class E Preferred Stock redeemed or repurchased by the Company will be restored to the status of authorized but un-issued shares of Preferred Stock, without designation as to series.

17. Stock Plans

Defined Contribution Plans—Substantially all permanent employees are eligible to participate in defined contribution plans provided by the Company. Under these plans, participants may make contributions into a variety of funds, including a fund that is fully invested in Company stock. Employees are not required to allocate any funds to Company stock, which allows employees to limit their exposure to market changes in the Company's stock price. Employees may generally reallocate their account balances on a daily basis. The only limit on the frequency of reallocations applies to changes involving Company stock investments by employees classified as insiders or restricted personnel under the Company's insider trading policy.

The Company sponsors the Deferred Compensation Plan (DCP), a stock purchase plan that provides an opportunity for eligible employees and non-employee directors to continue to invest in the Company when the Company's qualified plans are no longer available to them due to limitations contained in the U.S. Internal Revenue Code. Under the DCP, participants are permitted to defer compensation, on a pre-tax basis, for investment in common stock units. See also Note 2 relating to the Company funding a rabbi trust for certain diversified DCP balances in connection with the IPO. When a participant in the DCP ends employment, the Company will issue shares of AECOM common stock based on the total number of units credited to the participant's account. During the year ended September 30, 2009, participants of the DCP elected to diversify a portion of their investment from AECOM Common Stock units. As a result, $29.1 million in liabilities were established and recorded in other long-term liabilities.

Compensation expense relating to employer contributions under defined contribution plans, including the DCP, for fiscal years ended September 30, 2009, 2008 and 2007, was $16.1 million, $14.3 million and $17.1 million, respectively. Issuances and repurchases of AECOM common stock related to employee participants' contributions to and withdrawals from these defined contribution plans are included as issuances and repurchases of stock in the accompanying Consolidated Statements of Stockholders' Equity and of Cash Flows.

Stock Incentive Plans—The Company has stock incentive plans under which key employees can purchase up to 19,400,000 shares of Common Stock under stock options or restricted stock awards while

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

17. Stock Plans (Continued)

non-employee directors can purchase up to 500,000 shares of Common Stock under stock options. Stock options may be granted to employees and non-employee directors with an exercise price not less than the fair market value of the stock on the date of grant. Unexercised options expire seven years after date of grant. During the years ended September 30, 2009, 2008, and 2007, compensation expense recognized relating to stock options as a result of the fair value method was $4.4 million, $2.6 million, and $1.2 million, respectively. Unrecognized compensation expense relating to stock options outstanding as of September 30, 2009 was $6.8 million to be recognized over the awards' respective vesting periods which are generally three years.

The fair value of the Company's stock options were calculated using the following assumptions:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
Dividend yield	0.0%	0.0%	0.0%
Risk-free rate of return, annual	1.8%	3.5%	4.6%
Expected life	4.5 years	4.5 years	6 years
Volatility	37.6%	33.0%	25.0%

The weighted average grant-date fair value of stock options granted during the years ended September 30, 2009 and 2008 was $8.04 and $8.91, respectively.

During the three years in the period ended September 30, 2009, option activity was as follows:

	Number of Options	Weighted Average Exercise Price
Balance, October 1, 2006	8,928,640	$ 8.43
Granted	679,865	14.88
Exercised	(1,845,251)	13.80
Cancelled	(35,666)	7.17
Balance, September 30, 2007	7,727,588	9.27
Granted	517,100	27.65
Exercised	(2,851,150)	7.70
Cancelled	(84,793)	17.51
Balance, September 30, 2008	5,308,745	11.78
Granted	885,464	23.68
Exercised	(2,330,587)	8.58
Cancelled	(57,622)	22.17
Balance, September 30, 2009	3,806,000	$ 16.36
Exercisable as of September 30, 2007	7,139,923	$ 8.79
Exercisable as of September 30, 2008	4,560,286	$ 10.10
Exercisable as of September 30, 2009	2,508,973	$ 12.78

17. Stock Plans (Continued)

The following table summarizes information concerning outstanding and exercisable options as of September 30, 2009:

	Options Outstanding				Options Exercisable		
	Number Outstanding as of September 30, 2009	Weighted Average Remaining Contractual Life	Weighted Average Exercise Price	Aggregate Intrinsic Value (in millions)	Number Exercisable as of September 30, 2009	Weighted Average Remaining Contractual Life	Weighted Average Exercise Price
Range of Exercise Prices							
$7.84 - $8.37	97,460	0.21	$ 7.97	$ 1.87	81,460	0.22	$ 8.00
9.75 - 10.34	715,300	1.16	9.82	12.39	715,300	1.16	9.82
10.39 - 11.49	642,000	2.18	10.55	10.65	642,000	2.18	10.55
12.41 - 15.41	978,593	3.76	13.54	13.31	832,186	3.66	13.39
21.01 - 25.52	926,597	6.12	23.74	3.15	36,184	4.90	24.78
26.47 - 36.67	446,050	5.26	27.88	0.03	201,843	5.29	27.65
7.84 - 36.67	3,806,000	3.66	$ 16.36	$ 41.40	2,508,973	2.61	$ 12.78

The remaining contractual life of options outstanding at September 30, 2009, range from 0 to 7 years and have a weighted average remaining contractual life of 3.66 years. The aggregate intrinsic value of stock options exercised during the years ended September 30, 2009, 2008, and 2007 was $46.1 million, $65.5 million, and $55.9 million, respectively.

The Company grants stock units under the Performance Earnings Program (PEP), whereby units are earned and issued dependent upon meeting established cumulative performance objectives over a three-year period. The Company recognized compensation expense relating to the PEP of $19.3 million, $19.2 million, and $12.7 million during the years ended September 30, 2009, 2008, and 2007, respectively. Additionally, the Company issues restricted stock units in connection with acquisitions which vest immediately or which are earned based on service conditions, resulting in compensation expenses of $1.5 million, $0.0 million, and $0.0 million during the years ended September 30, 2009, 2008, and 2007, respectively. Unrecognized compensation expense related to PEP units and restricted stock units outstanding as of September 30, 2009 was $21.2 million and $3.9 million, respectively, to be recognized over the awards' respective vesting periods which are generally three years.

Cash flow is attributable to tax benefits resulting from tax deductions in excess of compensation cost recognized for those stock options (excess tax benefits) be classified as financing cash flows. Excess tax benefits of $15.0 million, $20.6 million, and $7.2 million for the years ended September 30, 2009, 2008, and 2007, respectively, have been classified as financing cash inflows in the Consolidated Statements of Cash Flows.

18. Redeemable Common Stock and Common Stock Units

Prior to the Company's IPO in May 2007, the Company's securities were not freely tradable. In accordance with EITF Topic D-98, later codified in ASC 480-10, "Classification and Measurement of Redeemable Securities," since the redemption of the Company's common and preferred stock and stock units was not solely within the control of the Company, such amounts were classified outside of permanent stockholders' equity. As a result of the IPO and the conversion of redeemable stock, amounts previously

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

18. Redeemable Common Stock and Common Stock Units (Continued)

recorded outside permanent equity are classified as equity in the accompanying Consolidated Balance Sheets and Statements of Changes in Stockholders' Equity. See also Note 2.

19. Income Taxes

Income tax expense on continuing operations is comprised of:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
		(in thousands)	
Current:			
Federal	$ 25,813	$ 57,443	$ 14,159
State	5,306	13,800	(237)
Foreign	49,093	39,720	17,614
Total current income tax expense	80,212	110,963	31,536
Deferred:			
Federal	4,233	(28,660)	6,551
State	(1,439)	(7,188)	1,753
Foreign	(6,004)	1,378	7,363
Total deferred income tax expense (benefit)	(3,210)	(34,470)	15,667
Total income tax expense	$ 77,002	$ 76,493	$ 47,203

The major elements contributing to the difference between the U.S. federal statutory rate of 35.0% and the effective tax rate are as follows:

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	Amount	%	Amount	%	Amount	%
			($ in thousands)			
Tax at federal statutory rate	$ 92,297	35.0%	$ 78,055	35.0%	$ 51,596	35.0%
U.S. income tax credits	(19,813)	(7.5)	(15,779)	(7.1)	(3,030)	(2.1)
State income tax, net of federal benefit	5,257	2.0	6,027	2.7	3,494	2.4
Foreign tax rate differential	5,231	2.0	(2,778)	(1.3)	(6,392)	(4.3)
Foreign R&E credits	(6,662)	(2.5)	(6,857)	(3.1)	—	—
Disallowance of meals & entertainment expense	628	0.2	472	0.2	963	0.6
Other items, net	877	0.3	(3,621)	(1.6)	572	0.4
Change in uncertain tax positions	(5,926)	(2.2)	20,180	9.1	—	—
Valuation allowance	5,113	1.9	794	0.4	—	—
Total income tax	$ 77,002	29.2%	$ 76,493	34.3%	$ 47,203	32.0%

expense

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

19. Income Taxes (Continued)

The deferred tax assets (liabilities) are as follows:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
	(in thousands)	
Deferred tax assets:		
Compensation and benefit accruals not currently deductible	$ 99,407	$ 117,607
Net operating loss carry forwards	32,079	46,923
Self insurance reserves	49,491	38,500
R&E tax credit carry forwards	5,643	1,670
Pension liability	46,995	27,843
Foreign tax attributes	1,808	2,570
Accrued liabilities	59,705	53,949
Investments in joint ventures/non-controlled subsidiaries	95	103
Other	1,908	537
Total deferred tax assets	297,131	289,702
Deferred tax liabilities:		
Unearned revenue	(98,397)	(120,527)
Depreciation and amortization	(12,575)	(18,488)
Acquired intangible assets	(23,430)	(35,321)
State taxes	(6,852)	(451)
Total deferred tax liabilities	(141,254)	(174,787)
Valuation allowance	(30,661)	(38,409)
Net deferred tax assets	$ 125,216	$ 76,506

As of September 30, 2009, the Company has available unused federal net operating loss (NOL) carry forwards of $5.0 million, state NOL carry forwards of $189.3 million, and foreign NOL carry forwards of $67.1 million which expire at various dates through 2028. In addition, as of September 30, 2009, the Company has available unused state research and development credits of $5.6 million which can be carried forward indefinitely and foreign tax attributes of $1.8 million which expire at various dates through 2028.

As of September 30, 2009, the deferred tax assets were $297.1 million. The Company has recorded a valuation allowance of approximately $30.7 million related to federal, state and foreign net operating loss carry forwards and credits. The Company has performed an assessment of positive and negative evidence regarding the realization of the net deferred tax asset in accordance with SFAS No. 109, later codified in ASC 740-10, " *Accounting for Income Taxes* ." This assessment included the evaluation of scheduled reversals of deferred tax liabilities, the availability of carry forwards and estimates of projected future taxable income. Although realization is not assured, based on the Company's assessment, the Company has concluded that it is more likely than not that the remaining asset of $266.4 million will be realized and, as such, no additional valuation allowance has been provided.

19. Income Taxes (Continued)

The Company does not provide for U.S. taxes or foreign withholding taxes on undistributed earnings from non-U.S. subsidiaries because such earnings are intended to be reinvested indefinitely. The undistributed earnings are approximately $318.2 million. If undistributed earnings were distributed, foreign tax credits could become available under current law to reduce the resulting U.S. income tax liability.

In July 2006, the FASB issued FASB Interpretation No. 48, later codified in ASC 740-10 and ASC 805-740, "*Accounting for Uncertainty in Income Taxes—an interpretation of FASB Statement No. 109* " (FIN 48). FIN 48 prescribes a comprehensive framework for the financial statement recognition, measurement, presentation, and disclosure of uncertain income tax positions that the Company has taken or anticipates taking in a tax return, and includes guidance on de-recognition, classification, interest and penalties, accounting in interim periods, and transition rules. On October 1, 2007, the Company adopted the provisions of FIN 48 and recorded adjustments of $1.9 million to deferred taxes and $0.2 million to retained earnings.

As of September 30, 2009, the Company had a liability for unrecognized tax benefits, including potential interest and penalties, net of related tax benefit, totaling $54.4 million. The gross unrecognized tax benefits as of September 30, 2009 and September 30, 2008 were $52.8 million and $57.0 million, respectively, excluding interest, penalties, and related tax benefit. The decrease of $4.2 million is primarily related to income tax credits less acquired unrecognized tax benefits. Of the $52.8 million, approximately $45.8 million, including related tax benefits, would be included in the effective tax rate if recognized in the fiscal year ended September 30, 2009. With respect to the remaining $7.0 million, the reversal would result in a reduction to the balance of goodwill. However, the adoption of SFAS 141R will prospectively change the impact of any reversal of these unrecognized tax benefits to an increase in the income tax benefit beginning in the fiscal year ending September 30, 2010. See Note 1 above for further discussion on SFAS 141R. A reconciliation of the beginning and ending amount of gross unrecognized tax benefits is as follows:

	Fiscal Year Ended	
	September 30, 2009	September 30, 2008
	(in thousands)	
Balance at the beginning of the year	$ 56,965	$ 36,292
Gross increase in prior years' tax positions	2,572	5,904
Gross decrease in prior years' tax positions	(11,413)	(3,856)
Gross increase in current period's tax positions	7,435	15,875
Lapse of statute of limitations	(4,457)	(1,877)
Unrecognized tax benefits acquired in current year	1,704	4,627
Balance at the end of the year	$ 52,806	$ 56,965

The Company classifies interest and penalties related to uncertain tax positions within the income tax expense line in the accompanying consolidated statement of income. At September 30, 2008, the accrued interest and penalties were $5.5 million and $1.2 million, respectively, excluding any related income tax benefits. As of September 30, 2009, the accrued interest and penalties were $6.0 million and $0.6 million, respectively, excluding any related income tax benefits.

The Company files income tax returns in numerous tax jurisdictions, including the U.S., and numerous U.S. states and non-U.S. jurisdictions around the world. The statute of limitations varies by jurisdiction in

19. Income Taxes (Continued)

which the Company operates. Because of the number of jurisdictions in which the Company files tax returns, in any given year the statute of limitations in certain jurisdictions may expire without examination within the 12-month period from the balance sheet date. With the normal closures of statutes of limitations, the Company anticipates that the amount of unrecognized tax benefits will decrease by $7.5 million within the next 12 months. With few exceptions, the Company is no longer subject to U.S. (including federal, state and local) or non-U.S. income tax examinations by tax authorities for years before fiscal year 2005.

A number of tax years are under audit by the relevant federal, state and foreign tax authorities. The Company is currently under examination by the U.S. Internal Revenue Service for the fiscal years 2006 and 2007. The Company anticipates that some of the audits may be concluded in the foreseeable future, including in fiscal year 2010. Based on the status of these audits, it is reasonably possible that the conclusion of the audits may result in a reduction of unrecognized tax benefits. However, it is not possible to estimate the impact of this change at this time due to the early status of the tax examinations.

20. Earnings Per Share

Basic earnings per share (EPS) excludes dilution and is computed by dividing net income available to common stockholders by the weighted average number of common shares outstanding for the period. Diluted EPS is computed by dividing net income by the weighted average number of common shares outstanding and potential common shares for the period. The Company includes as potential common shares the weighted average dilutive effects of outstanding stock options using the treasury stock method.

The following table sets forth a reconciliation of the denominators of basic and diluted earnings per share:

	Fiscal Year Ended		
	September 30, 2009	September 30, 2008	September 30, 2007
	(in thousands)		
Weighted average shares outstanding—Basic	108,003	101,456	73,091
Potential common shares:			
Preferred stock, Class F and Class G	—	—	11,331
Stock options	1,585	2,650	2,774
Preferred stock, other	118	109	341
Weighted average shares outstanding—Diluted	109,706	104,215	87,537

For the three fiscal years ended September 30, 2009, 2008, and 2007, no options were excluded from the calculation of potential common shares because they were considered anti-dilutive.

21. Commitments and Contingencies

The Company records amounts representing its estimated liabilities relating to claims, guarantees, litigation, audits and investigations. The Company relies in part on qualified actuaries to assist it in determining the level of reserves to establish for insurance-related claims that are known and have been asserted against it, and for insurance-related claims that are believed to have been incurred based on actuarial analysis, but have not yet been reported to the Company's claims administrators as of the respective balance sheet dates. The Company includes any adjustments to such insurance reserves in its consolidated results of operations. The Company is a defendant in various lawsuits arising in the normal course of business. In the opinion of management, the ultimate resolution of these matters will not have a material adverse effect on the financial position or results of operations of the Company.

Under the Company's unsecured revolving credit facility and other facilities discussed in Other Debt above, at September 30, 2009, the Company was contingently liable in the amount of approximately $135.7 million under standby letters of credit issued primarily in connection with payment and performance guarantees relating to domestic and overseas contracts and general and professional liability insurance programs. In addition, in some instances the Company guarantees that a project, when complete, will achieve specified performance standards. If the project subsequently fails to meet guaranteed performance standards, the Company may either incur significant additional costs or be held responsible for the costs incurred by the client to achieve the required performance standards.

In the ordinary course of business, the Company enters into various agreements providing financial or performance assurances to clients on behalf of certain unconsolidated partnerships, joint ventures and other jointly executed contracts. These agreements are entered into primarily to support the project execution commitments of these entities. The guarantees have various expiration dates. The maximum potential payment amount of an outstanding performance guarantee is the remaining cost of work to be performed by or on behalf of third parties. Under joint venture arrangements, if a partner is financially unable to complete its share of the contract, the other partner(s) will be required to complete those activities. The Company generally only enters into joint venture arrangements with partners who are reputable, financially sound and who carry appropriate levels of surety bonds for the project in order to adequately assure completion of their assignments. The Company does not expect that these guarantees will have a material adverse effect on its consolidated balance sheet or statements of income or cash flows.

22. Reportable Segments and Geographic Information

The Company's operations are organized into two reportable segments: Professional Technical Services (PTS) and Management Support Services (MSS). The Company's PTS reportable segment delivers planning, consulting, architectural and engineering design, and program and construction management services to commercial and government clients worldwide. The Company's MSS reportable segment provides program and facilities management and maintenance, training, logistics, consulting, and technical assistance and systems integration services, primarily for agencies of the U.S. government. These reportable segments are organized by the types of services provided, the differing specialized needs of the respective clients, and how the Company manages its business. The Company has aggregated various operating segments into its PTS reportable segment based on their similar characteristics, including similar long term financial performance, the nature of services provided, internal processes for delivering those services, and types of customers.

Management internally analyzes the results of its operations using several non-GAAP measures. A significant portion of the Company's revenues relates to services provided by subcontractors and other non-employees that it categorizes as other direct costs. Other direct costs are segregated from cost of revenues resulting in revenue, net of other direct costs, which is a measure of work performed by Company employees. The Company has included information on revenue, net of other direct costs, as it believes that it is useful to view our revenue exclusive of costs associated with external service providers.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

22. Reportable Segments and Geographic Information (Continued)

The following tables set forth summarized financial information concerning the Company's reportable segments:

	Professional Technical Services	Management Support Services	Corporate(1)	Total
	($ in thousands)			
Reportable Segments:				
Fiscal Year Ended September 30, 2009:				
Revenue	$ 5,057,688	$ 1,061,777	$ —	$ 6,119,465
Revenue, net of other direct costs	3,565,481	253,488	—	3,818,969
Gross profit	312,948	38,255	—	351,203
Gross profit as a % of revenue	6.2%	3.6%		5.7%
Gross profit as a % of revenue, net of other direct costs	8.8%	15.1%		9.2%
Equity in earnings of joint ventures	12,465	10,092		22,557
General and administrative expenses	—	—	86,894	86,894
Segment income from operations	325,413	48,347	(86,894)	286,866
Segment assets	3,537,342	266,328	(13,789)	3,789,881
Fiscal Year Ended September 30, 2008:				
Revenue	$ 4,327,871	$ 866,811	$ —	$ 5,194,682
Revenue, net of other direct costs	3,133,731	155,777	—	3,289,508
Gross profit	261,614	25,284	—	286,898
Gross profit as a % of revenue	6.0%	2.9%		5.5%
Gross profit as a % of revenue, net of other direct costs	8.3%	16.2%		8.7%
Equity in earnings of joint ventures	13,279	8,912		22,191
General and administrative expenses	—	—	70,582	70,582
Segment income from operations	274,893	34,196	(70,582)	238,507
Segment assets	3,289,489	216,537	90,164	3,596,190
Fiscal Year Ended September 30, 2007:				
Revenue	$ 3,418,683	$ 818,587	$ —	$ 4,237,270

Revenue, net of other direct costs	2,295,716	109,553	—	2,405,269
Gross profit	178,445	19,508	—	197,953
Gross profit as a % of revenue	5.2%	2.4%		4.7%
Gross profit as a % of revenue, net of other direct costs	7.8%	17.8%		8.2%
Equity in earnings of joint ventures	2,710	9,118	—	11,828
General and administrative expenses	—	—	53,842	53,842
Segment income from operations	181,155	28,626	(53,842)	155,939
Segment assets	1,909,098	170,043	412,680	2,491,821

(1)

Corporate assets include intercompany eliminations.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

22. Reportable Segments and Geographic Information (Continued)

Geographic Information:

	Fiscal Year Ended					
	September 30, 2009		September 30, 2008		September 30, 2007	
	Revenue	Long-Lived Assets	Revenue	Long-Lived Assets	Revenue	Long-Lived Assets
	(in thousands)					
United States	$ 3,756,804	$ 1,005,027	$ 3,149,663	$ 1,021,881	$ 2,904,570	$ 561,366
Foreign Countries	2,362,661	479,180	2,045,019	412,073	1,332,700	292,398
Total	$ 6,119,465	$ 1,484,207	$ 5,194,682	$ 1,433,954	$ 4,237,270	$ 853,764

The Company attributes revenue by geography based on the external customer's country of origin. Long-lived assets consist of noncurrent assets excluding deferred tax assets.

23. Major Clients

Approximately 26%, 23% and 26% of the Company's revenue was derived through direct contracts with agencies of the U.S. Federal Government in the years ended September 30, 2009, 2008 and 2007, respectively. One of these contracts in the MSS segment accounted for approximately 10%, 10% and 13% of the Company's revenue in the years ended September 30, 2009, 2008 and 2007, respectively. No other single client accounted for more than 10% of the Company's revenue.

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

24. Quarterly Financial Information—Unaudited

In the opinion of management, the following unaudited quarterly data reflects all adjustments necessary for a fair statement of the results of operations. All such adjustments are of a normal recurring nature. These results of operations include certain reclassifications for discontinued operations for the fourth quarter of fiscal year 2008 and the first, second, and third quarter of fiscal year 2009 as described in Note 5.

Fiscal Year 2009:	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
	(in thousands, except per share data)			
Revenue	$ 1,452,628	$ 1,498,058	$ 1,541,289	$ 1,627,490
Cost of revenue	1,372,021	1,410,125	1,453,772	1,532,344
Gross profit	80,607	87,933	87,517	95,146
Equity in earnings of joint ventures	5,736	4,904	6,153	5,764
General and administrative expenses	17,246	23,931	20,071	25,646
Income from operations	69,097	68,906	73,599	75,264
Minority interest in share of earnings	2,846	4,932	3,040	3,364
Other (expense) income	(4,788)	(1,418)	3,248	4,671
Interest (expense) income, net	(3,598)	(1,919)	(2,617)	(2,557)
Income from continuing operations before income tax expense	57,865	60,637	71,190	74,014
Income tax expense	17,460	18,431	21,187	19,924
Income from continuing operations	40,405	42,206	50,003	54,090
Discontinued operations, net of tax	500	1,192	1,118	182
Net income	$ 40,905	$ 43,398	$ 51,121	$ 54,272
Net income allocation:				
Preferred stock dividend	$ 36	$ 35	$ 34	$ 34
Net income available to common stockholders	40,869	43,363	51,087	54,238
Net income	$ 40,905	$ 43,398	$ 51,121	$ 54,272
Net income per share:				
Basic				
Continuing operations	$ 0.39	$ 0.40	$ 0.45	$ 0.49
Discontinued operations	—	0.01	0.01	—
	$ 0.39	$ 0.41	$ 0.46	$ 0.49
Diluted				
Continued operations	$ 0.38	$ 0.39	$ 0.45	$ 0.48
Discontinued operations	—	0.01	0.01	—
	$ 0.38	$ 0.40	$ 0.46	$ 0.48
Weighted average common shares outstanding:				
Basic	104,529	106,465	109,872	111,145
Diluted	106,620	108,148	111,515	112,542

AECOM TECHNOLOGY CORPORATION

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

24. Quarterly Financial Information—Unaudited (Continued)

Fiscal Year 2008:	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
	(in thousands, except per share data)			
Revenue	$ 1,080,250	$ 1,164,121	$ 1,321,203	$ 1,629,108
Cost of revenue	1,026,273	1,093,388	1,245,494	1,542,629
Gross profit	53,977	70,733	75,709	86,479
Equity in earnings of joint ventures	2,842	4,008	5,313	10,028
General and administrative expenses	12,287	15,782	16,840	25,673
Income from operations	44,532	58,959	64,182	70,834
Minority interest in share of earnings	1,279	4,798	4,862	2,451
Other (expense) income	(815)	(813)	756	(2,566)
Interest income (expense), net	2,248	2,061	(198)	(2,775)
Income from continuing operations before income tax expense	44,686	55,409	59,878	63,042
Income tax expense	15,193	19,580	21,424	20,296
Income from continuing operations	29,493	35,829	38,454	42,746
Discontinued operations, net of tax	—	—	—	704
Net income	$ 29,493	$ 35,829	$ 38,454	$ 43,450
Net income allocation:				
Preferred stock dividend	$ 56	$ 39	$ 36	$ 37
Net income available to common stockholders	29,437	35,790	38,418	43,413
Net income	$ 29,493	$ 35,829	$ 38,454	$ 43,450
Net income per share:				
Basic				
Continuing operations	$ 0.30	$ 0.36	$ 0.38	$ 0.41
Discontinued operations	—	—	—	0.01
	$ 0.30	$ 0.36	$ 0.38	$ 0.42
Diluted				
Continued operations	$ 0.29	$ 0.35	$ 0.37	$ 0.40
Discontinued operations	—	—	—	0.01
	$ 0.29	$ 0.35	$ 0.37	$ 0.41
Weighted average common shares outstanding:				
Basic	99,644	100,571	102,020	103,583
Diluted	103,025	103,454	104,563	105,817

25. Subsequent Events

The Company has evaluated the period after the balance sheet date up through November 27, 2009, which is the date that the consolidated financial statements were issued, and determined that other than noted below, there were no subsequent events or transactions that required recognition or disclosure in the consolidated financial statements.

25. Subsequent Events (Continued)

Subsequent to September 30, 2009, the Company adopted an amendment to freeze pension plan benefit accruals for certain U.S. employee plans. Its adoption will not have a material effect on the Company's financial statements.

The Company has elected to terminate its U.S. deferred compensation plan effective in December 2009. As a result of the termination, 6.3 million outstanding stock units and the Company's deferred compensation liability of $93 million as of September 30, 2009 are expected to be settled in December 2010. Participant balances will continue to accrue earnings until settlement.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our CEO and CFO, are responsible for establishing and maintaining "disclosure controls and procedures" (as defined in rules promulgated under the Exchange Act) for our company. Based on their evaluation as of the end of the period covered by this report, our CEO and CFO have concluded that our disclosure controls and procedures were effective to ensure that the information required to be disclosed by us in this Annual Report on Form 10-K was (i) recorded, processed, summarized and reported within the time periods specified in the SEC's rules and (ii) accumulated and communicated to our management, including our principal executive and principal financial officers, to allow timely decisions regarding required disclosures.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rule 13a-15(f) or 15d-15(f) promulgated under the Securities Exchange Act of 1934, as amended, as a process designed by, or under the supervision of, the company's principal executive and principal financial officers and effected by the company's board of directors, management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. Internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Projections of any evaluation of the effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Our management, with the participation of our CEO and CFO, assessed the effectiveness of our internal control over financial reporting as of September 30, 2009, the end of our fiscal year. Our management based its assessment on criteria established in *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission. Our management's assessment included evaluation and testing of the design and operating effectiveness of key financial reporting controls, process documentation, accounting policies, and our overall control environment.

Based on our management's assessment, our management has concluded that our internal control over financial reporting was effective as of September 30, 2009. Our management communicated the results of its assessment to the Audit Committee of our Board of Directors.

Our independent registered public accounting firm, Ernst & Young LLP, audited our financial statements for the fiscal year ended September 30, 2009 included in this Annual Report on Form 10-K, and

has issued an audit report on our assessment of the Company's internal control over financial reporting, a copy of which is included earlier in this Annual Report on Form 10-K.

Changes in Internal Control Over Financial Reporting

Our management, including our CEO and CFO, confirm that there were no changes in our company's internal control over financial reporting during the fiscal quarter ended September 30, 2009 that have materially affected, or are reasonably likely to materially affect, our company's internal control over financial reporting.

ITEM 9B. OTHER INFORMATION

On November 24, 2009, we elected to terminate the AECOM Deferred Compensation Plan (Plan), effective December 14, 2009. The Plan was established to allow members of our Board of Directors and highly compensated employees in the United States to defer a portion of their compensation to a later pre-determined date.

No deferrals will be made under the Plan after December 14, 2009, but participants' accounts will remain invested and continue to accrue earnings until the date the account balances are distributed in accordance with the provisions of the Plan and in compliance with Section 409A of the Internal Revenue Code of 1986, as amended (Section 409A). All of our directors and executive officers named in our Proxy Statement filed on January 23, 2009 (Proxy Statement), with the exception of Messrs. Francis Bong, Alan Krusi, William Ouchi and Nigel Robinson, participate in and have account balances under the Plan. It is currently anticipated that all deferred account balances will be distributed to Plan participants no later than December 31, 2010.

In connection with the termination of the Plan, we also approved the termination and liquidation of all deferred compensation arrangements that would be aggregated with the Plan for purposes of Section 409A, including the deferrals of compensation under the unvested restricted stock unit awards previously granted to Richard G. Newman on December 1, 2008, as described in our Proxy Statement.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

Incorporated by reference from our definitive proxy statement to be filed for the 2010 Annual Meeting of Stockholders, to be filed within 120 days of our fiscal 2009 year end.

ITEM 11. EXECUTIVE COMPENSATION

Incorporated by reference from our definitive proxy statement to be filed for the 2010 Annual Meeting of Stockholders, to be filed within 120 days of our fiscal 2009 year end.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

Incorporated by reference from our definitive proxy statement to be filed for the 2010 Annual Meeting of Stockholders, to be filed within 120 days of our fiscal 2009 year end.

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

Incorporated by reference from our definitive proxy statement to be filed for the 2010Annual Meeting of Stockholders, to be filed within 120 days of our fiscal 2009 year end.

ITEM 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

Incorporated by reference from our definitive proxy statement to be filed for the 2010 Annual Meeting of Stockholders, to be filed within 120 days of our fiscal 2009 year end.

PART IV

ITEM 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

(a)
Documents filed as part of this report:

(1)
The company's Consolidated Financial Statements at September 30, 2009 and 2008 and for each of the three years in the period ended September 30, 2009 and the notes thereto, together with the report of the independent auditors on those Consolidated Financial Statements are hereby filed as part of this report.

(2)
Financial statement schedules—schedules are omitted because they are not applicable, not required or because the required information is included in the Consolidated Financial Statements or Notes thereto.

(3)
See Exhibits and Index to Exhibits, below.

(b)
Exhibits.

Exhibit Numbers	Description
2.1*	Purchase Agreement, dated as of February 11, 2008, by and among AECOM Technology Corporation, Tyco International Finance S.A. and certain other seller parties thereto
2.2**	Amendment No. 1 to Purchase Agreement, dated as of July 25, 2008, by and among AECOM Technology Corporation, Tyco International Finance S.A. and certain other seller parties thereto

Exhibit Numbers	Description
2.3***	Amendment No. 2 to Purchase Agreement, dated as of July 25, 2008, by and among AECOM Technology Corporation, Tyco International Finance S.A. and certain other seller parties thereto
3.1****	Restated Certificate of Incorporation
3.2****	Certificate of Designations for Class C Preferred Stock
3.3****	Certificate of Designations for Class E Preferred Stock
3.4****	Certificate of Designations for Class F Convertible Preferred Stock, Series 1
3.5****	Certificate of Designations for Class G Convertible Preferred Stock, Series 1
3.6********	Amended and Restated Bylaws
4.1****	Form of Common Stock Certificate
4.2****	Investor Rights Agreement, dated as of February 9, 2006, among Registrant and the investors party thereto
4.3****	Joinder Agreement, dated as of February 9, 2006, between the Registrant and the investor party thereto
4.4****	Joinder Agreement, dated as of February 14, 2006, between the Registrant and the investor party thereto
4.5****	Amendment No. 1 to Investor Rights Agreement, dated as of February 14, 2006, among the Registrant and the investors party thereto
10.1****	Amended and Restated Credit Agreement, dated as of September 22, 2006, among Registrant, the Subsidiary Borrowers, Union Bank of California, N.A., as Administrative Agent, a Letter of Credit Issuing Lender and the Swing Line Lender, Harris N.A., as a Letter of Credit Issuing Lender, Bank of Montreal acting under its trade name BMO Capital Markets, as Syndication Agent and other financial institutions that are parties thereto
10.2****	Term Credit Agreement dated as of September 22, 2006, among Maunsell HK Holdings, Ltd., Faber Maunsell Limited, W.E. Bassett & Partners Pty. Ltd., Maunsell Group Limited, and Maunsell Australia Pty Ltd., as the Borrowers, Union Bank of California, N.A., as the Administrative Agent, BMO Capital Markets, as Co-Lead Arrangers and Co-Book Managers, Bank of Montreal, acting under its trade name BMO Capital Markets, as the Syndication Agent and other financial institutions that are parties thereto
10.3****	Guarantee dated as of January 9, 2007 among Registrant, HSBC Bank USA National Association and the other bank parties thereto
10.4****	Office Lease, dated June 13, 2001, between Registrant and Shuwa Investments Corporation
10.5****	First Amendment to Office Lease, dated September 2001, between Registrant and Shuwa Investments Corporation

10.6****	Second Amendment to Office Lease, dated October 22, 2001, between Registrant and Shuwa Investments Corporation
10.7****	Non-Qualified Stock Purchase Plan, restated as of October 1, 2006

Exhibit Numbers	Description
10.8****	Amendment 2006-1, dated as of October 1, 2006, to Non-Qualified Stock Purchase Plan
10.9****	1992 Supplemental Executive Retirement Plan, restated as of November 20, 1997
10.10****	First Amendment, effective July 1, 1998, to the 1992 Supplemental Executive Retirement Plan
10.11****	Second Amendment to the 1992 Supplemental Executive Retirement Plan
10.12****	Third Amendment to the 1992 Supplemental Executive Retirement Plan
10.13****	1996 Supplemental Executive Retirement Plan, restated as of November 20, 1997
10.14****	First Amendment, effective July 1, 1998, to the 1996 Supplemental Executive Retirement Plan
10.15****	Second Amendment to the 1996 Supplemental Executive Retirement Plan
10.16****	Agreement of Lease dated as of March 17, 1999, between 650 Third Avenue LLC and Frederick R. Harris, Inc.
10.17****	1998 Management Supplemental Executive Retirement Plan
10.18****	First Amendment, effective January 1, 2002, to the 1998 Management Supplemental Executive Retirement Plan
10.19****	Second Amendment to the 1998 Management Supplemental Executive Retirement Plan
10.20****	Third Amendment to the 1998 Management Supplemental Executive Retirement Plan
10.21****	1996 Excess Benefit Plan
10.22****	First Amendment, effective July 1, 1998, to the 1996 Excess Benefit Plan
10.23****	Second Amendment to the 1996 Excess Benefit Plan
10.24****	Third Amendment to the 1996 Excess Benefit Plan
10.25****	2005 ENSR Stock Purchase Plan
10.26****	2005 UMA Group Ltd. Employee Stock Purchase Plan
10.27****	2006 Stock Incentive Plan

10.28****	Cansult Maunsell Merger Investment Plan
10.29****	AECOM Equity Investment Plan
10.30****	Global Stock Investment Plan—United Kingdom
10.31****	Hong Kong Stock Investment Plan—Grandfathered Directors
10.32****	AECOM Retirement & Savings Plan
10.33****	Executive Employment Agreement between Registrant and James R. Royer
10.34******	Second Amended and Restated Credit Agreement
10.35*******	First Amendment to Term Credit Agreement
10.36**********	Change in Control Severance Policy for Key Executives

Exhibit Numbers	Description
10.37**********	Standard Terms and Conditions for Non-Qualified Stock Options
10.38**********	Standard Terms and Conditions for Restricted Stock Units
10.39**********	Standard Terms and Conditions for Performance Earnings Program
21.1*********	Subsidiaries of AECOM
23.1	Consent of Independent Registered Public Accounting Firm
31.1	Certification of the Company's Chief Executive Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
31.2	Certification of the Company's Chief Financial Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
32	Certification of the Company's Chief Executive Officer and Chief Financial al Officer pursuant to Section 906 of the Sarbanes-Oxley Act of 2002

* Incorporated by reference to Exhibit 2.1 to the Company's current report on Form 8-K filed with the SEC on February 12, 2008

** Incorporated by reference to Exhibit 2.1 to the Company's current report on Form 8-K filed with the SEC on July 31, 2008

*** Incorporated by reference to Exhibit 2.2 to the Company's current report on Form 8-K filed with the SEC on July 31, 2008

**** Incorporated by reference to exhibit of like number to the Company's registration statement on Form 10 filed with the SEC on January 29, 2007.

***** Incorporated by reference to exhibit of like number to the Company's registration statement on Form 10 filed with the SEC on March 7, 2007.

****** Incorporated by reference to Exhibit 10.1 to the Company's current report on Form 8-K filed with the SEC on September 7, 2007.

******* Incorporated by reference to Exhibit 10.2 to the Company's current report on Form 8-K filed with the SEC on September 7, 2007.

******** Incorporated by reference to Exhibit 3.1 to the Company's current report on Form 8-K filed with the SEC on September 2, 2009.

********* Incorporated by reference to Exhibit 21.1 to the Company's quarterly report on Form 10-Q filed with the SEC on May 8, 2009.

********** Incorporated by reference to Exhibit 10.1 to the Company's current report on Form 8-K filed with the SEC on May 11, 2009.

****

Incorporated by reference to Exhibit 10.1 to the Company's current report on Form 8-K filed with the SEC on December 5, 2008.

****

Incorporated by reference to Exhibit 10.2 to the Company's current report on Form 8-K filed with the SEC on December 5, 2008.

****

Incorporated by reference to Exhibit 10.3 to the Company's current report on Form 8-K filed with the SEC on December 5, 2008.

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SIGNATURE

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

AECOM TECHNOLOGY CORPORATION

By: /s/ JOHN M. DIONISIO

John M. Dionisio
President and Chief Executive Officer
(Principal Executive Officer)

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the Registrant in the capacities and on the date indicated.

Signature	Title	Date
/s/ JOHN M. DIONISIO John M. Dionisio	President and Chief Executive Officer (Principal Executive Officer)	November 27, 2009
/s/ MICHAEL S. BURKE Michael S. Burke	Executive Vice President and Chief Financial Officer (Principal Financial Officer)	November 27, 2009
/s/ RONALD E. OSBORNE Ronald E. Osborne	Vice President, Corporate Controller (Principal Accounting Officer)	November 27, 2009
/s/ RICHARD G. NEWMAN Richard G. Newman	Director, Chairman	November 27, 2009
/s/ FRANCIS S.Y. BONG Francis S.Y. Bong	Director, Chairman Asia	November 27, 2009
/s/ H. FREDERICK CHRISTIE H. Frederick Christie	Director	November 27, 2009
/s/ JAMES H. FORDYCE James H. Fordyce	Director	November 27, 2009
/s/ S. MALCOLM GILLIS S. Malcolm Gillis	Director	November 27, 2009

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Signature	Title	Date
/s/ LINDA GRIEGO Linda Griego	Director	November 27, 2009
/s/ ROBERT J. LOWE Robert J. Lowe	Director	November 27, 2009
/s/ NORMAN Y. MINETA Norman Y. Mineta	Director	November 27, 2009
/s/ WILLIAM G. OUCHI William G. Ouchi	Director	November 27, 2009
/s/ WILLIAM P. RUTLEDGE William P. Rutledge	Director	November 27, 2009

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EXHIBIT 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We consent to the incorporation by reference in the Registration Statement (Form S-3 No. 333-157646) of AECOM Technology Corporation and in the related Prospectus of our reports dated November 27, 2009, with respect to the consolidated financial statements of AECOM Technology Corporation, and the effectiveness of internal control over financial reporting of AECOM Technology Corporation, incorporated by reference in this Annual Report (Form 10-K) for the year ended September 30, 2009.

/s/ Ernst & Young LLP

Los Angeles, California
November 27, 2009

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EXHIBIT 23.1

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EXHIBIT 31.1

Chief Executive Officer Certification Pursuant to
Rule 13a-14(a)/15d-14(a)

I, John M. Dionisio, President and Chief Executive Officer of AECOM Technology Corporation, certify that:*1.*
I have reviewed this Annual Report on Form 10-K of AECOM Technology Corporation;

2.
Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3.
Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4.
The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a)
Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b)
Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c)
Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

(d)
Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5.
The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

(a)
All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b)
Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Dated: November 27, 2009

/s/ JOHN M. DIONISIO

John M. Dionisio
President and Chief Executive Officer
(Principal Executive Officer)

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EXHIBIT 31.1

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EXHIBIT 31.2

Chief Financial Officer Certification Pursuant to
Rule 13a-14(a)/15d-14(a)

I, Michael S. Burke, Executive Vice President and Chief Financial Officer of AECOM Technology Corporation, certify that:*1*.
I have reviewed this Annual Report on Form 10-K of AECOM Technology Corporation;

2.
Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3.
Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4.
The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a)
Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b)
Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c)
Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

(d)
Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5.
The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

(a)
All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b)
Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Dated: November 27, 2009

/s/ MICHAEL S. BURKE

Michael S. Burke
Executive Vice President and Chief Financial Officer
(Principal Financial Officer)

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EXHIBIT 31.2

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Exhibit 32

Certification of Chief Executive Officer and Chief Financial Officer Pursuant to 18 U.S.C. Section 1350

In connection with the Annual Report of AECOM Technology Corporation (the "Company") on Form 10-K for the period ended September 30, 2009 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), we, John M. Dionisio, Chief Executive Officer of the Company, and Michael S. Burke, Chief Financial Officer of the Company, hereby certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to our knowledge:

1.
The Report fully complies with the requirements of Section 13(a) or Section 15(d) of the Securities Exchange Act of 1934, as amended; and

2.
The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ JOHN M. DIONISIO

John M. Dionisio
President and Chief Executive Officer
November 27, 2009

/s/ MICHAEL S. BURKE

Michael S. Burke
Executive Vice President and Chief Financial Officer
November 27, 2009

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Exhibit 32

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2. Technical Proposal

AECOM understands that the information contained in this proposal is considered public information under the Access to Public Records Act (APRA), IC 5-14-3 *et seq,* and that a purpose must be included if statutory exemptions are requested. **We respectfully request that the Indiana Department of Administration consider Section 2.4 (Technical Proposal) of this proposal to be confidential information under the following exemption:**

"Records that are intra-agency or interagency advisory or deliberative material, including material developed by a private contractor under a contract with a public agency, that are expressions of opinion or are of a speculative nature, and that are communicated for the purpose of decision making"

http://sunshinereview.org/index.php/Indiana_Access_to_Public_Records_Act#Must_a_purpose_be_stated.3F

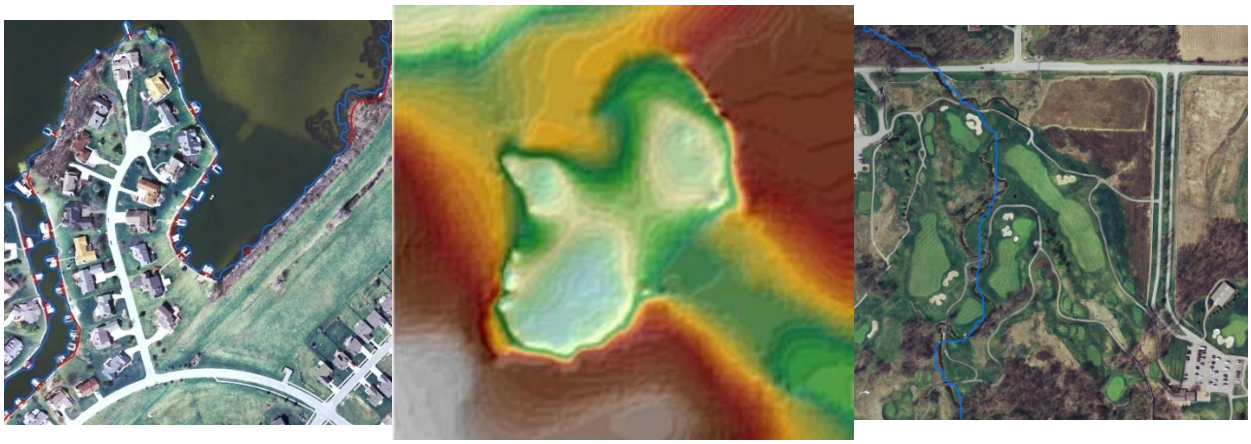
3. Supporting Documentation

Per the requirement in the RFP (p.19 and p.20), this section includes the following documents:

- Indiana Local-Resolution NHD Pilot
- Issue Paper: 6 Acre Drainage Calculation
- Issue Paper: Water Body Specifications
- FGDC Geospatial Data Standard
- Content Standards for Digital Geospatial Metadata (Federal Geographic Data Committee, 1994)

Indiana Stream Digitization Pilot Study Report

Prepared by AECOM
for the
Indiana Geographic Information Council
(IGIC)
Waters Workgroup



Submitted: June 5, 2009

Indiana Pilot Study

AECOM has conducted a stream mapping pilot study for the State of Indiana for use with the Indiana Local Resolution NHD Initiative. This study solely includes water feature creation; conflation procedures have not been included as part of this study. Detailed procedures regarding NHD creation and associated costs for the Indiana Local Resolution NHD Initiative will be provided as a response to a request for proposal from the State.

This pilot provides the Indiana Geographic Information Council's (IGIC) Waters Workgroup with a good basis for stream location accuracy and upstream drainage area limit assessments. It is AECOM's understanding that the State would like to meet a ± 1 meter horizontal accuracy and a 6-acre upstream drainage area limit. These potential requirements are explored in this report.

Pilot Area Selection

The area selected to conduct the Indiana pilot study was chosen as a direct head-to-head comparison to the pilot that was conducted by another contractor in July 2008. This pilot area serves as a good representation of the water features that would be produced as a result of the Indiana Local Resolution NHD Initiative.

The pilot area (shown in blue in Figure 1 below) is located in Hamilton County, just north of Indianapolis. This area predominately consists of the Morse Reservoir, where rapid development of golf course communities is occurring. To the north and northwest of the pilot area is agricultural land, which is laid out in the township and range grid system.

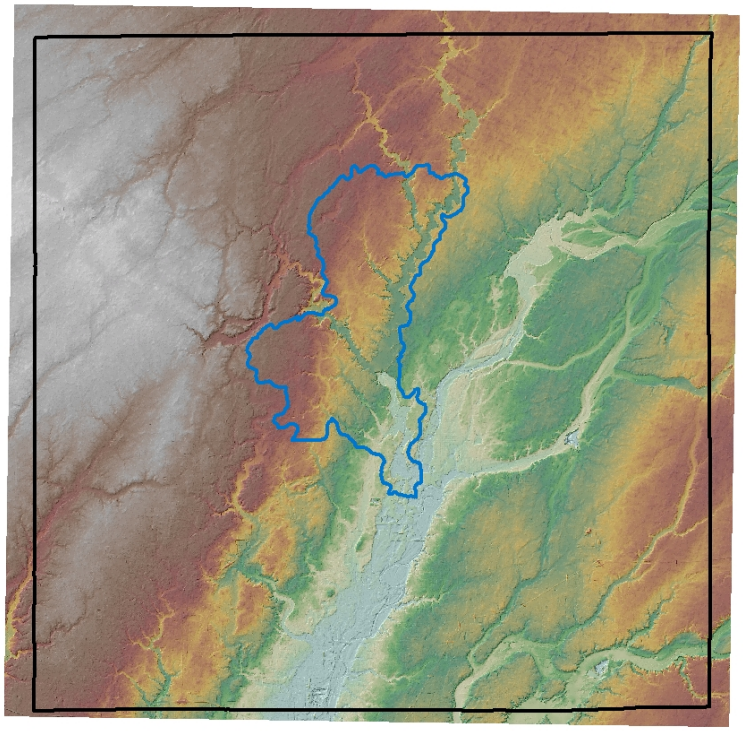


Fig.1 - Pilot Area in Hamilton County, Indiana

Base Data / Procedures Used For Pilot Study

Base Data

- **Terrain –** The terrain data used is an IStar product that was created as part of the 2005 IndianaMap Orthophotography Project. ERDAS IMAGINE Format was used. The terrain data was imported into AECOM's proprietary software called the Watershed Information System (WISE)® to create a six acre stream reference file. Contours and hillshades were generated from the IStar terrain data, but due to quality concerns the datasets were rarely used to digitize streams for the pilot study.

- **Imagery** – 2005 ADS40 imagery was downloaded from the Indiana Spatial Data Portal in Natural Color MrSID format. The imagery was also collected as part of the 2005 IndianaMap Orthophotography Project.

- **6-Acre Drainage Basins and Streamlines** – These were created by AECOM using WISE and the IStar terrain data. The process used to generate the 6-acre drainage basins and streams is further explained in the procedures section that follows.

- **Digital Stream Files** – A county-created shapefile was downloaded from the Indiana Spatial Data Portal. The stream file was created in 2006 and matched the upstream extents of the 1:24,000 scale NHD. It was adjusted to match the imagery flown as part of the 2005 IndianaMap Orthophotography Project. After removing data such as culvert headwalls, pipe ends, drainage ditches, etc., a total of 150 miles of line work was used for the pilot study. Water bodies and banklines for area features were also included the dataset and were used for the pilot study.

Procedures – One AECOM GIS Specialist was tasked with the following procedures for the pilot study: processing terrain data, digitizing water features, and testing two approaches to automating feature extraction.

- ***Terrain Processing*** – The Indiana Local Resolution NHD Initiative may use a 6-acre upstream drainage limit, which is similar to the work performed by AECOM for the State of North Carolina. In North Carolina, a general 6-acre stream file was created inside of AECOM's WISE software program, and was used as a reference for the project. This same stream creation process was used for the Indiana pilot study.

  The 2005 IStar terrain data was converted to an ASCII raster file for portability into WISE. Once imported, it was then hydro-corrected using a patented process called FAUCET. FAUCET is an automated burning technique which is used to change the elevation of the DEM between the identified flow problem and the next cell with the lowest elevation within a limited buffer. Once the terrain data was hydro-corrected, 6-acre drainage basins and streamlines were then created in WISE.

  WISE does have the ability to create very detailed and accurate streams. However, due to the processing time required to create a very detailed terrain model, it is much faster to create a less detailed terrain model and digitize the streams based on a general stream shapefile (in this case, the 6-acre stream file).

- ***Manual Digitization*** – Using the county-created stream shapefile as a base source, additional streams were digitized using the 6-acre streams created in WISE as a guide to where the streams flow. The 2005 ADS40 imagery was used as the main source for locating the streams since it proved to be more accurate than the IStar terrain data. The final mileage

of line work digitized within the pilot area totaled 309 miles (Fig.2). The 6-acre streamlines added to the existing 1:24,000 scale NHD are shown in green.

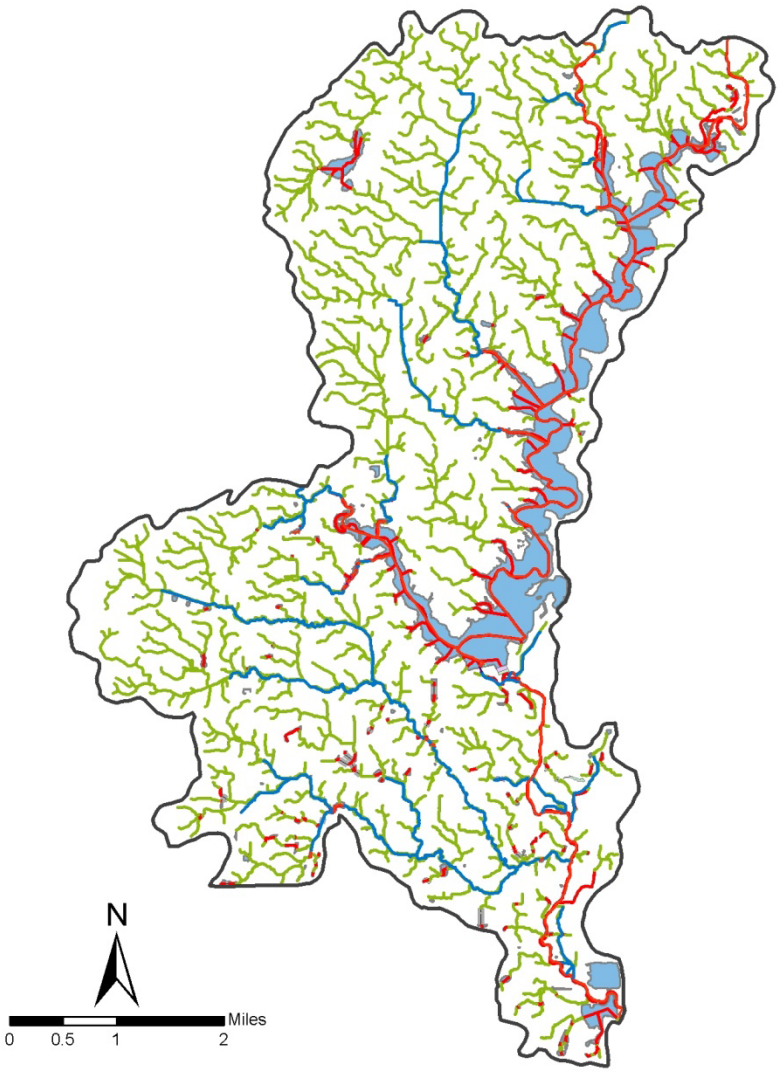


Fig.2 - Additional Streams Digitized in Pilot Area

- ***Automated Approaches*** – AECOM tested two approaches to extracting water features: from imagery using ERDAS software and from terrain using Arc Hydro.
    - ***Feature Extraction from Imagery*** – An automated feature extraction software package provided by ERDAS was tested for extracting streams and waterbody features from the imagery using the 2005 ADS40 imagery as a base. The approach was much more successful for the water body features than for extracting streams. A little more than 77 percent of the total waterbody features digitized were successfully extracted. Many needed additional adjustments to meet horizontal accuracy requirements. Stream extraction from the ADS40 imagery proved to be difficult due to the lack of visibility of streamlines at a 6-acre level, as well as obscurity in vegetated areas.

Figure 3 shows a sample of the area around Morse Reservoir. The blue line work shows what the feature extraction software identified and the red line work is data that was either added or adjusted to better match the imagery. The docks along the lake proved very difficult to remove using an automated process because the color was very similar to the roads and sidewalks.

Fig.3 – Waterbody Extraction from ADS40 Imagery

- ***Feature Extraction from Terrain*** – Using the IStar DEM as a base, Arc Hydro was used to extract streams directly from the terrain. Using the process outlined by Arc Hydro to create streams from a DEM gave poor results. Even in open areas, the streams could be off by as much as several hundred feet. An example of the streams extracted from the IStar terrain data using Arc Hydro is shown in Figure 4 below.

Fig.4 – Stream Extraction from ADS40 Imagery

Pilot Study Data Findings

AECOM has GIS Specialists with experience in editing IStar terrain data. Some of the challenges associated with IStar terrain data include difficulty with penetrating vegetation and returning false elevations depending on the color of the imagery. For example, an agricultural flat area divided by a fence where one side is planted with early season hay and the other is left empty returns significantly different elevations.

Another significant problem with IStar is that every lake or pond appears as a sink hole (Fig. 5 and 6), creating a general unreliability of the product as a whole. For example, is the dark spot in the field (Fig. 7) truly where the stream goes? Or did it return a false elevation due to the darker color? Also, does the stream go along the vegetated area where drainage ditches are typically placed? The underlying bedrock in this area is limestone which often creates natural sink holes. With the inconsistencies in the IStar data, it is difficult to determine whether the sinkhole should actually be there.

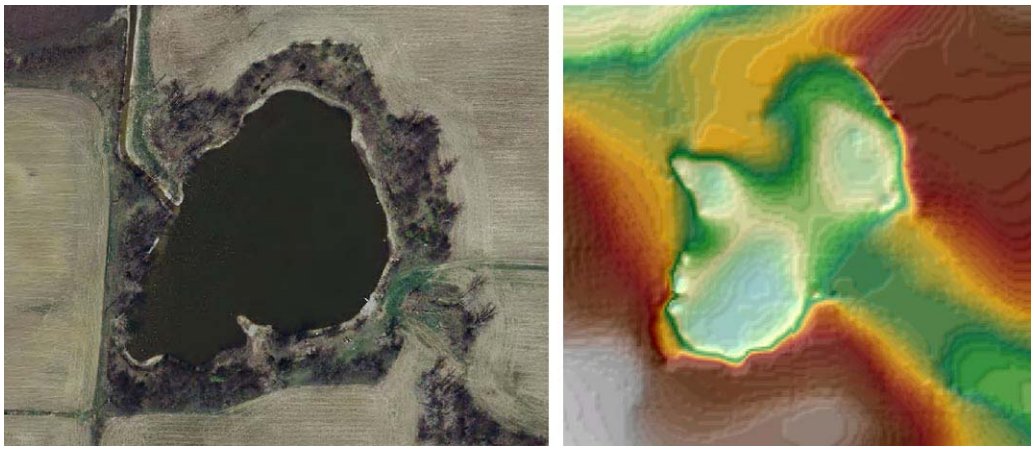


Fig 5 and 6. A lake in the orthophotography (Fig. 5) is represented as a sink hole in the IStar data.

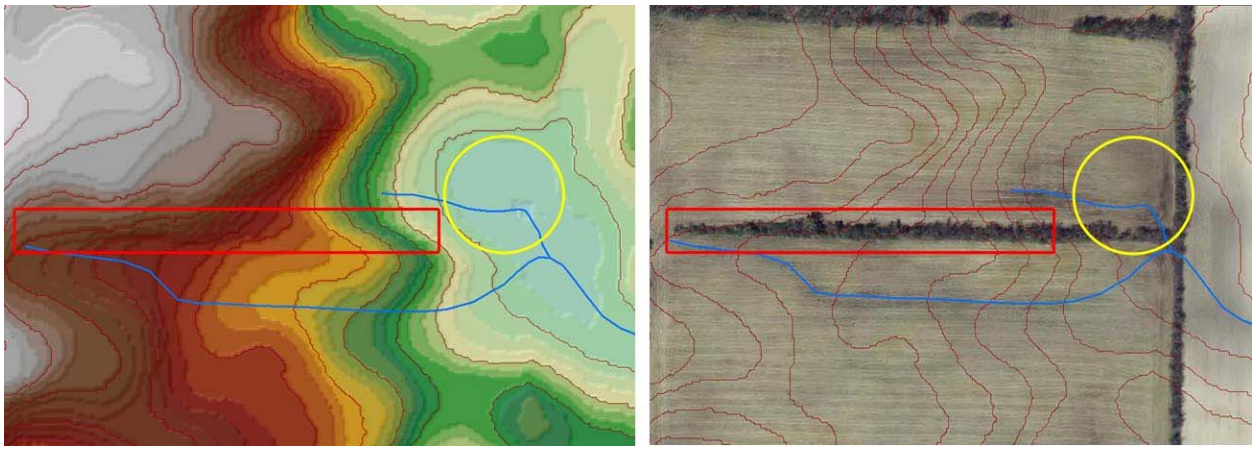


Fig.7 and 8 - Moisture in fields may cause false depressions (Yellow Circle). The field may contain a drainage trench (Red Rectangle) that may not be represented in the terrain due to IStar limitations.

It was determined that the IStar product could not be used as the sole method for the extraction of detailed streamlines due to inconsistencies in the data. Based on AECOM's findings in the pilot area, the accuracy of the IStar terrain data would not allow a 1 meter horizontal accuracy standard to be met.

The pilot study determined that at a 6-acre upstream limit there are 9.93 stream miles per square mile. The state has a total of 36,189 square miles. This would create a total of 359,368 miles of stream.

AECOM Pilot Study vs. Previous Pilot Study Conducted

AECOM analyzed the documentation provided for the pilot study previously conducted for the State of Indiana. A comparison of the line work collected for the previous pilot (Fig. 10) with AECOM's 6-acre streams (Fig. 9) shows discrepancies in the quantity of streams collected. It appears that the previous

study was performed at a 1:2,400 scale or 12-acre drainage limit. This discrepancy may be caused by the software used to create 6-acre drainage basins.

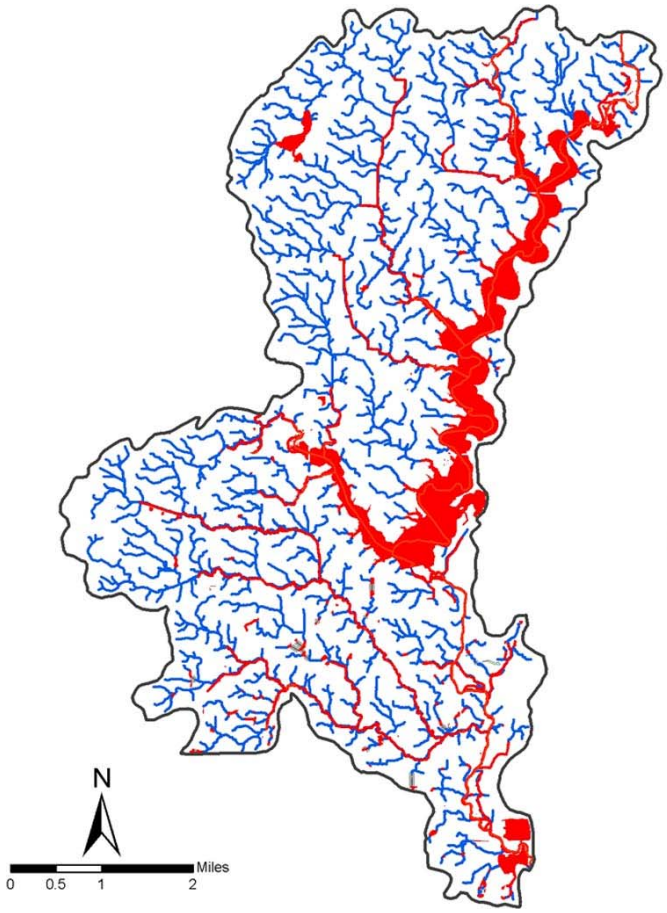


Fig.9 AECOM 6-acre streams

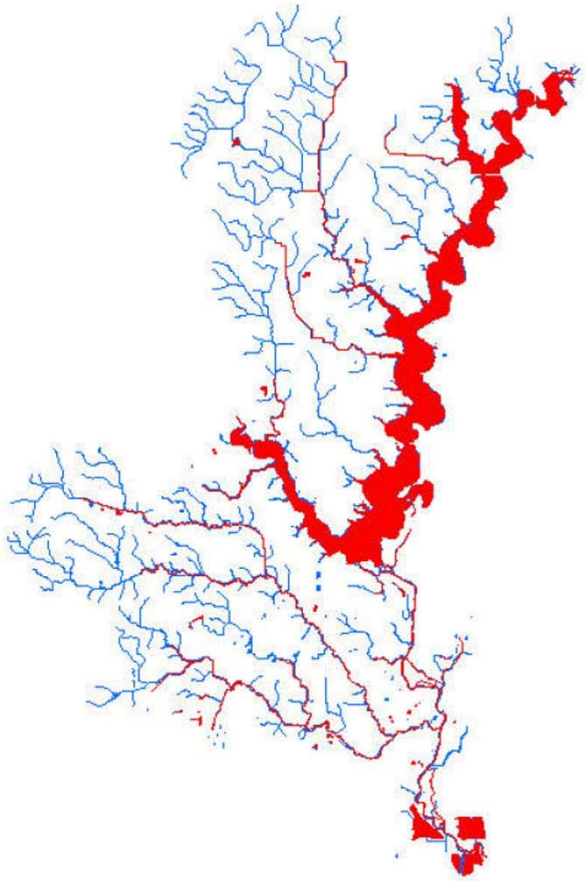


Fig. 10 Previous contractor's 6-acre coverage

AECOM Recommendations

Through experimentation with feature extraction software from the imagery, AECOM found that a large number of waterbodies and wider streams (area features) can be extracted. However, streams that are not visible in the imagery, such as drainage ditches, forested and urban areas, and the upstream reaches (near the 6-acre limit), could not be extracted using the ERDAS software.

Using automated feature extraction on the IStar terrain data proved to be very difficult. The IStar product does not meet the ± 1 meter accuracy level necessary for the Indiana Local Resolution NHD Initiative. The streams that were created using the automated feature extraction were significantly misaligned from the stream's visible location in the imagery.

AECOM recommends using automated stream extraction from imagery for streams that are clearly visible in the ADS40 imagery. In areas where streams are obscured, AECOM recommends

manually digitizing streams using the 6-acre streams as well as the IStar terrain data as reference files to determine stream locations. Even in obscured areas, the imagery may still be utilized to determine where a stream crosses a road; to correctly identify where streams confluence; and especially to route streams through urban areas.

Additional recommendations:

- State, county and local websites can be searched for existing stream files that meet project requirements and accuracy standards. For example, the local stream file for Hamilton County provided nearly half of the new line work in the AECOM pilot study.

- For counties in Indiana that possess LIDAR data, AECOM can incorporate this data into the Indiana Local Resolution NHD Initiative. Detailed terrain models can be created using WISE, and from these models, more accurate 6-acre basins and streamlines can be generated. These LIDAR-derived streamlines can then be used in conjunction with imagery feature extraction software to fully automate stream creation. Manual adjustments will still be required to blend the two automated stream files and to check them against the ADS40 imagery.

- The ability to include stormwater data is now available in the NHD data model. If any cities in Indiana have digital stormwater inventory data available, it can be incorporated into the Indiana Local Resolution NHD Initiative. This will provide a more accurate depiction of how water flows through urban areas.

- Increasing the drainage area requirement from the current 6-acre limit is an option for the Indiana Local Resolution NHD Initiative. A larger drainage area requirement will reduce the quantity of streams to be collected, which in turn reduces total project cost and hours. AECOM can assist the State of Indiana with a needs assessment to determine an appropriate drainage area limit that will best meet user requirements as well as budget constraints.

- Compare AECOM's pilot dataset with what was provided by the previous contractor and look at differences in various land covers (forest, urban, open, etc.), as well as at road crossings and stream confluences.

- AECOM has found that the best way to test accuracy is to collect field survey points at the center of several streams and at various drainage areas. These survey points can then be compared to the digital stream locations provided by both contractors to determine an appropriate accuracy requirement for the Indiana Local Resolution NHD Initiative. This method was previously used by AECOM in North Carolina for the Stream Mapping Project.

ISSUE 3: The Western North Carolina 6-Acre Drainage Area Calculation

Background

The NC Streambed Project has established an upstream limit of six acres as the point in which the Streambed Mapping Dataset linework should terminate. The establishment of the six acre criteria is detailed within Issue Paper 001 – Drainage Area Requirements. The purpose of this issue paper is to describe the methods that are used to calculate and create six acre drainage basins using an automated procedure. These automated basins have also been compared with manually delineated drainage basins for reference in this paper.

LIDAR and 50-foot DEMs have been provided by the NC Floodplain Mapping Program (NCFMP) for use with the Streambed Mapping Project. These DEMs can be downloaded from www.ncfloodmaps.com under the heading Download Maps & Data. This data is the base data used to assist in the creation of 6-acre drainage area delineations and the visual determination of the upstream limits. The 50-foot DEMS provided by the NCFMP have been hydro-corrected using the process outlined in Method 1. The hydro-correction process is lengthy and time consuming, yet is a vital process. Due to Streambed Mapping Project time and budget constraints, the DEMs provided are used as delivered, and have not been adjusted in any way. Creating and testing other sized hydro-correct DEMs would not fit project constraints.

It is important to note that the 50-foot hydro-correct DEMs supplied by the NCFMP are solely used for the creation of drainage basins and for the determination of upstream limits. These DEMs are not used for the actual generation of the streamlines and water bodies for the project. Non hydro-correct DEMs that have been re-sampled from the TIN are created for the digitizing process. Hillshades are created from the 4 foot DEMs for use with the LIDAR as a base source for streamline and waterbody generation.

Issue

The existing hydro-correct 50-foot NCFMP DEMS are being used for the Streambed Mapping Project. These DEMS are not adjusted in any way. The NCFMP DEMs are accurate for any areas up to a 1 square mile drainage area, which is the specification for the NC Floodplain Mapping Project. However, effort was not made to accurately hydro-correct the DEMs for drainage areas above the 1 square mile limits of the NC Floodplain Mapping Project.

If the 50-foot hydro-correct DEMs were the sole source used to create streamlines and waterbodies above the 1 square mile drainage area limit, then horizontally inaccurate streamlines would be generated. However, these DEMS are only used to create 6-acre drainage basins and to visually determine the upstream limits of the streamlines and waterbodies for the project. The issue revolves around the method used to create the 6-acre drainage basins used to visually determine the upstream limits—this is the physical distance between the 1 square mile drainage area limit and the 6-acre drainage area limit. Two methods of basin delineation are explored in this paper—an automated approach and a manual approach.

Methods

Method 1 – An Automated Approach

The 6-acre upstream drainage basin limits are determined for the operators as a visual reference when the streamlines and water bodies are delineated. The source data that is utilized to calculate this information is the 50-foot hydrologically-corrected DEMs from the NC Floodplain Mapping Program. The DEMs are created from a re-sampled TIN surface. The TINS are created from the bare earth LIDAR points and breaklines. Breaklines are lines on the earth's surface that are used to indicate abrupt changes in elevation. Hydrologic breaklines represent the centerline of a stream, and account for distortions in the terrain. Hydrologic breaklines are created using an 8 ft. grid that is created from Bare Earth LIDAR data as the terrain base. They are drawn using a reference scoping streams file, and Color Infrared 1m DOQQ imagery. In addition to breaklines along the scoping streams, many more breaklines are produced typically along clearly defined channels. When the breaklines are built into the TIN, the breaklines "break" those features forcing the stream to always flow down hill.

The DEMS are then hydrologically-corrected using a patented automated process. Additional manual processes are also used to hydro-correct the DEM. The 50 foot DEMs supplied by the NCFMP are generated from TINs, in which all bridges, buildings, and concrete dams have been removed which impede the natural flow of water. The breaklines are "burned" into the DEM. This process cuts a drain through road fill, allowing water to flow downhill. Burning these streams into the source terrain data also eliminates impediments, such as culverts. Using the FAUCET program inside of WISE™ many flow problems are eliminated using an automated burning technique that changes the elevation of the DEM between the identified flow problem and the next cell with the lowest elevation within a limited buffer.

For areas in which breaklines do not exist, and in areas where FAUCET could not fix the flow problem, manually created cutlines or ditches are drawn from a sump to the next lowest elevation, typically on the other side of a structure. These cutlines are burned into the underlying terrain; interpolating each DEM cell along that cutline from the elevation at the flow problem to the next lowest elevation. This averaging creates a constant downhill slope thus allowing water to flow through the impediment.

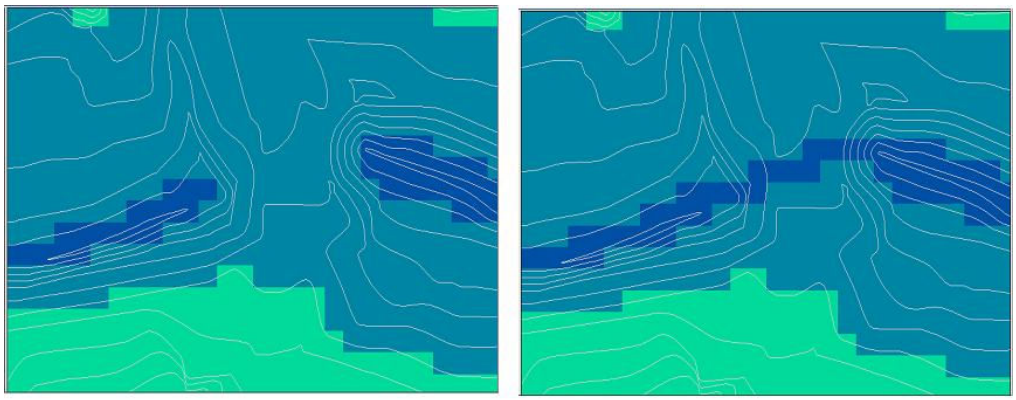


Figure 1. Example of FAUCET. FAUCET automatically found the best place to breach this culvert without causing any additional fill.

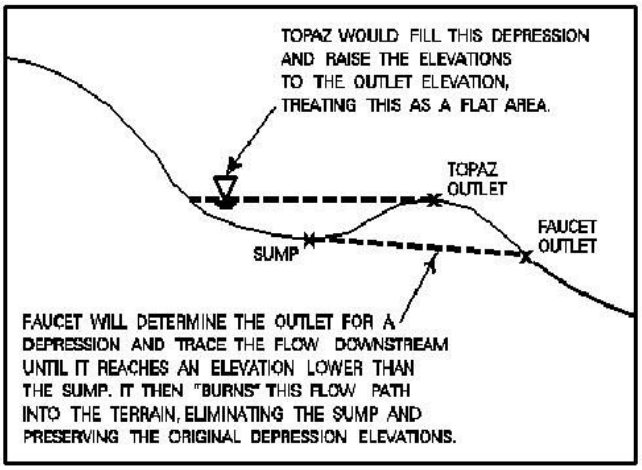
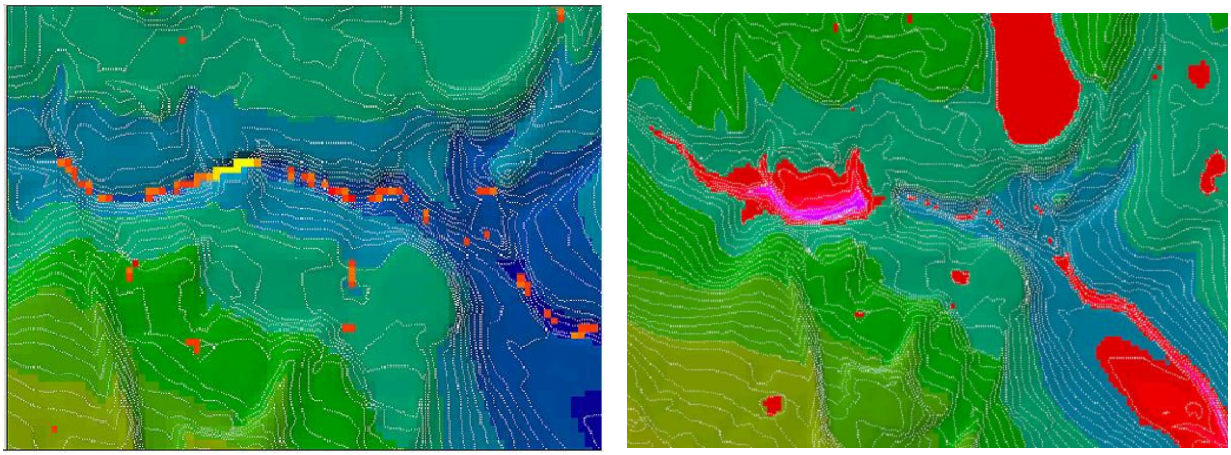


Figure 2. Other hydro-correction software packages such as TOPAZ and ArcHydro use a fill method which raises the depression elevation to the outlet elevation behind structures. This creates a lake effect behind structures that create additional flow problems in the form of flat areas.



FAUCET Modifications *TOPAZ Modifications*

Figure 3. The number of cells modified during the hydro-correction process varies greatly depending on the methodology used. The modified elevations appear in red, purples and bright yellows. FAUCET modifies significantly less DEM cells, which preserves the integrity of the original terrain data.

The D8 method is used to determine flow directions (flow vectors), which indicate the way water will leave a cell. There are eight possible neighboring flow directions, hence the name. The neighbor with the steepest slope is where the water will flow. In a truly hydrologically-correct terrain model a flow direction can be calculated for every cell based on this method alone.

Figure 4 below display example D8 flow calculations and example D8 flow directions. In these examples, values indicate elevation in feet, and arrows indicates direction of flow

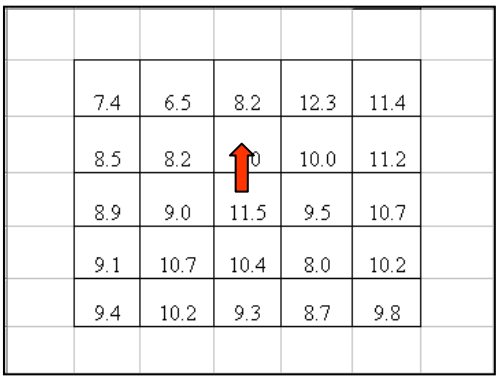
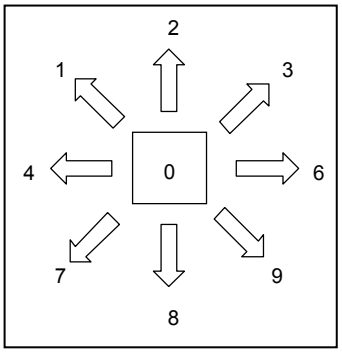


Figure 4. Example D8 Flow Calculation



Example D8 Flow Directions

Figure 5 is an example of the NC Floodplain Mapping Project 50 foot DEM cells which display D8 flow vectors. Three drainage basins have been added for clarity. The basins were created from the NCFMP data, which utilized 50-foot DEM cells.

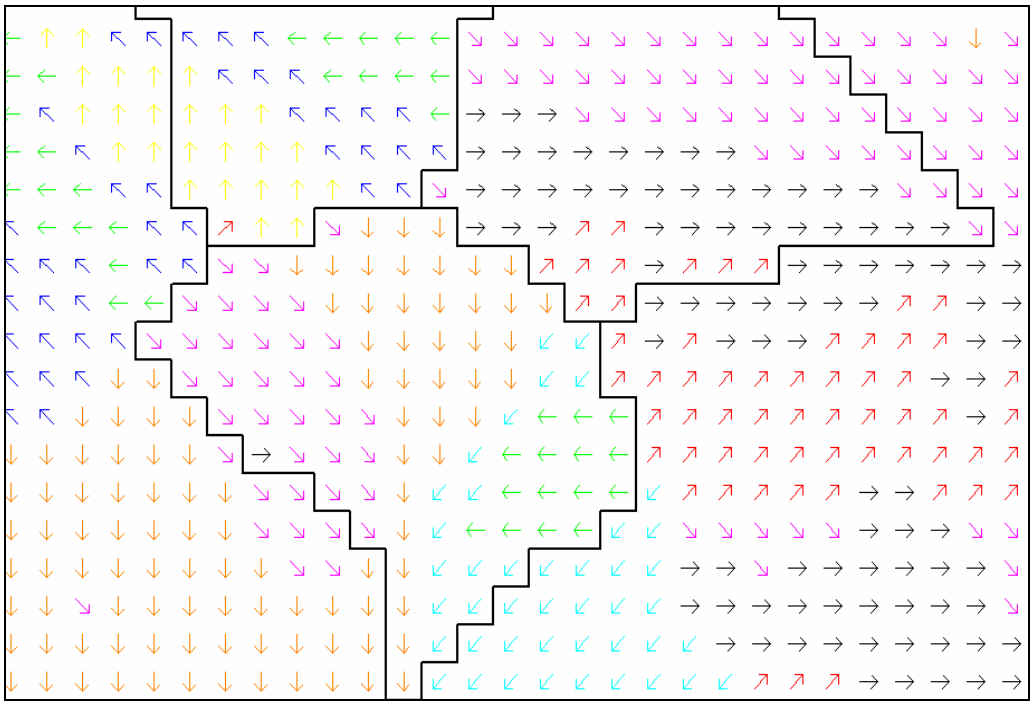


Figure 5. Example of the NCFMP 50 foot DEM cells which display D8 flow vectors.

Based on predetermined flow directions, flow accumulation calculation is performed. Streamlines, basin breakpoints (outfalls), and drainage basin boundaries can then be automatically generated up to a user-defined drainage basin area (such as all streams with drainage areas greater than 6 acres). The program first generates all 6-acre basin breakpoints at the outfall of each basin. The streams are then generated according to these breakpoint locations. The program then draws in the basin polygons, "filling in the gaps" creating the larger and smaller basins to create a complete polygon coverage. The operator generated streamlines and waterbodies will be drawn 200 feet beyond the basin outfall, in order to ensure penetration of the 6-acre basin.

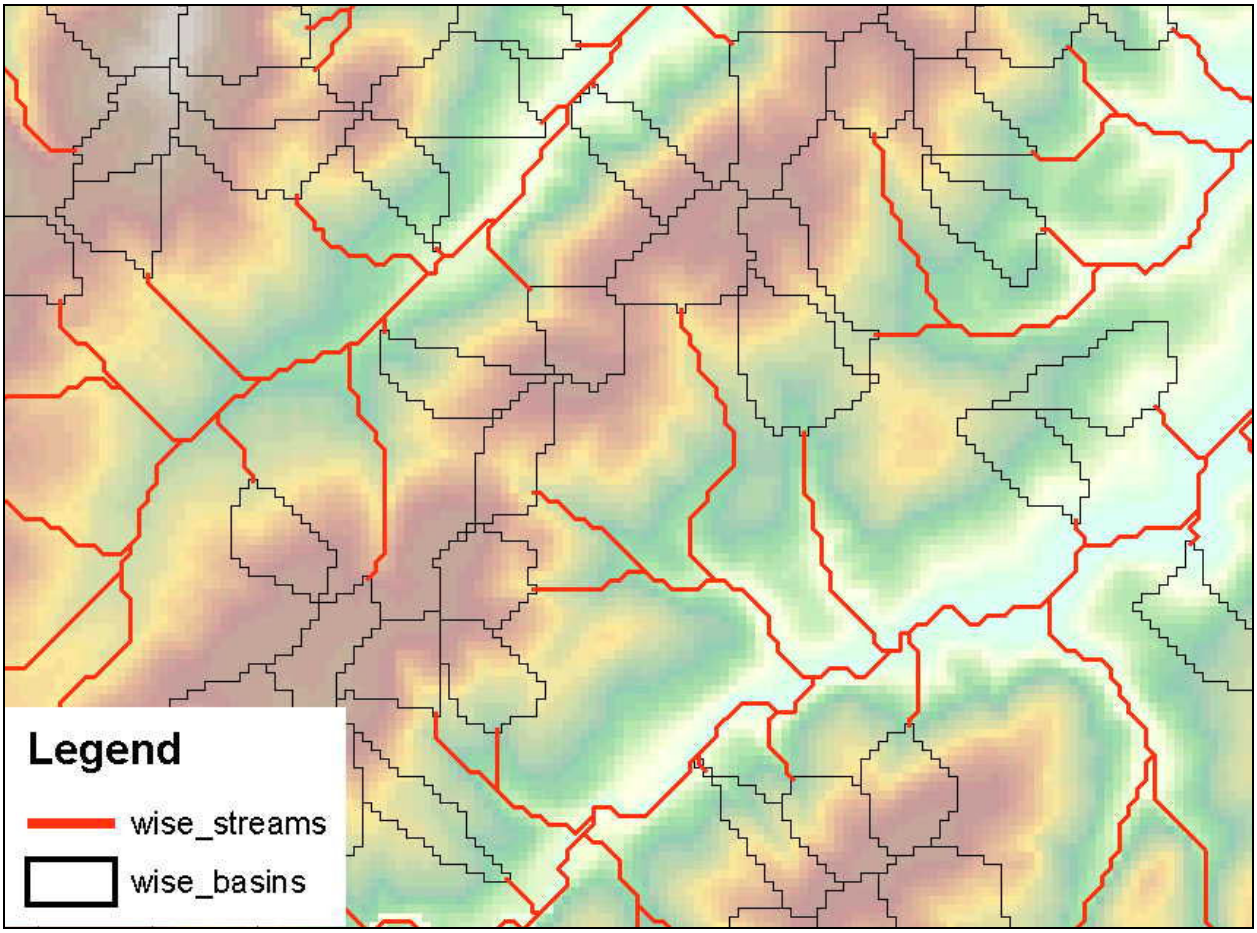


Figure 6. A sample of the basins and streams created by the proposed automated method. The red streams generated actually penetrate each basin to ensure that the proper coverage is attained. Some of the basins shown are larger or smaller than 6 acres, yet create a full basin coverage.

Method 2 -- A Manual Approach

The manual approach involves using the non hydro-correct 4 foot DEMs re-sampled from the TIN. In addition, 5-foot contours are generated from the 50-foot DEM and are utilized for the manual delineation of the basins. The DEMs are pulled into an ArcMap session, and polygons are drawn along and between ridgelines. The polygons are measured and redrawn until they are approximately 6 acres in size. This manual approach gives a comparable method to the automated approach for the generation of 6-acre drainage basins. While this method does introduce the potential for operator inconsistency and error, a skilled hand could create more accurate basins.

Figure 7 demonstrates the differences between an automated and a manual approach to basin delineation. The automated process uses flow vectors to determine the middle of a ridge, while the manual approach uses a visual interpretation of these ridgelines. The blue lines represent the manually delineated basins, while the green lines denote the basins delineated by an automated process. The drainage area in acres for the manual and the automated basins has been added to the graphic for reference.

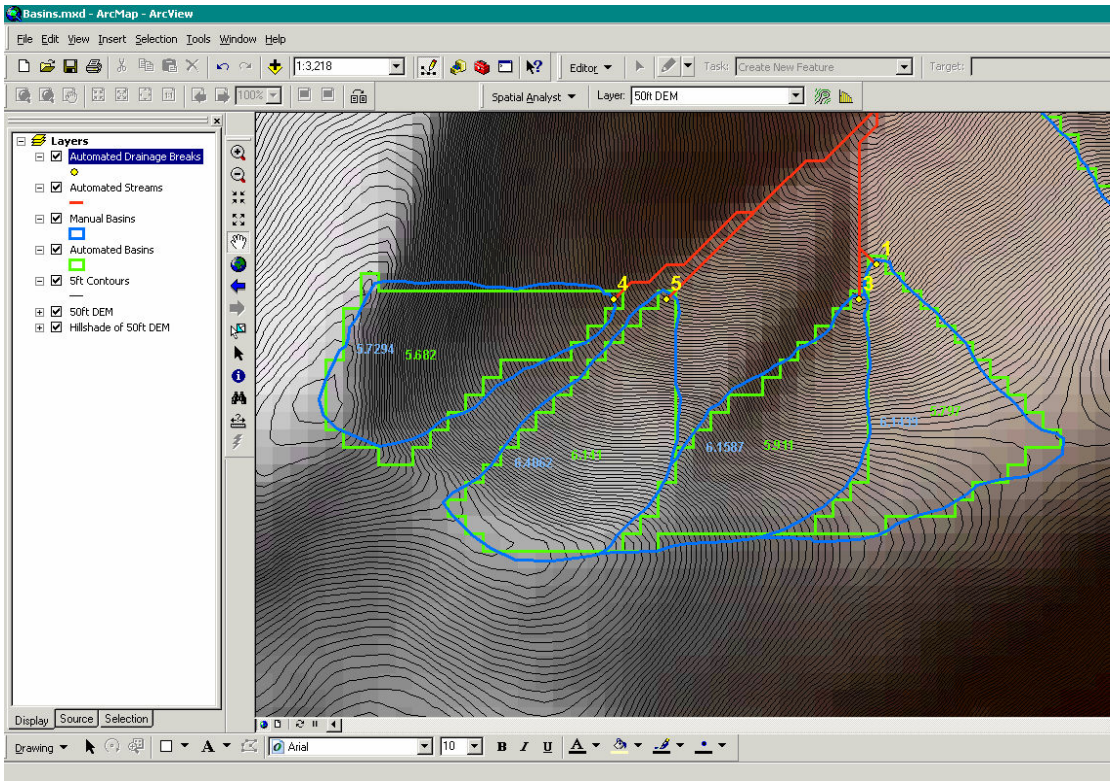


Figure 7. Differences between an automated and a manual approach to basin delineation.

Figure 8 displays an overview of the test area. A total of thirty-five areas were chosen on which to complete the manual and automated delineation of basins. The outfall points in Figure 7 are labeled in yellow, for reference with the point numbers shown in Table 1.

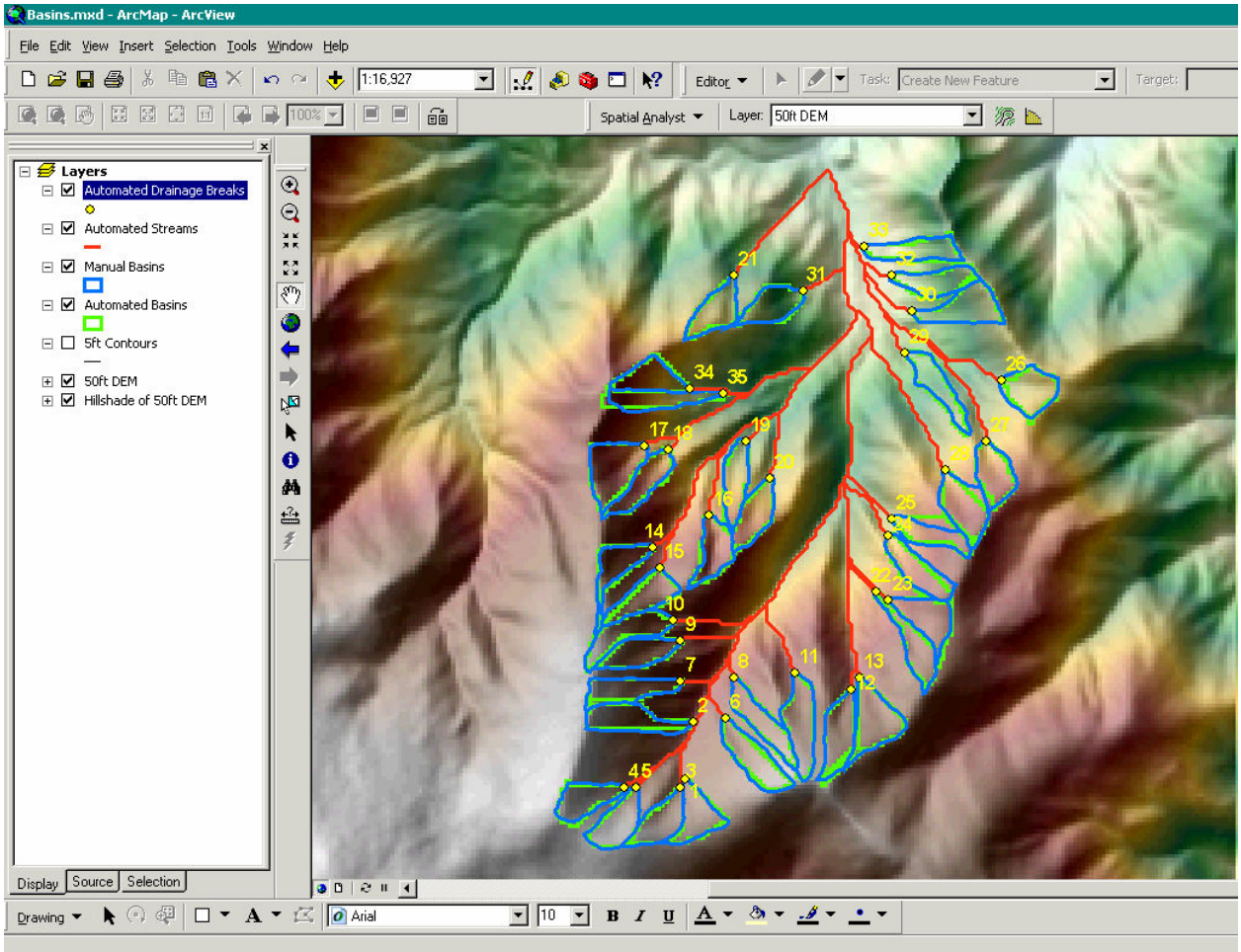


Figure 8. Overview of the test area

Table 1 below displays the 35 areas that were chosen for basin delineation. The difference column compares the drainage areas for both the automated and manual processes in acres. The average drainage area for both types of basin delineation has also been included.

Point Number	NC DEM Drainage Area (Acres)	Manual Drainage Area (Acres)	Difference (Acres)	Difference (%)
1	5.80	6.14	0.34	6%
2	6.43	7.30	0.87	14%
3	5.91	6.16	0.25	4%
4	5.68	5.73	0.05	1%
5	6.14	6.41	0.27	4%

Point Number	NC DEM Drainage Area (Acres)	Manual Drainage Area (Acres)	Difference (Acres)	Difference (%)
6	6.37	7.86	1.49	23%
7	5.51	6.53	1.02	19%
8	6.26	6.55	0.29	5%
9	5.74	5.95	0.21	4%
10	6.54	7.25	0.71	11%
11	7.75	8.20	0.45	6%
12	6.14	7.12	0.98	16%
13	8.15	8.43	0.28	3%
14	5.74	5.44	0.30	5%
15	5.51	6.46	0.95	17%
16	5.91	5.70	0.21	4%
17	8.83	9.27	0.44	5%
18	6.31	5.88	0.43	7%
19	5.62	5.61	0.01	0%
20	5.62	6.13	0.51	9%
21	5.57	5.86	0.29	5%
22	5.51	6.18	0.67	12%
23	7.23	6.38	0.85	12%
24	6.02	6.61	0.59	10%
25	5.57	4.99	0.58	10%
26	6.03	6.97	0.94	16%
27	5.68	6.43	0.75	13%
28	6.20	7.77	1.57	25%
29	5.62	5.79	0.17	3%
30	7.46	7.52	0.06	1%
31	5.68	5.61	0.07	1%
32	5.51	5.80	0.29	5%
33	5.51	5.87	0.36	7%
34	5.85	5.47	0.38	6%
35	6.03	5.98	0.05	1%
Average	**6.15**	**6.50**	**0.51**	**8%**

Table 1: Evaluation of Automated vs. Manual Drainage Basin Delineation Methods for the NC Streambed Mapping Project.

Recommendations

The recommended method for the creation of 6-acre basins is to use the method 1, the automated method. The automated method can be performed in a quarter of the time that the basins can be delineated using a manual process. Streamlines and waterbodies will be drawn 200 feet past the visual 6-acre basin outfalls produced by the automated process for the Streambed Mapping Project. This additional 200 feet of stream will account for variations between differing methods that might be used to generate the drainage basins. This additional 200 feet of stream will also ensure penetration into the 6-acre drainage basin. Time and budget constraints are important project factors, and must be considered when determining the best methodology for drainage basin creation. An automated process would be the most time and cost effective option for the creation of drainage basins for the project.

Discussion Summary

Date Discussed: 3/16/2006
Discussion Participants: Periann Russell, Silvia Terziotti, Melani Harrell, Tom Calhoun, Terri McLean

Summary of Discussion: During the call, concern was expressed over the algorithms (flow accumulation calculations) used to create the basins and in turn create the 6-acre streams. The 6-acre streams provide the guidelines for where the streams should be drawn and for the upstream limits of the streamlines.

The concern involves "gaps" between the basins created by the automated method, and whether or not streams would be captured where these gaps appear. The attached screen capture (Basins1) shows two areas where in a separate test performed by a subcommittee member--basins were drawn using a flow accumulation calculation. However, the flow accumulation grid skips the tolerance used to generate the watershed, so stream end points may be missed to create a watershed. The concern was whether or not the proposed automated method for the Streambed Mapping Project would produce streams in this area. A sample dataset was provided for analysis using the proposed automated method in the Issue Paper.

Final Guidelines

The sample datasets were run through the automated method. The automated method did indeed create basins and streams for the two areas in question. The method generates 6-acre basins first, and then generates the larger or smaller basins to "fill in the gaps". Both of the areas in question had drainage areas higher than 6-acres, but they were still generated by the method. Consensus was obtained to use the automated outlined in method 1 of this issue paper.

ISSUE 2: WATER BODY SPECIFICATIONS

Background

In Delivery Order 30: "Streambed Mapping for Western North Carolina Counties Included in Federal Disaster Declarations for Hurricanes Frances and Ivan", one of the requirements listed is the collection of lakes, ponds and other water bodies within the 19 counties. Since the creation of the "Implementation Plan to Improve the Mapping and Digital Representation of Surface Waters in North Carolina" in the fall of 2004, the Advisory Committee has determined that the 1:24,000 scale NHD, including the water body feature class, shall be conflated to the Streambed Mapping Dataset. In addition, it was agreed that water bodies not found in the existing NHD shall be drawn and attributed accordingly. Specifications must be established for the collection of water bodies and double-line streams.

In the Implementation Plan, it states that the North Carolina Division of Water Quality's (NCDWQ) definitions shall be used for the Streambed Mapping Project. NCDWQ defines a perennial waterbody as "a natural or man-made basin that stores surface water permanently at depths sufficient to preclude growth of rooted plants, including lakes, ponds, sounds, non-stream estuaries and ocean. For the purpose of the State's riparian buffer protection program, the waterbody must be part of a natural drainageway (i.e., connected by surface flow to a stream)." In the NHD dataset, there are several different subtypes within the waterbody feature class. The most predominant subtype is lake/pond, which is defined as "a standing body of water with a predominantly natural shoreline".

It was previously stated in the Implementation Plan that "the final statewide digital surface waters file may actually contain two shapefiles for water bodies: one for lines and one for polygons. The NHD currently displays water bodies in polygon format, yet some agencies have need for the features to be displayed in line format." Although no final decision was made about the display of water bodies, it was determined that artificial paths would be added to the center of double-line streams and water bodies. It was also established in the Implementation Plan that 40 feet will be the stream width criteria for denoting double-line streams, with a map scale of 1:500 being a determining factor. The establishment of the 40 foot stream width is based on the fact that the breaklines created for the North Carolina Floodplain Mapping Program utilize this standard. These breaklines are a key source of data that will be used to generate the final Streambed Mapping Dataset.

Methods

Method 1 – ½ Acre for Minimum Water Body Size

The basis of method 1 is that the minimum size for water body collection shall be ½ acre. With an area of ½ acre, the water body should be visible on the orthophotography. If a water body is not visible on the orthophotography provided, then it will not be collected. Only new water bodies that lie within the stream network will be drawn. Any new water bodies that are not connected to a streamline will not be included in the Streambed Mapping Dataset.

- *All water bodies that are included in the existing 1:24,000 scale NHD dataset shall be included in the Streambed Mapping Dataset.*

- *Only NHD water bodies that lie within the stream network will be modified. Any existing NHD water body that is not a part of the stream network will be conflated to the Streambed Mapping Dataset but will not be modified from its original geometry.*

- *Retention and detention ponds shall not be collected for this project. Where available, stormwater inventory data will be used to identify these areas.*

- *If the 1:24,000 scale NHD water bodies do not appear to exist any longer within the orthophotography (i.e. the water body lies over a house or building), then the water body will be deleted and marked in the change table for the final Streambed Mapping Dataset. Consideration should be given to the fact that the purpose of the project is the creation of streamlines and water bodies that are more horizontally accurate than their previous counterparts.*

- *Any streamlines that are less than 40 feet wide will be drawn as single-line streams. Double-line streams will be collected when the stream width is 40 feet or greater. Also, the stream must remain 40 feet wide for a continuous length of 540 feet to be depicted as a double-line stream. The specification of 540 feet is based on a map scale of 1:500, where one inch of stream would equate to approximately 540 feet of stream on the ground.*

Method 2 – 1 Acre for Minimum Water Body Size

The basis of method 2 is that the minimum size for water body collection shall be 1 acre. As with the ½ acre limit, water bodies of 1 acre or greater should be visible on the orthophotography. If a water body is not visible on the orthophotography provided, then it will not be collected. Only new water bodies that lie within the stream network will be drawn. Any new water bodies that are not connected to a streamline will not be included in the Streambed Mapping Dataset.

- *All water bodies that are included in the existing 1:24,000 scale NHD dataset shall be included in the Streambed Mapping Dataset.*

- *Only NHD water bodies that lie within the stream network will be modified. Any existing NHD water body that is not a part of the stream network will be conflated to the Streambed Mapping Dataset but will not be modified from its original geometry.*

- *Retention and detention ponds shall not be collected for this project. Where available, stormwater inventory data will be used to identify these areas.*

- *If the 1:24,000 scale NHD water bodies do not appear to exist any longer within the orthophotography (i.e. the water body lies over a house or building), then the water body will be deleted and marked in the change table for the final Streambed Mapping Dataset. Consideration should be given to the fact that the purpose of the project is the creation of*

streamlines and water bodies that are more horizontally accurate than their previous counterparts.

- *Any streamlines that are less than 40 feet wide will be drawn as single-line streams. Double-line streams will be collected when the stream width is 40 feet or greater. Also, the stream must remain 40 feet wide for a continuous length of 540 feet to be depicted as a double-line stream. The specification of 540 feet is based on a map scale of 1:500, where one inch of stream would equate to approximately 540 feet of stream on the ground.*

Below is an analysis of the NHD water bodies within three of the nineteen counties in Western North Carolina. Relationships between the number and percentages of water bodies to the county area have been included to demonstrate the variance between the three counties. The table illustrates that the majority of the water bodies that were collected in the existing NHD data are less than 1 acre yet greater than ¼ acre in size.

County Statistics	*Watauga*	*Buncombe*	*Swain*
County Area (Acres)	200,033	422,180	345,572
County Area (Square Miles)	313	660	540
Total Water Body Area (Acres)	367	2,246	17,744
Total Number of Water Bodies	151	488	77
Number of Water Bodies per Square Mile	0.48	0.74	0.14
Percentage of Water Body Area to County Area	0.18%	0.53%	5.13%

Total Number of Water Bodies (Ranges)	*Watauga*	*Buncombe*	*Swain*
0 - 0.25 Acres	0	0	0
0.25 - 0.5 Acres	63	203	24
0.5 - 1 Acres	34	80	12
1 - 2 Acres	24	98	22
2 - 5 Acres	20	64	9
5 - 10 Acres	3	21	4
10+ Acres	7	22	6

Total Percentage of Water Bodies (Ranges)	*Watauga*	*Buncombe*	*Swain*
0 - 0.25 Acres	0%	0%	0%
0.25 - 0.5 Acres	42%	42%	31%
0.5 - 1 Acres	23%	16%	16%
1 - 2 Acres	16%	20%	29%
2 - 5 Acres	13%	13%	12%
5 - 10 Acres	2%	4%	5%
10+ Acres	5%	5%	8%

Issue

There has been much discussion within the Advisory Committee in regard to the minimum size water body that should be collected for the Streambed Mapping Project. The requirement for the incorporation of lakes, ponds and other water features was set forth in the "Implementation Plan to Improve the Mapping and Digital Representation of Surface Waters in North Carolina", as well as in Delivery Order 30 from the State of North Carolina. More detailed specifications regarding water bodies and double-line streams are required to move forward with the creation of the Streambed Mapping Dataset.

Recommendations

The recommended solution for the minimum size for water body collection is ½ acre. If a water body exists in the current NHD dataset, then it will be conflated to the Streambed Mapping Dataset. The only NHD water bodies that will be modified as far as their horizontal location are those that lie within the stream network. If it is apparent from the orthophotography that the NHD water body no longer exists, then it shall be deleted. Any additional water bodies will only be collected if they are visible on the orthophotography and if they are connected to the stream network. Retention and detention ponds shall not be collected, assuming that they can be differentiated from other types of water bodies. Double-line streams will be collected when the stream width is 40 feet or greater. Also, the stream must remain 40 feet wide for a continuous length of 540 feet to be depicted as a double-line stream. Artificial paths will be delineated for the center of double-line streams and water bodies that lie within the stream network.

Other specifications, such as how deletions and modifications to existing NHD water bodies should be handled as well as the depiction of water bodies as both closed polygons and linear features, will need to be discussed and finalized by the Advisory Committee.

Discussion Summary

Date Discussed: December 7th, 2005
Discussion Participants: Scott Edelman, Cam McNutt, Peter Perry, Susan Phelps, Periann Russell, Joe Sewash, Silvia Terziotti

Summary of Discussion

During the conference call discussion on December 7th, 2005, it was determined that the methodologies listed above provided a solid starting point for the basis of the water body specifications. One of the comments was that a definition of water bodies needed to be added. There was also a comment that specifications should be established for the collection of double-line streams.

Discussion Summary

Date Discussed: August 8th, 2006
Discussion Participants: Dave Hill, Aaron Lowery, Andy McDaniel, Cam McNutt, Periann Russell, Joe Sewash

Summary of Discussion

The group reviewed the issue paper and previous recommendations in the context of preliminary Pigeon sub-basin dataset. The preliminary dataset included waterbodies less than ½-acre in size. The group evaluated the dataset based on waterbodies between ½- and ¼-acre in size. When accounting for water bodies already included from 1:24,000-scale NHD forty-two (42) additional features were created during the data compilation process. In the interest of business process known by the participants, and potential business processes that may need to rely on features in this range, it was the group's recommendation to capture waterbody features down to the 1/4 –acre threshold during initial data production.

The group noted this threshold is oriented towards guidance during initial data production; the data maintenance process may discover criteria to create and include specific waterbodies smaller than ¼-acre; these features would be evaluated and integrated as part of the data maintenance process.

Final Guidelines

The final recommendation is to adopt Method #1, with the noted exception that all references to "½-acre" are replaced with "¼-acre".

FGDC-STD-001-1998

National Spatial Data Infrastructure

Content Standard for Digital Geospatial Metadata

Metadata Ad Hoc Working Group
Federal Geographic Data Committee

Federal Geographic Data Committee
Department of Agriculture ● Department of Commerce ● Department of Defense ● Department of Energy
Department of Housing and Urban Development ● Department of the Interior ● Department of State
Department of Transportation ● Environmental Protection Agency
Federal Emergency Management Agency ● Library of Congress
National Aeronautics and Space Administration ● National Archives and Records Administration
Tennessee Valley Authority

Federal Geographic Data Committee

Established by Office of Management and Budget Circular A-16, the Federal Geographic Data Committee (FGDC) promotes the coordinated development, use, sharing, and dissemination of geographic data.

The FGDC is composed of representatives from the Departments of Agriculture, Commerce, Defense, Energy, Housing and Urban Development, the Interior, State, and Transportation; the Environmental Protection Agency; the Federal Emergency Management Agency; the Library of Congress; the National Aeronautics and Space Administration; the National Archives and Records Administration; and the Tennessee Valley Authority. Additional Federal agencies participate on FGDC subcommittees and working groups. The Department of the Interior chairs the committee.

FGDC subcommittees work on issues related to data categories coordinated under the circular. Subcommittees establish and implement standards for data content, quality, and transfer; encourage the exchange of information and the transfer of data; and organize the collection of geographic data to reduce duplication of effort. Working groups are established for issues that transcend data categories.

For more information about the committee, or to be added to the committee's newsletter mailing list, please contact:

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Department of Transportation ● Environmental Protection Agency
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Introduction

1. Objectives. The objectives of the standard are to provide a common set of terminology and definitions for the documentation of digital geospatial data. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements.

The major uses of metadata are:

- to maintain an organization's internal investment in geospatial data,
- to provide information about an organization's data holdings to data catalogues, clearinghouses, and brokerages, and
- to provide information needed to process and interpret data to be received through a transfer from an external source.

The information included in the standard was selected based on four roles that metadata play:

- availability -- data needed to determine the sets of data that exist for a geographic location.
- fitness for use -- data needed to determine if a set of data meets a specific need.
- access -- data needed to acquire an identified set of data.
- transfer -- data needed to process and use a set of data.

These roles form a continuum in which a user cascades through a pyramid of choices to determine what data are available, to evaluate the fitness of the data for use, to access the data, and to transfer and process the data. The exact order in which data elements are evaluated, and the relative importance of data elements, will not be the same for all users.

2. Scope.
This standard is intended to support the collection and processing of geospatial metadata. It is intended to be useable by all levels of government and the private sector. The standard is not intended to reflect an implementation design. An implementation design requires adapting the structure and form of the standard to meet application requirements.

The standard was developed from the perspective of defining the information required by a prospective user to determine the availability of a set of geospatial data; to determine the fitness and the set of geospatial data for an intended use; to determine the means of accessing the set of geospatial data; and to successfully transfer the set of geospatial data. As such, the standard establishes the names of data elements and compound elements to be used for these purposes, definitions of these data elements and compound elements, and information about the values that are to be provided for the data elements. The standard does not specify the means by which this information is organized in a computer system or in a data transfer, nor the means by which this information is transmitted, communicated, or presented to the user.[1]

[1] The variety of means of organizing data in a computer, the differences among data providers to describe their data holdings because of varying institutional and technical capabilities, the rapid evolution of means to provide information through the Internet for different purposes, and the need to accommodate existing standards have guided the evolution of this decision. The FGDC is pursuing several implementation methods.

3. Applicability

This standard is for the documentation of geospatial data. Executive Order 12906, "Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure," was signed on April 11, 1994, by President William J. Clinton. Section 3, Development of a National Geospatial Data Clearinghouse, paragraph (b) states: "Standardized Documentation of Data. Beginning nine months from the date of this order, each agency shall document all new geospatial data it collects or produces, either directly or indirectly, using the standard under development by the FGDC, and make that standardized documentation electronically accessible to the Clearinghouse network. Within one year of the date of this order, agencies shall adopt a schedule, developed in consultation with the FGDC, for documenting, to the extent practicable, geospatial data previously collected or produced, either directly or indirectly, and making that data documentation electronically accessible to the Clearinghouse network." This standard is the data documentation standard referenced in the executive order.

The FGDC invites and encourages organizations and persons from State, local, and tribal governments, the private sector, and non-profit organizations to use the standard to document their geospatial data. A major difficulty in the geospatial data community is the lack of information that helps prospective users to determine what data exist, the fitness of existing data for planned applications, and the conditions for accessing existing data, and to transfer data to a user's system. This standard, developed with aid of broad public participation, will help to ease these problems and to develop the National Spatial Data Infrastructure.

4. Related Standards

The Spatial Data Transfer Standard (SDTS) was developed to allow the transfer of digital spatial data sets between spatial data software. The Content Standard for Digital Geospatial Metadata was developed to identify and define the metadata elements used to document digital geospatial data sets for many purposes. These include metadata to: 1) preserve the meaning and value of a data set; 2) contribute to a catalog or clearinghouse and; 3) aid in data transfer. Since the SDTS is a standard for data transfer, its primary metadata content is used to determine the fitness of the data set for the user's purpose. There is a close relationship between the Metadata Standard and the SDTS metadata elements contained in the Data Quality module, and in other locations inside of the SDTS transfer set. Since the Metadata Standard contains metadata used to search for digital spatial data sets through a clearinghouse (metadata for locating, describing access, use, and distribution), these elements may not be contained in the SDTS transfer set.

The Content Standard for Digital Geospatial Metadata uses to the maximum extent possible, existing International or National Standards, as documented in Office of Management and Budget Circular A-119 “Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity assessment Activities.” American National Standards referenced in the Content Standard for Digital Geospatial Metadata include the American National Standards Institute, 1975, Representations of universal time, local time differentials, and United States time zone reference for information interchange (ANSI X3.51-1975): New York, American National Standards Institute; American National Standards Institute, 1986, Representation for calendar date and ordinal date for information interchange (ANSI X3.30-1985): New York, American National Standards Institute; American National Standards Institute, 1986, Representations of local time of day for information interchange (ANSI X3.43-1986): New York, American National Standards Institute.

The June 8, 1994 FGDC Metadata Standard was used as the base document for International Organization for Standardization (ISO) 15046 Part 15. The draft ISO Metadata Standard 15046 Part 15 has had a number of changes made to it. At this time this revision was prepared, the ISO Metadata Standard was

still in Committee Draft form and subject to significant change before final approval, therefore, is not identical to the current ISO draft but is thought to be consistent with it.

5. Standards Development Process
The Federal Geographic Data Committee (FGDC) initiated work on the first version of the standard in June, 1992, through a forum on geospatial metadata. At the forum, the participants agreed on the need for a standard on the information content of metadata about geospatial data. The committee accepted the offer of ASTM[2] Section D18.01.05 to develop a draft information content standard. The draft was slightly revised, and offered for public review from October 1992 to April 1993. Extensive comments were received from the public. The FGDC Standards Working Group revised the draft. The revised draft was provided for further review and testing in July 1993. Refined drafts were offered for review and testing in January and March 1994. The first version was approved June 8, 1994.

Since the FGDC Metadata Standard was adopted, it has been implemented by numerous Federal, state, and local agencies, companies, and groups. It has also been used by other nations as they develop their own national metadata standards. Proposed changes to the Metadata Standard have been suggested during the time since it was issued. Further, an implementor's workshop was held specifically to discuss strengths, weaknesses, and proposed improvements. Drawing on this body of knowledge, the FGDC proposed to modify the current Metadata Standard.

The June 1998 version is fully backward compatible with and supersedes the June 8, 1994 version. The June 1998 version provides for the definition of Profiles (Appendix E) and extensibility through User Defined Metadata Extensions (Appendix D). The June 1998 version also modifies some production rules to ease implementation.

6. Maintenance Authority. The current maintenance authority for the standard is the FGDC Secretariat. The Federal Geographic Data Committee is the approving authority for the standard. Questions concerning the standard are to be addressed to the FGDC Secretariat, in care of the U.S. Geological Survey, 590 National Center, Reston, Virginia 20192. Copies of this publication are available from the Federal Geographic Data Committee. Secretariat, in care of the U.S. Geological Survey, 590 National Center, Reston, Virginia 20192; telephone (703) 648-5514; facsimile (703) 648-5755; Internet (electronic mail) gdc@usgs.gov. The text also is available from anonymous File Transfer Protocol (anonymous ftp) server fgdc.er.usgs.gov and at the FGDC web site http://www.fgdc.gov/metadata.

[2] formally the American Society for Testing and Materials

Organization of the Standard

Numbered Sections

The standard is organized in a hierarchy of data elements and compound elements that define the information content for metadata to document a set of digital geospatial data. The starting point is "metadata" (section 0). The compound element "metadata" is composed of other compound elements representing different concepts about the data set. Each of these compound elements has a numbered section in the standard. In each numbered section, these compound elements are defined by other compound elements and data elements. The section "contact information" is a special section that specifies the data elements for contacting individuals and organizations. This section is used by other sections, and is defined once for convenience.

Each section begins with the name and definition of the compound element that defines the section. The name and definition are followed by production rules (see below) that define this compound element in terms of data elements, either directly or by the use of intermediate compound elements. When intermediate compound elements are used, the production rules for these elements also are provided in this part of the section.

Additional information about the organization of the Standard follows:

- The production rules are followed by a list of names and definitions of compound elements and data elements used in the section.

- Section and element numbers are provided for user navigation of the standard. They are neither authoritative nor intended for use in implementation and are subject to change in future revisions of the standard.

Compound Elements

A compound element is a group of data elements and other compound elements. All compound elements are described by data elements, either directly or through intermediate compound elements. Compound elements represent higher-level concepts that cannot be represented by individual data elements. The form for the definition of compound elements is:

Compound element name -- definition.
Type: compound
Short Name:

The type of "compound" uniquely identifies the compound elements in the lists of terms and definitions.

Short names consisting of eight alphabetic characters or less are included to assist in implementation of the standard.

Data Elements

A data element is a logically primitive item of data. The entry for a data element includes the name of the data element, the definition of the data element, a description of the values that can be assigned to the data element, and a short name for the data element. The form for the definition of the data elements is:

Data element name -- definition.
Type:
Domain:
Short Name:

The information about the values for the data elements include a description of the type of the value, and a description of the domain of the valid values. The type of the data element describes the kind of value to be provided. The choices are "integer" for integer numbers, "real" for real numbers, "text" for ASCII characters, "date" for day of the year, and "time" for time of the day.

The domain describes valid values that can be assigned to the data element. The domain may specify a list of valid values, references to lists of valid values, or restrictions on the range of values that can be assigned to a data element.

The domain also may note that the domain is free from restrictions, and any values that can be represented by the "type" of the data element can be assigned. These unrestricted domains are represented by the use of the word "free" followed by the type of the data element (that is, free text, free date, free real, free time, free integer). Some domains can be partly, but not completely, specified. For example, there are several widely used data transfer formats, but there may be many more that are less well known. To allow a producer to describe its data in these circumstances, the convention of providing a list of values followed by the designation of a "free" domain was used. In these cases, assignments of values shall be made from the provided domain when possible. When not possible, providers may create and assign their own value. A created value shall not redefine a value provided by the standard.

Short names consisting of eight alphabetic characters or less are included to assist in user implementation of the standard.

Another issue is the representation of null values (representing such concepts as "unknown") in the domain. While this is relatively simple for textual entries (one would enter the text "Unknown"), it is not as simple for the integer, real, date, and time types. (For example, which integer value means "unknown"?). Because conventions for providing this information vary among implementations, the standard specifies what concepts shall be represented, but does not mandate a means for representing them.

In addition to the values to be represented, the form of representation also is important, especially to applications that will manipulate the data elements. The following conventions for forms of values for data elements shall be used:

<u>Calendar Dates (Years, Months, and Days)</u>

- A.D. Era to December 31, 9999 A.D. -- Values for day and month of year, and for years, shall follow the calendar date convention (general forms of YYYY for years; YYYYMM for month of a year (with month being expressed as an integer), and YYYYMMDD for a day of the year) specified in American National Standards Institute, 1986, Representation for calendar date and ordinal date for information interchange (ANSI X3.30-1985): New York, American National Standards Institute (adopted as Federal Information Processing Standard 4-1).

- B.C. Era to 9999 B.C. -- Values for day and month of year, and for years, shall follow the calendar

date convention, preceded by the lower case letters "bc" (general forms of bcYYYY for years; bcYYYYMM for month of a year (with month being expressed as an integer), and bcYYYYMMDD for a day of the year).

- B.C. Era before 9999 B.C. -- Values for the year shall consist of as many numeric characters as needed to represent the number of the year B.C., preceded by lower case letters "cc" (general form of ccYYYYYYY...).

- A.D. Era after 9999 A.D. -- Values for the year shall consist of as many numeric characters as needed to represent number of the year A.D., preceded by the lower case letters "cd" (general form of cdYYYYYYY...).

Time of Day (Hours, Minutes, and Seconds)

- Because some geospatial data and related applications are sensitive to time of day information, three conventions are permitted. Only one convention shall be used for metadata for a data set. The conventions are:

  - Local Time. For producers who wish to record time in local time, values shall follow the 24-hour timekeeping system for local time of day in the hours, minutes, seconds, and decimal fractions of a second (to the precision desired) without separators convention (general form of HHMMSSSS) specified in American National Standards Institute, 1986, Representations of local time of day for information interchange (ANSI X3.43-1986): New York, American National Standards Institute.

  - Local Time with Time Differential Factor. For producers who wish to record time in local time and the relationship to Universal Time (Greenwich Mean Time), values shall follow the 24-hour timekeeping system for local time of day in hours, minutes, seconds, and decimal fractions of a second (to the resolution desired) without separators convention. This value shall be followed, without separators, by the time differential factor. The time differential factor expresses the difference in hours and minutes between local time and Universal Time. It is represented by a four-digit number preceded by a plus sign (+) or minus sign (-), indicating hours and minutes local time is ahead of or behind Universal Time, respectively. The general form is HHMMSSSSshhmm, where HHMMSSSS is the local time using 24-hour timekeeping (expressed to the precision desired), 's' is the plus or minus sign for the time differential factor, and hhmm is the time differential factor. (This option allows producers to record local time and time zone information. For example, Eastern Standard Time has a time differential factor of -0500, Central Standard Time has a time differential factor of -0600, Eastern Daylight Time has a time differential factor of -0400, and Central Daylight Time has a time differential factor of -0500.) This option is specified in American National Standards Institute, 1975, Representations of universal time, local time differentials, and United States time zone reference for information interchange (ANSI X3.51-1975): New York, American National Standards Institute.

  - Universal Time (Greenwich Mean Time). For producers who wish to record time in Universal Time (Greenwich Mean Time), values shall follow the 24-hour timekeeping system for Universal Time of day in hours, minutes, seconds, and decimal fractions of a second (expressed to the precision desired) without separators convention, with the upper case letter "Z" directly following the low-order (or extreme right hand) time element of the 24-hour clock time expression. The general form is HHMMSSSSZ, where HHMMSSSS is

Universal Time using 24-hour timekeeping, and Z is the letter "Z". This option is specified in American National Standards Institute, 1975, Representations of universal time, local time differentials, and United States time zone reference for information interchange (ANSI X3.51-1975): New York, American National Standards Institute.

Latitude and Longitude

- Values for latitude and longitude shall be expressed as decimal fractions of degrees. Whole degrees of latitude shall be represented by a two-digit decimal number ranging from 0 through 90. Whole degrees of longitude shall be represented by a three-digit decimal number ranging from 0 through 180. When a decimal fraction of a degree is specified, it shall be separated from the whole number of degrees by a decimal point. Decimal fractions of a degree may be expressed to the precision desired.

  - Latitudes north of the equator shall be specified by a plus sign (+), or by the absence of a minus sign (-), preceding the two digits designating degrees. Latitudes south of the Equator shall be designated by a minus sign (-) preceding the two digits designating degrees. A point on the Equator shall be assigned to the Northern Hemisphere.

  - Longitudes east of the prime meridian shall be specified by a plus sign (+), or by the absence of a minus sign (-), preceding the three digits designating degrees of longitude. Longitudes west of the meridian shall be designated by minus sign (-) preceding the three digits designating degrees. A point on the prime meridian shall be assigned to the Eastern Hemisphere. A point on the 180th meridian shall be assigned to the Western Hemisphere. One exception to this last convention is permitted. For the special condition of describing a band of latitude around the earth, the East Bounding Coordinate data element shall be assigned the value +180 (180) degrees.

  - Any spatial address with a latitude of +90 (90) or -90 degrees will specify the position at the North or South Pole, respectively. The component for longitude may have any legal value.

  With the exception of the special condition described above, this form is specified in American National Standards Institute, 1986, Representations of Geographic Point Locations for Information Interchange (ANSI X3.61-1986): New York, American National Standards Institute.

Network Addresses and File Names

Values for file names, network addresses for computer systems, and related services should follow the Uniform Resource Locator convention of the Internet when possible. See http://www.ncsa.uiuc.edu/demoweb/url-primer.html for additional details about the Uniform Resource Locator.

Optionality

The standard categorizes elements as being mandatory, mandatory-if-applicable, or optional as follows:

- Mandatory elements must be provided.
- Mandatory-if-applicable elements must be provided if the data set exhibits the defined characteristic.
- Optional elements are provided at the discretion of the metadata producer.

The optionality of a section or compound element always takes precedence over the elements that it contains. Once a section or compound element is recognized by the data set producer as applicable, then the optionality of its subordinate elements is to be interpreted. See Production Rules section for additional interpretive guidance.

Mandatory sections in the standard have some elements that are always required for all types of geospatial data sets. For comparison with other metadata standards, these elements are referred to as “core” elements.

Production Rules

A production rule specifies the relationship between a compound element, and data elements and other (lower-level) compound elements. Each production rule has a left side (identifier) and a right side (expression) connected by the symbol "=", meaning that the term on the left side is replaced by or produces the term on the right side. Terms on the right side are either other compound elements or individual data elements. By making substitutions using matching terms in the production rules, one can explain higher-level concepts using data elements. The symbols used in the production rules have the following meaning:

Symbol Meaning

=	is replaced by, produces, consists of
+	and
[|]	selection - select one term from the list of enclosed terms (exclusive or). Terms are separated by "|"
m{}n	iteration - the term(s) enclosed is(are) repeated from "m" to "n" times
()	optional - the term(s) enclosed is(are) optional

Examples:

a = b + c	"a consists of b and c"
a = [b | c	"a consists of one of b or c"
a = 4{b}6	"a consists of four to six occurrences of b"
a = b + (c)	"a consists of b and optionally c"

Interpreting the production rules:

The terms bounded by parentheses, "(" and ")", are optional and are provided at the discretion of the data producer. If a producer chooses to provide information enclosed by parentheses, the producer shall follow the production rules for the enclosed information. For example, if the producer decides to provide the optional information described in the term:

(a + b + c)

the producer shall provide a and b and c.

Only for terms bounded by parentheses does the producer have the discretion of deciding

whether or not to provide the information.

The variation among the ways in which geospatial data are produced and distributed, the fact that all geospatial data does not have the same characteristics, and the issue that all details of data sets that are in work or are planned may not be decided, caused the need to express the concept of "mandatory if applicable." This concept means that if the data set exhibits (or, for data sets that are in work or planned, it is known that the data set will exhibit) a defined characteristic, then the producer shall provide the information needed to describe that characteristic. This concept is described by the production rule:

0{ term }1

Extensibility

Extended elements may be defined by a data set producer or a user community. Extended elements are elements outside the standard, but needed by the data set producer. If extended elements are created, they must follow the guidelines in Appendix D, Guidelines for creating extended elements to the Content Standard for Digital Geospatial Metadata.

Metadata

0 Metadata -- data about the content, quality, condition, and other characteristics of data.
Type: compound
Short Name: metadata

Metadata =
Identification_Information +
0{Data_Quality_Information}1 +
0{Spatial_Data_Organization_Information}1 +
0{Spatial_Reference_Information}1 +
0{Entity_and_Attribute_Information}1 +
0{Distribution_Information}n +
Metadata_Reference_Information

(Sections 1 through 7 define the terms on the right side of the production rule.)

Identification Information

1 Identification Information -- basic information about the data set.
Type: compound
Short Name: idinfo

Identification_Information =
Citation +
Description +
Time_Period_of_Content +
Status +
Spatial_Domain +
Keywords +
Access_Constraints +
Use_Constraints +
(Point_of_Contact) +
(1{Browse_Graphic}n) +
(Data_Set_Credit) +
(Security_Information) +
(Native_Data_Set_Environment) +
(1{Cross_Reference}n)

Citation =
Citation_Information *(see section 8 for production rules)*

Description =
Abstract +
Purpose +
(Supplemental_Information)

Time_Period_of_Content =
Time_Period_Information *(see section 9 for production rules)* +
Currentness_Reference

Status =
Progress +
Maintenance_and_Update_Frequency

Spatial_Domain =
Bounding_Coordinates +
(1{Data_Set_G-Polygon}n)

Bounding_Coordinates =
West_Bounding_Coordinate +
East_Bounding_Coordinate +
North_Bounding_Coordinate +
South_Bounding_Coordinate

Data_Set_G-Polygon =
Data_Set_G-Polygon_Outer_G-Ring +

0{Data_Set_G-Polygon_Exclusion_G-Ring}n

Data_Set_G-Polygon_Outer_G-Ring =
[4{G-Ring_Point}n | G-Ring]

Data_Set_G-Polygon_Exclusion_G-Ring =
[4{G-Ring_Point}n | G-Ring]

G-Ring_Point =
G-Ring_Latitude +
G-Ring_Longitude

Keywords =
1{Theme}n +
0{Place}n +
0{Stratum}n +
0{Temporal}n

Theme =
Theme_Keyword_Thesaurus +
1{Theme_Keyword}n

Place =
Place_Keyword_Thesaurus +
1{Place_Keyword}n

Stratum =
Stratum_Keyword_Thesaurus +
1{Stratum_Keyword}n

Temporal =
Temporal_Keyword_Thesaurus +
1{Temporal_Keyword}n

Point_of_Contact =
Contact_Information *(see section 10 for production rules)*

Browse_Graphic =
Browse_Graphic_File_Name +
Browse_Graphic_File_Description +
Browse_Graphic_File_Type

Security_Information =
Security_Classification_System +
Security_Classification +
Security_Handling_Description

Cross_Reference =
Citation_Information *(see section 8 for production rules)*

1.1 Citation -- information to be used to reference the data set.
Type: compound
Short Name: citation

1.2 Description -- a characterization of the data set, including its intended use and limitations.
Type: compound
Short Name: descript

1.2.1 Abstract -- a brief narrative summary of the data set.
Type: text
Domain: free text
Short Name: abstract

1.2.2 Purpose -- a summary of the intentions with which the data set was developed.
Type: text
Domain: free text
Short Name: purpose

1.2.3 Supplemental Information -- other descriptive information about the data set.
Type: text
Domain: free text
Short Name: supplinf

1.3 Time Period of Content -- time period(s) for which the data set corresponds to the currentness reference.
Type: compound
Short Name: timeperd

1.3.1 Currentness Reference -- the basis on which the time period of content information is determined.
Type: text
Domain: "ground condition" "publication date" free text
Short Name: current

1.4 Status -- the state of and maintenance information for the data set.
Type: compound
Short Name: status

1.4.1 Progress -- the state of the data set.
Type: text
Domain: "Complete" "In work" "Planned"
Short Name: progress

1.4.2 Maintenance and Update Frequency -- the frequency with which changes and additions are made to the data set after the initial data set is completed.
Type: text
Domain: "Continually" "Daily" "Weekly" "Monthly" "Annually" "Unknown" "As needed" "Irregular" "None planned" free text
Short Name: update

1.5 Spatial Domain - the geographic areal domain of the data set.
Type: compound
Short Name: spdom

1.5.1 Bounding Coordinates - the limits of coverage of a data set expressed by latitude and longitude values in the order western-most, eastern-most, northern-most, and southern-most. For data sets that include a complete band of latitude around the earth, the West Bounding Coordinate shall be assigned the value -180.0, and the East Bounding Coordinate shall be assigned the value 180.0
Type: compound
Short Name: bounding

1.5.1.1 West Bounding Coordinate -- western-most coordinate of the limit of coverage expressed in longitude.
Type: real
Domain: -180.0 <= West Bounding Coordinate < 180.0
Short Name: westbc

1.5.1.2 East Bounding Coordinate -- eastern-most coordinate of the limit of coverage expressed in longitude.
Type: real
Domain: -180.0 <= East Bounding Coordinate <= 180.0
Short Name: eastbc

1.5.1.3 North Bounding Coordinate -- northern-most coordinate of the limit of coverage expressed in latitude.
Type: real
Domain: -90.0 <= North Bounding Coordinate <= 90.0;
North Bounding Coordinate >= South Bounding Coordinate
Short Name: northbc

1.5.1.4 South Bounding Coordinate -- southern-most coordinate of the limit of coverage expressed in latitude.
Type: real
Domain: -90.0 <= South Bounding Coordinate <= 90.0;
South Bounding Coordinate <= North Bounding Coordinate
Short Name: southbc

1.5.2 Data Set G-Polygon -- coordinates defining the outline of an area covered by a data set.
Type: compound
Short Name: dsgpoly

1.5.2.1 Data Set G-Polygon Outer G-Ring -- the closed nonintersecting boundary of an interior area.
Type: compound
Short Name: dsgpolyo

1.5.2.1.1 G-Ring Point -- a single geographic location.
Type: compound
Short Name: grngpoin

1.5.2.1.1.1 G-Ring Latitude -- the latitude of a point of the g-ring.
Type: real
Domain: -90.0 <= G-Ring Latitude <= 90.0
Short Name: gringlat

1.5.2.1.1.2 G-Ring Longitude -- the longitude of a point of the g-ring.
Type: real
Domain: -180.0 <= G-Ring Longitude < 180.0
Short Name: gringlon

1.5.2.1.2 G-Ring -- a set of ordered pairs of floating-point numbers, separated by commas, in which the first number in each pair is the longitude of a point and the second is the latitude of the point. Longitude and latitude are specified in decimal degrees with north latitudes positive and south negative, east longitude positive and west negative
Type: text
Domain: -90<= Latitude_elements <= 90,
-180 <= Longitude_Elements = 180
Short Name: gring

1.5.2.2 Data Set G-Polygon Exclusion G-Ring -- the closed nonintersecting boundary of a void area (or “hole” in an interior area).
Type: compound
Short Name: dsgpolyx

1.6 Keywords -- words or phrases summarizing an aspect of the data set.
Type: compound
Short Name: keywords

1.6.1 Theme -- subjects covered by the data set (for a list of some commonly-used thesauri, see Part IV: Subject/index term sources *in* Network Development and MARC Standards Office, 1988, USMARC code list for relators, sources, and description conventions: Washington, Library of Congress).
Type: compound
Short Name: theme

1.6.1.1 Theme Keyword Thesaurus -- reference to a formally registered thesaurus or a similar authoritative source of theme keywords.
Type: text
Domain: "None" free text
Short Name: themekt

1.6.1.2 Theme Keyword -- common-use word or phrase used to describe the subject of the data set.
Type: text
Domain: free text
Short Name: themekey

1.6.2 Place -- geographic locations characterized by the data set.
Type: compound

Short Name: place

1.6.2.1 Place Keyword Thesaurus -- reference to a formally registered thesaurus or a similar authoritative source of place keywords.
Type: text
Domain: "None" "Geographic Names Information System" free text
Short Name: placekt

1.6.2.2 Place Keyword -- the geographic name of a location covered by a data set.
Type: text
Domain: free text
Short Name: placekey

1.6.3 Stratum -- layered, vertical locations characterized by the data set.
Type: compound
Short Name: stratum

1.6.3.1 Stratum Keyword Thesaurus -- reference to a formally registered thesaurus or a similar authoritative source of stratum keywords.
Type: text
Domain: "None" free text
Short Name: stratkt

1.6.3.2 Stratum Keyword -- the name of a vertical location used to describe the locations covered by a data set.
Type: text
Domain: free text
Short Name: stratkey

1.6.4 Temporal -- time period(s) characterized by the data set.
Type: compound
Short Name: temporal

1.6.4.1 Temporal Keyword Thesaurus -- reference to a formally registered thesaurus or a similar authoritative source of temporal keywords.
Type: text
Domain: "None" free text
Short Name: tempkt

1.6.4.2 Temporal Keyword -- the name of a time period covered by a data set.
Type: text
Domain: free text
Short Name: tempkey

1.7 Access Constraints -- restrictions and legal prerequisites for accessing the data set. These include any access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the data set.
Type: text
Domain: "None" free text
Short Name: accconst

1.8 Use Constraints -- restrictions and legal prerequisites for using the data set after access is granted. These include any use constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on using the data set.

Type: text
Domain: "None" free text
Short Name: useconst

1.9 Point of Contact -- contact information for an individual or organization that is knowledgeable about the data set.

Type: compound
Short Name: ptcontac

1.10 Browse Graphic -- a graphic that provides an illustration of the data set. The graphic should include a legend for interpreting the graphic.

Type: compound
Short Name: browse

1.10.1 Browse Graphic File Name -- name of a related graphic file that provides an illustration of the data set.

Type: text
Domain: free text
Short Name: browsen

1.10.2 Browse Graphic File Description -- a text description of the illustration.

Type: text
Domain: free text
Short Name: browsed

1.10.3 Browse Graphic File Type -- graphic file type of a related graphic file.

Type: text
Domain: domain values in the table below; free text
Short Name: browset

Domain Value	Definition
"CGM"	Computer Graphics Metafile
"EPS"	Encapsulated Postscript format
“EMF”	Enhanced Metafile
"GIF"	Graphic Interchange Format
"JPEG"	Joint Photographic Experts Group format
"PBM"	Portable Bit Map format
"PS"	Postscript format
"TIFF"	Tagged Image File Format
“WMF”	Windows metafile
"XWD"	X-Windows Dump

1.11 Data Set Credit -- recognition of those who contributed to the data set.

Type: text
Domain: free text
Short Name: datacred

1.12 Security Information -- handling restrictions imposed on the data set because of national security, privacy, or other concerns.
Type: compound
Short Name: secinfo

1.12.1 Security Classification System -- name of the classification system.
Type: text
Domain: free text
Short Name: secsys

1.12.2 Security Classification -- name of the handling restrictions on the data set.
Type: text
Domain: "Top secret" "Secret" "Confidential" "Restricted" "Unclassified" "Sensitive" free text
Short Name: secclass

1.12.3 Security Handling Description -- additional information about the restrictions on handling the data set.
Type: text
Domain: free text
Short Name: sechandl

1.13 Native Data Set Environment -- a description of the data set in the producer's processing environment, including items such as the name of the software (including version), the computer operating system, file name (including host-, path-, and filenames), and the data set size.
Type: text
Domain: free text
Short Name: native

1.14 Cross Reference -- information about other, related data sets that are likely to be of interest.
Type: compound
Short Name: crossref

Data Quality Information

2 Data Quality Information -- a general assessment of the quality of the data set. (Recommendations on information to be reported and tests to be performed are found in "Spatial Data Quality," which is chapter 3 of part 1 in Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, Department of Commerce, National Institute of Standards and Technology.)

Type: compound
Short Name: dataqual

```
Data_Quality_Information =
                    0{Attribute_Accuracy}1 +
                    Logical_Consistency_Report +
                    Completeness_Report +
                    0{Positional_Accuracy}1 +
                    Lineage +
                    (Cloud_Cover)

    Attribute_Accuracy =
                    Attribute_Accuracy_Report +
                    (1{Quantitative_Attribute_Accuracy_Assessment}n)

        Quantitative_Attribute_Accuracy_Assessment =
                    Attribute_Accuracy_Value +
                    Attribute_Accuracy_Explanation

    Positional_Accuracy =
                    0{Horizontal_Positional_Accuracy}1 +
                    0{Vertical_Positional_Accuracy}1

        Horizontal_Positional_Accuracy =
                    Horizontal_Positional_Accuracy_Report +
                    (1{Quantitative_Horizontal_Positional_Accuracy_Assessment}n)

            Quantitative_Horizontal_Positional_Accuracy_Assessment =
                    Horizontal_Positional_Accuracy_Value +
                    Horizontal_Positional_Accuracy_Explanation

        Vertical_Positional_Accuracy =
                    Vertical_Positional_Accuracy_Report +
                    (1{Quantitative_Vertical_Positional_Accuracy_Assessment}n)

            Quantitative_Vertical_Positional_Accuracy_Assessment =
                    Vertical_Positional_Accuracy_Value +
                    Vertical_Positional_Accuracy_Explanation

    Lineage =
                    0{Source_Information}n +
                    1{Process_Step}n
                    Source_Information =
```

Source_Citation +
0{Source_Scale_Denominator}1 +
Type_of_Source_Media +
Source_Time_Period_of_Content +
Source_Citation_Abbreviation +
Source_Contribution

Source_Citation =
Citation_Information *(see section 8 for production rules)*

Source_Time_Period_of_Content =
Time_Period_Information *(see section 9 for production rules)* +
Source_Currentness_Reference

Process_Step =
Process_Description +
0{Source_Used_Citation_Abbreviation}n +
Process_Date +
(Process_Time) +
0{Source_Produced_Citation_Abbreviation}n +
(Process_Contact)

Process_Contact =
Contact_Information *(see section 10 for production rules)*

2.1 Attribute Accuracy -- an assessment of the accuracy of the identification of entities and assignment of attribute values in the data set.
Type: compound
Short Name: attracc

2.1.1 Attribute Accuracy Report -- an explanation of the accuracy of the identification of the entities and assignments of values in the data set and a description of the tests used.
Type: text
Domain: free text
Short Name: attraccr

2.1.2 Quantitative Attribute Accuracy Assessment -- a value assigned to summarize the accuracy of the identification of the entities and assignments of values in the data set and the identification of the test that yielded the value.
Type: compound
Short Name: qattracc

2.1.2.1 Attribute Accuracy Value -- an estimate of the accuracy of the identification of the entities and assignments of attribute values in the data set.
Type: text
Domain: "Unknown" free text
Short Name: attraccv

2.1.2.2 Attribute Accuracy Explanation -- the identification of the test that yielded the Attribute Accuracy Value.

Type: text
Domain: free text
Short Name: attracce

2.2 Logical Consistency Report -- an explanation of the fidelity of relationships in the data set and tests used.
Type: text
Domain: free text
Short Name: logic

2.3 Completeness Report -- information about omissions, selection criteria, generalization, definitions used, and other rules used to derive the data set.
Type: text
Domain: free text
Short Name: complete

2.4 Positional Accuracy -- an assessment of the accuracy of the positions of spatial objects.
Type: compound
Short Name: posacc

2.4.1 Horizontal Positional Accuracy -- an estimate of accuracy of the horizontal positions of the spatial objects.
Type: compound
Short Name: horizpa

2.4.1.1 Horizontal Positional Accuracy Report -- an explanation of the accuracy of the horizontal coordinate measurements and a description of the tests used.
Type: text
Domain: free text
Short Name: horizpar

2.4.1.2 Quantitative Horizontal Positional Accuracy Assessment -- numeric value assigned to summarize the accuracy of the horizontal coordinate measurements and the identification of the test that yielded the value.
Type: compound
Short Name: qhorizpa

2.4.1.2.1 Horizontal Positional Accuracy Value -- an estimate of the accuracy of the horizontal coordinate measurements in the data set expressed in (ground) meters.
Type: real
Domain: free real
Short Name: horizpav

2.4.1.2.2 Horizontal Positional Accuracy Explanation -- the identification of the test that yielded the Horizontal Positional Accuracy Value.
Type: text
Domain: free text
Short Name: horizpae

2.4.2 Vertical Positional Accuracy -- an estimate of accuracy of the vertical positions in the data set.
Type: compound
Short Name: vertacc

2.4.2.1 Vertical Positional Accuracy Report -- an explanation of the accuracy of the vertical coordinate measurements and a description of the tests used.
Type: text
Domain: free text
Short Name: vertaccr

2.4.2.2 Quantitative Vertical Positional Accuracy Assessment -- numeric value assigned to summarize the accuracy of vertical coordinate measurements and the identification of the test that yielded the value.
Type: compound
Short Name: qvertpa

2.4.2.2.1 Vertical Positional Accuracy Value -- an estimate of the accuracy of the vertical coordinate measurements in the data set expressed in (ground) meters.
Type: real
Domain: free real
Short Name: vertaccv

2.4.2.2.2 Vertical Positional Accuracy Explanation -- the identification of the test that yielded the Vertical Positional Accuracy Value.
Type: text
Domain: free text
Short Name: vertacce

2.5 Lineage -- information about the events, parameters, and source data which constructed the data set, and information about the responsible parties.
Type: compound
Short Name: lineage

2.5.1 Source Information -- list of sources and a short discussion of the information contributed by each.
Type: compound
Short Name: srcinfo

2.5.1.1 Source Citation -- reference for a source data set.
Type: compound
Short Name: srccite

2.5.1.2 Source Scale Denominator -- the denominator of the representative fraction on a map (for example, on a 1:24,000-scale map, the Source Scale Denominator is 24000).
Type: integer
Domain: Source Scale Denominator > 1
Short Name: srcscale

2.5.1.3 Type of Source Media -- the medium of the source data set.

Type: text
Domain: "paper" "stable-base material" "microfiche" "microfilm" "audiocassette" "chart" "filmstrip" "transparency" "videocassette" "videodisc" "videotape" "physical model" "computer program" "disc" "cartridge tape" "magnetic tape" "online" "CD-ROM" "electronic bulletin board" "electronic mail system" free text
Short Name: typesrc

2.5.1.4 Source Time Period of Content -- time period(s) for which the source data set corresponds to the ground.
Type: compound
Short Name: srctime

2.5.1.4.1 Source Currentness Reference -- the basis on which the source time period of content information of the source data set is determined.
Type: text
Domain: "ground condition" "publication date" free text
Short Name: srccurr

2.5.1.5 Source Citation Abbreviation -- short-form alias for the source citation.
Type: text
Domain: free text
Short Name: srccitea

2.5.1.6 Source Contribution -- brief statement identifying the information contributed by the source to the data set.
Type: text
Domain: free text
Short Name: srccontr

2.5.2 Process Step -- information about a single event.
Type: compound
Short Name: procstep

2.5.2.1 Process Description -- an explanation of the event and related parameters or tolerances.
Type: text
Domain: free text
Short Name: procdesc

2.5.2.2 Source Used Citation Abbreviation -- the Source Citation Abbreviation of a data set used in the processing step.
Type: text
Domain: Source Citation Abbreviations from the Source Information entries for the data set.
Short Name: srcused

2.5.2.3 Process Date -- the date when the event was completed.
Type: date
Domain: "Unknown" "Not complete" free date

Short Name: procdate

2.5.2.4 Process Time -- the time when the event was completed.
Type: time
Domain: free time
Short Name: proctime

2.5.2.5 Source Produced Citation Abbreviation -- the Source Citation Abbreviation of an intermediate data set that (1) is significant in the opinion of the data producer, (2) is generated in the processing step, and (3) is used in later processing steps.
Type: text
Domain: Source Citation Abbreviations from the Source Information entries for the data set.
Short Name: srcprod

2.5.2.6 Process Contact -- the party responsible for the processing step information.
Type: compound
Short Name: proccont

2.6 Cloud Cover -- area of a data set obstructed by clouds, expressed as a percentage of the spatial extent.
Type: integer
Domain: 0 <= Cloud Cover <= 100 "Unknown"
Short Name: cloud

Spatial Data Organization Information

3 Spatial Data Organization Information -- the mechanism used to represent spatial information in the data set.

Type: compound
Short Name: spdoinfo

```
Spatial_Data_Organization_Information =
                    0{Indirect_Spatial_Reference}1 +
                    0{Direct_Spatial_Reference_Method +
                        ( [Point_and_Vector_Object_Information |
                            Raster_Object_Information] )}1

Point_and_Vector_Object_Information =
                    [1{SDTS_Terms_Description}n |
                    VPF_Terms_Description]

    SDTS_Terms_Description =
                    SDTS_Point_and_Vector_Object_Type +
                        (Point_and_Vector_Object_Count)

    VPF_Terms_Description =
                    VPF_Topology_Level +
                    1{VPF_Point_and_Vector_Object_Information}n

        VPF_Point_and_Vector_Object_Information =
                    VPF_Point_and_Vector_Object_Type +
                        (Point_and_Vector_Object_Count)

Raster_Object_Information =
                    Raster_Object_Type +
                        (Row_Count +
                            Column_Count +
                            0{Vertical_Count}1 )
```

3.1 Indirect Spatial Reference -- name of types of geographic features, addressing schemes, or other means through which locations are referenced in the data set.

Type: text
Domain: free text
Short Name: indspref

3.2 Direct Spatial Reference Method -- the system of objects used to represent space in the data set.

Type: text
Domain: "Point" "Vector" "Raster"
Short Name: direct

3.3 Point and Vector Object Information -- the types and numbers of vector or nongridded point spatial objects in the data set.

Type: compound
Short Name: ptvctinf

3.3.1 SDTS Terms Description -- point and vector object information using the terminology and concepts from "Spatial Data Concepts," which is Chapter 2 of Part 1 *in* Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, Department of Commerce, National Institute of Standards and Technology. *(Note that this reference to the SDTS is used ONLY to provide a set of terminology for the point and vector objects.)*

Type: compound
Short Name: sdtsterm

3.3.1.1 SDTS Point and Vector Object Type -- name of point and vector spatial objects used to locate zero-, one-, and two-dimensional spatial locations in the data set.

Type: text
Domain: (The domain is from "Spatial Data Concepts," which is Chapter 2 of Part 1 *in* Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, Department of Commerce, National Institute of Standards and Technology):

"Point" "Entity point" "Label point" "Area point" "Node, planar graph"
"Node, network" "String" "Link" "Complete chain" "Area chain"
"Network chain, planar graph" "Network chain, nonplanar graph"
"Circular arc, three point center" "Elliptical arc" "Uniform B-spline"
"Piecewise Bezier" "Ring with mixed composition"
"Ring composed of strings" "Ring composed of chains"
"Ring composed of arcs" "G-polygon" "GT-polygon composed of rings"
"GT-polygon composed of chains"
"Universe polygon composed of rings"
"Universe polygon composed of chains"
"Void polygon composed of rings" "Void polygon composed of chains"

Short Name: sdtstype

3.3.1.2 Point and Vector Object Count -- the total number of the point or vector object type occurring in the data set.

Type: integer
Domain: Point and Vector Object Count > 0
Short Name: ptvctcnt

3.3.2 VPF Terms Description -- point and vector object information using the terminology and concepts from Department of Defense, 1992, Vector Product Format (MIL-STD-600006): Philadelphia, Department of Defense, Defense Printing Service Detachment Office. *(Note that this reference to the VPF is used ONLY to provide a set of terminology for the point and vector objects.)*

Type: compound
Short Name: vpfterm

3.3.2.1 VPF Topology Level -- the completeness of the topology carried by the data set. The levels of completeness are defined in Department of Defense, 1992, Vector Product Format (MIL-STD-600006): Philadelphia, Department of Defense, Defense Printing Service Detachment Office.

Type: integer
Domain: 0 <= VPF Topology Level <= 3
Short Name: vpflevel

3.3.2.2 VPF Point and Vector Object Information -- information about VPF point and vector objects
Type: compound
Short Name: vpfinfo

3.3.2.2.1 VPF Point and Vector Object Type -- name of point and vector spatial objects used to locate zero-, one-, and two-dimensional spatial locations in the data set.
Type: text
Domain: (The domain is from Department of Defense, 1992, Vector Product Format (MIL-STD-600006): Philadelphia, Department of Defense, Defense Printing Service Detachment Office):
"Node" "Edge" "Face" "Text"
Short Name: vpftype

3.4 Raster Object Information -- the types and numbers of raster spatial objects in the data set.
Type: compound
Short Name: rastinfo

3.4.1 Raster Object Type -- raster spatial objects used to locate zero-, two-, or three-dimensional locations in the data set.
Type: text
Domain: (With the exception of "voxel", the domain is from "Spatial Data Concepts," which is chapter 2 of part 1 *in* Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, Department of Commerce, National Institute of Standards and Technology):
"Point" "Pixel" "Grid Cell" "Voxel"
Short Name: rasttype

3.4.2 Row Count -- the maximum number of raster objects along the ordinate (y) axis. For use with rectangular raster objects.
Type: Integer
Domain: Row Count > 0
Short Name: rowcount

3.4.3 Column Count -- the maximum number of raster objects along the abscissa (x) axis. For use with rectangular raster objects.
Type: Integer
Domain: Column Count > 0
Short Name: colcount

3.4.4 Vertical Count -- the maximum number of raster objects along the vertical (z) axis. For use with rectangular volumetric raster objects (voxels).
Type: Integer
Domain: Depth Count > 0
Short Name: vrtcount

Spatial Reference Information

4 Spatial Reference Information -- the description of the reference frame for, and the means to encode, coordinates in the data set.

Type: compound
Short Name: spref

```
Spatial_Reference_Information =
                    0{Horizontal_Coordinate_System_Definition}1 +
                    0{Vertical_Coordinate_System_Definition}1

    Horizontal_Coordinate_System_Definition =
                    [Geographic |
                        1{Planar}n |
                        Local] +
                    0{Geodetic_Model}1

        Geographic =
                    Latitude_Resolution +
                    Longitude_Resolution +
                    Geographic_Coordinate_Units

        Planar =
                    [Map_Projection |
                        Grid_Coordinate_System |
                        Local_Planar] +
                    Planar_Coordinate_Information

            Map_Projection =
                    Map_Projection_Name +
                    [Albers_Conical_Equal_Area |
                        Azimuthal_Equidistant |
                        Equidistant_Conic |
                        Equirectangular |
                        General_Vertical_Near-sided_Perspective |
                        Gnomonic |
                        Lambert_Azimuthal_Equal_Area |
                        Lambert_Conformal_Conic |
                        Mercator |
                        Modified_Stereographic_for_Alaska |
                        Miller_Cylindrical |
                        Oblique_Mercator |
                        Orthographic |
                        Polar_Stereographic |
                        Polyconic |
                        Robinson |
                        Sinusoidal |
                        Space_Oblique_Mercator_(Landsat) |
                        Stereographic |
                        Transverse Mercator |
```

```
                van_der_Grinten |
                Map_Projection_Parameters]

Albers_Conical_Equal_Area =
        1{Standard_Parallel}2 +
        Longitude_of_Central_Meridian +
        Latitude_of_Projection_Origin +
        False_Easting +
        False_Northing

Azimuthal_Equidistant =
        Longitude_of_Central_Meridian +
        Latitude_of_Projection_Origin +
        False_Easting +
        False_Northing

Equidistant_Conic =
        1{Standard_Parallel}2 +
        Longitude_of_Central_Meridian +
        Latitude_of_Projection_Origin +
        False_Easting +
        False_Northing

Equirectangular =
        Standard_Parallel +
        Longitude_of_Central_Meridian +
        False_Easting +
        False_Northing

General_Vertical_Near-sided_Perspective =
        Height_of_Perspective_Point_Above_Surface +
        Longitude_of_Projection_Center +
        Latitude_of_Projection_Center +
        False_Easting +
        False_Northing

Gnomonic =
        Longitude_of_Projection_Center +
        Latitude_of_Projection_Center +
        False_Easting +
        False_Northing

Lambert_Azimuthal_Equal_Area =
        Longitude_of_Projection_Center +
        Latitude_of_Projection_Center +
        False_Easting +
        False_Northing

Lambert_Conformal_Conic =
        1{Standard_Parallel}2 +
```

```
        Longitude_of_Central_Meridian +
        Latitude_of_Projection_Origin +
        False_Easting +
        False_Northing

Mercator =
        [Standard_Parallel |
                Scale_Factor_at_Equator] +
        Longitude_of_Central_Meridian +
        False_Easting +
        False_Northing

Modified_Stereographic_for_Alaska =
        False_Easting +
        False_Northing

Miller_Cylindrical =
        Longitude_of_Central_Meridian +
        False_Easting +
        False_Northing

Oblique_Mercator =
        Scale_Factor_at_Center_Line +
        [Oblique_Line_Azimuth |
                Oblique_Line_Point] +
        Latitude_of_Projection_Origin +
        False_Easting +
        False_Northing

Oblique_Line_Azimuth =
        Azimuthal_Angle +
        Azimuth_Measure_Point_Longitude

Oblique_Line_Point =
        2{Oblique_Line_Latitude +
                Oblique_Line_Longitude}2

Orthographic =
        Longitude_of_Projection_Center +
        Latitude_of_Projection_Center +
        False_Easting +
        False_Northing

Polar_Stereographic =
        Straight-Vertical_Longitude_from_Pole +
        [Standard_Parallel |
                Scale_Factor_at_Projection_Origin] +
        False_Easting +
        False_Northing
```

Polyconic =
Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

Robinson =
Longitude_of_Projection_Center +
False_Easting +
False_Northing

Sinusoidal =
Longitude_of_Central_Meridian +
False_Easting +
False_Northing

Space_Oblique_Mercator_(Landsat) =
Landsat_Number +
Path_Number +
False_Easting +
False_Northing

Stereographic =
Longitude_of_Projection_Center +
Latitude_of_Projection_Center +
False_Easting +
False_Northing

Transverse_Mercator =
Scale_Factor_at_Central_Meridian +
Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

van_der_Grinten =
Longitude_of_Central_Meridian +
False_Easting +
False_Northing

Map_Projection_Parameters =
Appropriate data elements 4.1.2.1.23.1 through 4.1.2.1.23.18 to document the map projection parameters.

Grid_Coordinate_System =
Grid_Coordinate_System_Name +
[Universal_Transverse_Mercator |
Universal_Polar_Stereographic |
State_Plane_Coordinate_System |
ARC_Coordinate_System |

```
                    Other_Grid_System's_Definition]

            Universal_Transverse_Mercator =
                UTM_Zone_Number +
                Transverse_Mercator

            Universal_Polar_Stereographic =
                UPS_Zone_Identifier +
                Polar_Stereographic

            State_Plane_Coordinate_System =
                SPCS_Zone_Identifier +
                [Lambert_Conformal_Conic |
                        Transverse_Mercator |
                        Oblique_Mercator |
                        Polyconic]

            ARC_Coordinate_System =
                ARC_System_Zone_Identifier +
                [Equirectangular |
                    Azimuthal_Equidistant]

        Local_Planar =
                Local_Planar_Description +
                Local_Planar_Georeference_Information

        Planar_Coordinate_Information =
                Planar_Coordinate_Encoding_Method +
                [Coordinate_Representation |
                    Distance_and_Bearing_Representation] +
                Planar_Distance_Units

            Coordinate_Representation =
                Abscissa_Resolution +
                Ordinate_Resolution

            Distance_and_Bearing_Representation =
                Distance_Resolution +
                Bearing_Resolution +
                Bearing_Units +
                Bearing_Reference_Direction +
                Bearing_Reference_Meridian

    Local =
                Local_Description +
                Local_Georeference_Information

    Geodetic_Model =
                0{Horizontal_Datum_Name}1 +
                Ellipsoid_Name +
```

Semi-major_Axis +
Denominator_of_Flattening_Ratio

Vertical_Coordinate_System_Definition =
0{Altitude_System_Definition}1 +
0{Depth_System_Definition}1

Altitude_System_Definition =
Altitude_Datum_Name +
1{Altitude_Resolution}n +
Altitude_Distance_Units +
Altitude_Encoding_Method

Depth_System_Definition =
Depth_Datum_Name +
1{Depth_Resolution}n +
Depth_Distance_Units +
Depth_Encoding_Method

4.1 Horizontal Coordinate System Definition -- the reference frame or system from which linear or angular quantities are measured and assigned to the position that a point occupies.
Type: compound
Short Name: horizsys

4.1.1 Geographic -- the quantities of latitude and longitude which define the position of a point on the Earth's surface with respect to a reference spheroid.
Type: compound
Short Name: geograph

4.1.1.1 Latitude Resolution -- the minimum difference between two adjacent latitude values expressed in Geographic Coordinate Units of measure.
Type: real
Domain: Latitude Resolution > 0.0
Short Name: latres

4.1.1.2 Longitude Resolution -- the minimum difference between two adjacent longitude values expressed in Geographic Coordinate Units of measure.
Type: real
Domain: Longitude Resolution > 0.0
Short Name: longres

4.1.1.3 Geographic Coordinate Units -- units of measure used for the latitude and longitude values.
Type: text
Domain: "Decimal degrees" "Decimal minutes" "Decimal seconds" "Degrees and decimal minutes" "Degrees, minutes, and decimal seconds" "Radians" "Grads"
Short Name: geogunit

4.1.2 Planar -- the quantities of distances, or distances and angles, which define the position of a

point on a reference plane to which the surface of the Earth has been projected.
Type: compound
Short Name: planar

4.1.2.1 Map Projection -- the systematic representation of all or part of the surface of the Earth on a plane or developable surface.
Type: compound
Short Name: mapproj

4.1.2.1.1 Map Projection Name -- name of the map projection.
Type: text
Domain: "Albers Conical Equal Area" "Azimuthal Equidistant" "Equidistant Conic" "Equirectangular" "General Vertical Near-sided Projection" "Gnomonic" "Lambert Azimuthal Equal Area" "Lambert Conformal Conic" "Mercator" "Modified Stereographic for Alaska" "Miller Cylindrical" "Oblique Mercator" "Orthographic" "Polar Stereographic" "Polyconic" "Robinson" "Sinusoidal" "Space Oblique Mercator" "Stereographic" "Transverse Mercator" "van der Grinten" free text
Short Name: mapprojn

4.1.2.1.2 Albers Conical Equal Area -- contains parameters for the Albers Conical Equal Area projection.
Type: compound
Short Name: albers

4.1.2.1.3 Azimuthal Equidistant -- contains parameters for the Azimuthal Equidistant projection.
Type: compound
Short Name:azimequi

4.1.2.1.4 Equidistant Conic -- contains parameters for the Equidistant Conic projection.
Type: compound
Short Name: equicon

4.1.2.1.5 Equirectangular -- contains parameters for the Equirectangular projection.
Type: compound
Short Name: equirect

4.1.2.1.6 General Vertical Near-sided Perspective -- contains parameters for the General Vertical Near-sided Perspective projection.
Type: compound
Short Name: gvnsp

4.1.2.1.7 Gnomonic -- contains parameters for the Gnomonic projection.
Type: compound
Short Name: gnomonic

4.1.2.1.8 Lambert Azimuthal Equal Area -- contains parameters for the Lambert Azimuthal Equal Area projection.

Type: compound
Short Name: lamberta

4.1.2.1.9 Lambert Conformal Conic -- contains parameters for the Lambert Conformal Conic projection.
Type: compound
Short Name:lambertc

4.1.2.1.10 Mercator -- contains parameters for the Mercator projection
Type: compound
Short Name: mercator

4.1.2.1.11 Modified Stereographic for Alaska -- contains parameters for the Modified Stereographic for Alaska projection.
Type: compound
Short Name: modsak

4.1.2.1.12 Miller Cylindrical -- contains parameters for the Miller Cylindrical projection.
Type: compound
Short Name: miller

4.1.2.1.13 Oblique Mercator -- contains parameters for the Oblique Mercator projection.

Type: compound
Short Name: obqmerc

4.1.2.1.14 Orthographic -- contains parameters for the Orthographic projection.
Type: compound
Short Name:orthogr

4.1.2.1.15 Polar Stereographic -- contains parameters for the Polar Stereographic projection.
Type: compound
Short Name:polarst

4.1.2.1.16 Polyconic -- contains parameters for the Polyconic projection.
Type: compound
Short Name:polycon

4.1.2.1.17 Robinson -- contains parameters for the Robinson projection.
Type: compound
Short Name: robinson

4.1.2.1.18 Sinusoidal -- contains parameters for the Sinusoidal projection.
Type: compound
Short Name: sinusoid

4.1.2.1.19 Space Oblique Mercator (Landsat) -- contains parameters for the Space Oblique Mercator (Landsat) projection.
Type: compound

Short Name: spaceobq

4.1.2.1.20 Stereographic -- contains parameters for the Stereographic projection.
Type: compound
Short Name: stereo

4.1.2.1.21 Transverse Mercator -- contains parameters for theTransverse mercator projection.
Type: compound
Short Name: transmer

4.1.2.1.22 van der Grinten -- contains parameters for the van der Grinten projection.
Type: compound
Short Name: vdgrin

4.1.2.1.23 Map Projection Parameters -- a complete parameter set of the projection that was used for the data set. The information provided shall include the names of the parameters and values used for the data set that describe the mathematical relationship between the Earth and the plane or developable surface for the projection.
Type: compound

4.1.2.1.23.1 Standard Parallel -- line of constant latitude at which the surface of the Earth and the plane or developable surface intersect.
Type: real
Domain: -90.0 <= Standard Parallel <= 90.0
Short Name: stdparll

4.1.2.1.23.2 Longitude of Central Meridian -- the line of longitude at the center of a map projection generally used as the basis for constructing the projection.
Type: real
Domain: -180.0 <= Longitude of Central Meridian < 180.0
Short Name: longcm

4.1.2.1.23.3 Latitude of Projection Origin -- latitude chosen as the origin of rectangular coordinates for a map projection.
Type: real
Domain: -90.0 <= Latitude of Projection Origin <= 90.0
Short Name: latprjo

4.1.2.1.23.4 False Easting -- the value added to all "x" values in the rectangular coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units.
Type: real
Domain: free real
Short Name: feast

4.1.2.1.23.5 False Northing -- the value added to all "y" values in the rectangular

coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units.
Type: real
Domain: free real
Short Name: fnorth

4.1.2.1.23.6 Scale Factor at Equator -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance along the equator.
Type: real
Domain: Scale Factor at Equator > 0.0
Short Name: sfequat

4.1.2.1.23.7 Height of Perspective Point Above Surface -- height of viewpoint above the Earth, expressed in meters.
Type: real
Domain: Height of Perspective Point Above Surface > 0.0
Short Name: heightpt

4.1.2.1.23.8 Longitude of Projection Center -- longitude of the point of projection for azimuthal projections.
Type: real
Domain: -180.0 <= Longitude of Projection Center < 180.0
Short Name: longpc

4.1.2.1.23.9 Latitude of Projection Center -- latitude of the point of projection for azimuthal projections.
Type: real
Domain: -90.0 <= Latitude of Projection Center <= 90.0
Short Name: latprjc

4.1.2.1.23.10 Scale Factor at Center Line -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance along the center line.
Type: real
Domain: Scale Factor at Center Line > 0.0
Short Name: sfctrlin

4.1.2.1.23.11 Oblique Line Azimuth -- method used to describe the line along which an oblique mercator map projection is centered using the map projection origin and an azimuth.
Type: compound
Short Name: obqlazim

4.1.2.1.23.11.1 Azimuthal Angle -- angle measured clockwise from north, and expressed in degrees.
Type: real
Domain: 0.0 <= Azimuthal Angle < 360.0
Short Name: azimangl

4.1.2.1.23.11.2 Azimuth Measure Point Longitude -- longitude of the map projection origin.
Type: real
Domain: -180.0 <= Azimuth Measure Point Longitude < 180.0
Short Name: azimptl

4.1.2.1.23.12 Oblique Line Point -- method used to describe the line along which an oblique mercator map projection is centered using two points near the limits of the mapped region that define the center line.
Type: compound
Short Name: obqlpt

4.1.2.1.23.12.1 Oblique Line Latitude -- latitude of a point defining the oblique line.
Type: real
Domain: -90.0 <= Oblique Line Latitude <= 90.0
Short Name: obqllat

4.1.2.1.23.12.2 Oblique Line Longitude -- longitude of a point defining the oblique line.
Type: real
Domain: -180.0 <= Oblique Line Longitude < 180.0
Short Name: obqllong

4.1.2.1.23.13 Straight Vertical Longitude from Pole -- longitude to be oriented straight up from the North or South Pole.
Type: real
Domain: -180.0 <= Straight Vertical Longitude from Pole < 180.0
Short Name: svlong

4.1.2.1.23.14 Scale Factor at Projection Origin -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance at the projection origin.
Type: real
Domain: Scale Factor at Projection Origin > 0.0
Short Name: sfprjorg

4.1.2.1.23.15 Landsat Number -- number of the Landsat satellite. *(Note: This data element exists solely to provide a parameter needed to define the space oblique mercator projection. It is not used to identify data originating from a remote sensing vehicle.)*
Type: Integer
Domain: free integer
Short Name: landsat

4.1.2.1.23.16 Path Number -- number of the orbit of the Landsat satellite. *(Note: This data element exists solely to provide a parameter needed to define the space oblique mercator projection. It is not used to identify data*

originating from a remote sensing vehicle.)
Type: integer
Domain: 0 < Path Number < 251 for Landsats 1, 2, or 3
0 < Path Number < 233 for Landsats 4 or 5, free integer
Short Name: pathnum

4.1.2.1.23.17 Scale Factor at Central Meridian -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance along the central meridian.
Type: real
Domain: Scale Factor at Central Meridian > 0.0
Short Name: sfctrmer

4.1.2.1.23.18 Other Projection's Definition -- a description of a projection, not defined elsewhere in the standard, that was used for the data set. The information provided shall include the name of the projection, names of parameters and values used for the data set, and the citation of the specification for the algorithms that describe the mathematical relationship between Earth and plane or developable surface for the projection.
Type: text
Domain: free text

4.1.2.2 Grid Coordinate System -- a plane-rectangular coordinate system usually based on, and mathematically adjusted to, a map projection so that geographic positions can be readily transformed to and from plane coordinates.
Type: compound
Short Name gridsys

4.1.2.2.1 Grid Coordinate System Name -- name of the grid coordinate system.
Type: text
Domain: "Universal Transverse Mercator"
"Universal Polar Stereographic" "State Plane Coordinate System 1927"
"State Plane Coordinate System 1983" "ARC Coordinate System"
"other grid system"
Short Name: gridsysn

4.1.2.2.2 Universal Transverse Mercator (UTM) -- a grid system based on the transverse mercator projection, applied between latitudes 84 degrees north and 80 degrees south on the Earth's surface.
Type: compound
Short Name: utm

4.1.2.2.2.1 UTM Zone Number -- identifier for the UTM zone.
Type: integer
Domain: 1 <= UTM Zone Number <= 60 for the northern hemisphere;
-60 <= UTM Zone Number <= -1 for the southern hemisphere
Short Name: utmzone

4.1.2.2.3 Universal Polar Stereographic (UPS) -- a grid system based on the polar stereographic projection, applied to the Earth's polar regions north of 84 degrees north and south of 80 degrees south.
Type: compound
Short Name: ups

4.1.2.2.3.1 UPS Zone Identifier -- identifier for the UPS zone.
Type: text
Domain: "A" "B" "Y" "Z"
Short Name: upszone

4.1.2.2.4 State Plane Coordinate System (SPCS) -- a plane-rectangular coordinate system established for each state in the United States by the National Geodetic Survey.
Type: compound
Short Name: spcs

4.1.2.2.4.1 SPCS Zone Identifier -- identifier for the SPCS zone.
Type: text
Domain: Four-digit numeric codes for the State Plane Coordinate Systems based on the North American Datum of 1927 are found in Department of Commerce, 1986, Representation of geographic point locations for information interchange (Federal Information Processing Standard 70-1): Washington: Department of Commerce, National Institute of Standards and Technology. Codes for the State Plane Coordinate Systems based on the North American Datum of 1983 are found in Department of Commerce, 1989 (January), State Plane Coordinate System of 1983 (National Oceanic and Atmospheric Administration Manual NOS NGS 5): Silver Spring, Maryland, National Oceanic and Atmospheric Administration, National Ocean Service, Coast and Geodetic Survey.
Short Name: spcszone

4.1.2.2.5 ARC Coordinate System -- the Equal Arc-second Coordinate System, a plane-rectangular coordinate system established in Department of Defense, 1990, Military specification ARC Digitized Raster Graphics (ADRG) (MIL-A-89007): Philadelphia, Department of Defense, Defense Printing Service Detachment Office.
Type: compound
Short Name: arcsys

4.1.2.2.5.1 ARC System Zone Identifier -- identifier for the ARC Coordinate System Zone.
Type: integer
Domain: 1 <= ARC System Zone Identifier <= 18
Short Name: arczone

4.1.2.2.6 Other Grid System's Definition -- a complete description of a grid system, not defined elsewhere in this standard, that was used for the data set. The information provided shall include the name of the grid system, the names of

the parameters and values used for the data set, and the citation of the specification for the algorithms that describe the mathematical relationship between the Earth and the coordinates of the grid system.
Type: text
Domain: free text
Short Name: othergrd

4.1.2.3 Local Planar -- any right-handed planar coordinate system of which the z-axis coincides with a plumb line through the origin that locally is aligned with the surface of the Earth.
Type: compound
Short Name: localp

4.1.2.3.1 Local Planar Description -- a description of the local planar system.
Type: text
Domain: free text
Short Name: localpd

4.1.2.3.2 Local Planar Georeference Information -- a description of the information provided to register the local planar system to the Earth (e.g. control points, satellite ephemeral data, inertial navigation data).
Type: text
Domain: free text
Short Name: localpgi

4.1.2.4 Planar Coordinate Information -- information about the coordinate system developed on the planar surface.
Type: compound
Short Name: planci

4.1.2.4.1 Planar Coordinate Encoding Method -- the means used to represent horizontal positions.
Type: text
Domain: "coordinate pair" "distance and bearing" "row and column"
Short Name: plance

4.1.2.4.2 Coordinate Representation -- the method of encoding the position of a point by measuring its distance from perpendicular reference axes (the "coordinate pair" and "row and column" methods).
Type: compound
Short Name: coordrep

4.1.2.4.2.1 Abscissa Resolution -- the (nominal) minimum distance between the "x" or column values of two adjacent points, expressed in Planar Distance Units of measure.
Type: real
Domain: Abscissa Resolution > 0.0
Short Name: absres

4.1.2.4.2.2 Ordinate Resolution -- the (nominal) minimum distance between the "y"

or row values of two adjacent points, expressed in Planar Distance Units of measure.
Type: real
Domain: Ordinate Resolution > 0.0
Short Name: ordres

4.1.2.4.3 Distance and Bearing Representation -- a method of encoding the position of a point by measuring its distance and direction (azimuth angle) from another point.
Type: compound
Short Name: distbrep

4.1.2.4.3.1 Distance Resolution -- the minimum distance measurable between two points, expressed Planar Distance Units of measure.
Type: real
Domain: Distance Resolution > 0.0
Short Name: distres

4.1.2.4.3.2 Bearing Resolution -- the minimum angle measurable between two points, expressed in Bearing Units of measure.
Type: real
Domain: Bearing Resolution > 0.0
Short Name: bearres

4.1.2.4.3.3 Bearing Units -- units of measure used for angles.
Type: text
Domain: "Decimal degrees" "Decimal minutes" "Decimal seconds" “Degrees and decimal minutes" "Degrees, minutes, and decimal seconds" "Radians" "Grads"
Short Name: bearunit

4.1.2.4.3.4 Bearing Reference Direction -- direction from which the bearing is measured.
Type: text
Domain: "North" "South"
Short Name: bearrefd

4.1.2.4.3.5 Bearing Reference Meridian -- axis from which the bearing is measured.
Type: text
Domain: "Assumed" "Grid" "Magnetic" "Astronomic" "Geodetic"
Short Name: bearrefm

4.1.2.4.4 Planar Distance Units -- units of measure used for distances.
Type: text
Domain: "meters" "international feet" "survey feet" free text
Short Name: plandu

4.1.3 Local -- a description of any coordinate system that is not aligned with the surface of the Earth.
Type: compound

Short Name: local

4.1.3.1 Local Description -- a description of the coordinate system and its orientation to the surface of the Earth.
Type: text
Domain: free text
Short Name: localdes

4.1.3.2 Local Georeference Information -- a description of the information provided to register the local system to the Earth (e.g. control points, satellite ephemeral data, inertial navigation data).
Type: text
Domain: free text
Short Name: localgeo

4.1.4 Geodetic Model -- parameters for the shape of the earth.
Type: compound
Short Name: geodetic

4.1.4.1 Horizontal Datum Name -- the identification given to the reference system used for defining the coordinates of points.
Type: text
Domain: "North American Datum of 1927" "North American Datum of 1983" free text
Short Name: horizdn

4.1.4.2 Ellipsoid Name -- identification given to established representations of the Earth's shape.
Type: text
Domain: "Clarke 1866" "Geodetic Reference System 80" free text
Short Name: ellips

4.1.4.3 Semi-major Axis -- radius of the equatorial axis of the ellipsoid.
Type: real
Domain: Semi-major Axis > 0.0
Short Name: semiaxis

4.1.4.4 Denominator of Flattening Ratio -- the denominator of the ratio of the difference between the equatorial and polar radii of the ellipsoid when the numerator is set to 1.
Type: real
Domain: Denominator of Flattening > 0.0
Short Name: denflat

4.2 Vertical Coordinate System Definition -- the reference frame or system from which vertical distances (altitudes or depths) are measured.
Type: compound
Short Name: vertdef

4.2.1 Altitude System Definition -- the reference frame or system from which altitudes (elevations) are measured. The term "altitude"' is used instead of the common term "elevation" to

conform to the terminology in Federal Information Processing Standards 70-1 and 173.
Type: compound
Short Name: altsys

4.2.1.1 Altitude Datum Name -- the identification given to the surface taken as the surface of reference from which altitudes are measured.
Type: text
Domain: "National Geodetic Vertical Datum of 1929" "North American Vertical Datum of 1988" free text
Short Name: altdatum

4.2.1.2 Altitude Resolution -- the minimum distance possible between two adjacent altitude values, expressed in Altitude Distance Units of measure.
Type: real
Domain: Altitude Resolution > 0.0
Short Name: altres

4.2.1.3 Altitude Distance Units -- units in which altitudes are recorded.
Type: text
Domain: "meters" "feet" free text
Short Name: altunits

4.2.1.4 Altitude Encoding Method -- the means used to encode the altitudes.
Type: text
Domain: "Explicit elevation coordinate included with horizontal coordinates" "Implicit coordinate" "Attribute values"
Short Name: altenc

4.2.2 Depth System Definition -- the reference frame or system from which depths are measured.
Type: compound
Short Name: depthsys

4.2.2.1 Depth Datum Name -- the identification given to surface of reference from which depths are measured.
Type: text
Domain: "Local surface" "Chart datum; datum for sounding reduction" "Lowest astronomical tide" "Highest astronomical tide" "Mean low water" "Mean high water" "Mean sea level" "Land survey datum" "Mean low water springs" "Mean high water springs" "Mean low water neap" "Mean high water neap" "Mean lower low water" "Mean lower low water springs" "Mean higher high water" "Mean higher low water" "Mean lower high water" "Spring tide" "Tropic lower low water" "Neap tide" "High water" "Higher high water" "Low water" "Low-water datum" "Lowest low water" "Lower low water" "Lowest normal low water" "Mean tide level" "Indian spring low water" "High-water full and charge" "Low-water full and charge" "Columbia River datum" "Gulf Coast low water datum" "Equatorial springs low water" "Approximate lowest astronomical tide" "No correction" free text
Short Name: depthdn

4.2.2.2 Depth Resolution -- the minimum distance possible between two adjacent depth values, expressed in Depth Distance Units of measure.
Type: real
Domain: Depth Resolution > 0.0
Short Name: depthres

4.2.2.3 Depth Distance Units -- units in which depths are recorded.
Type: text
Domain: "meters" "feet" free text
Short Name: depthdu

4.2.2.4 Depth Encoding Method -- the means used to encode depths.
Type: text
Domain: "Explicit depth coordinate included with horizontal coordinates" "Implicit coordinate" "Attribute values"
Short Name: depthem

Entity and Attribute Information

5 Entity and Attribute Information -- details about the information content of the data set, including the entity types, their attributes, and the domains from which attribute values may be assigned.

Type: compound
Short Name: eainfo

```
Entity_and_Attribute_Information =
                    [1{Detailed_Description}n |
                        1{Overview_Description}n |
                        1{Detailed_Description}n +
                        1{Overview_Description}n]

    Detailed_Description =
                    Entity_Type +
                        0{Attribute}n

        Entity_Type =
                    Entity_Type_Label +
                    Entity_Type_Definition +
                    Entity_Type_Definition_Source

        Attribute =
                    Attribute_Label +
                    Attribute_Definition +
                    Attribute_Definition_Source +
                    1{Attribute_Domain_Values}n +
                    0{Beginning_Date_of_Attribute_Values +
                        0{Ending_Date_of_Attribute_Values}1}n +
                    (Attribute_Value_Accuracy_Information) +
                    (Attribute_Measurement_Frequency)

            Attribute_Domain_Values =
                    [Enumerated_Domain |
                        Range_Domain |
                        Codeset_Domain |
                        Unrepresentable_Domain]

                Enumerated_Domain =
                    1{Enumerated_Domain_Value +
                        Enumerated_Domain_Value_Definition +
                        Enumerated_Domain_Value_Definition_Source +
                        0{Attribute}n }n

                Range_Domain =
                    Range_Domain_Minimum +
                    Range_Domain_Maximum +
                    0{Attribute_Units_of_Measure}1 +
                    (Attribute_Measurement_Resolution) +
                    0{Attribute}n
```

Codeset_Domain=
Codeset_Name +
Codeset_Source

Attribute_Value_Accuracy_Information =
Attribute_Value_Accuracy +
Attribute_Value_Accuracy_Explanation

Overview_Description =
Entity_and_Attribute_Overview +
1{Entity_and_Attribute_Detail_Citation}n

5.1 Detailed Description -- description of the entities, attributes, attribute values, and related characteristics encoded in the data set.
Type: compound
Short Name: detailed

5.1.1 Entity Type -- the definition and description of a set into which similar entity instances are classified.
Type: compound
Short Name: enttype

5.1.1.1 Entity Type Label -- the name of the entity type.
Type: text
Domain: free text
Short Name: enttypl

5.1.1.2 Entity Type Definition -- the description of the entity type.
Type: text
Domain: free text
Short Name: enttypd

5.1.1.3 Entity Type Definition Source -- the authority of the definition.
Type: text
Domain: free text
Short Name: enttypds

5.1.2 Attribute -- a defined characteristic of an entity.
Type: compound
Short Name: attr

5.1.2.1 Attribute Label -- the name of the attribute.
Type: text
Domain: free text
Short Name: attrlabl

5.1.2.2 Attribute Definition -- the description of the attribute.
Type: text
Domain: free text
Short Name: attrdef

5.1.2.3 Attribute Definition Source -- the authority of the definition.
Type: text
Domain: free text
Short Name: attrdefs

5.1.2.4 Attribute Domain Values -- the valid values that can be assigned for an attribute.
Type: compound
Short Name: attrdomv

5.1.2.4.1 Enumerated Domain -- the members of an established set of valid values.
Type: compound
Short Name: edom

5.1.2.4.1.1 Enumerated Domain Value -- the name or label of a member of the set.
Type: text
Domain: free text
Short Name: edomv

5.1.2.4.1.2 Enumerated Domain Value Definition -- the description of the value.
Type: text
Domain: free text
Short Name: edomvd

5.1.2.4.1.3 Enumerated Domain Value Definition Source -- the authority of the definition.
Type: text
Domain: free text
Short Name: edomvds

5.1.2.4.2 Range Domain -- the minimum and maximum values of a continuum of valid values.
Type: compound
Short Name: rdom

5.1.2.4.2.1 Range Domain Minimum -- the least value that the attribute can be assigned.
Type: text
Domain: free text
Short Name: rdommin

5.1.2.4.2.2 Range Domain Maximum -- the greatest value that the attribute can be assigned.
Type: text
Domain: free text
Short Name: rdommax

5.1.2.4.2.3 Attribute Units of Measure -- the standard of measurement for an attribute value.
Type: text
Domain: free text

Short Name: attrunit

5.1.2.4.2.4 Attribute Measurement Resolution -- the smallest unit increment to which an attribute value is measured.
Type: real
Domain: Attribute Measurement Resolution > 0.0
Short Name: attrmres

5.1.2.4.3 Codeset Domain -- reference to a standard or list which contains the members of an established set of valid values.
Type: compound
Short Name: codesetd

5.1.2.4.3.1 Codeset Name -- the title of the codeset.
Type: text
Domain: free text
Short Name: codesetn

5.1.2.4.3.2 Codeset Source -- the authority for the codeset.
Type: text
Domain: free text
Short Name: codesets

5.1.2.4.4 Unrepresentable Domain -- description of the values and reasons why they cannot be represented.
Type: text
Domain: free text
Short Name: udom

5.1.2.5 Beginning Date of Attribute Values -- earliest or only date for which the attribute values are current. In cases when a range of dates are provided, this is the earliest date for which the information is valid.
Type: date
Domain: free date
Short Name: begdatea

5.1.2.6 Ending Date of Attribute Values -- latest date for which the information is current. Used in cases when a range of dates are provided.
Type: date
Domain: free date
Short Name: enddatea

5.1.2.7 Attribute Value Accuracy Information -- an assessment of the accuracy of the assignment of attribute values.
Type: compound
Short Name: attrvai

5.1.2.7.1 Attribute Value Accuracy -- an estimate of the accuracy of the assignment of attribute values.
Type: real

Domain: free real
Short Name: attrva

5.1.2.7.2 Attribute Value Accuracy Explanation -- the definition of the Attribute Value Accuracy measure and units, and a description of how the estimate was derived.
Type: text
Domain: free text
Short Name: attrvae

5.1.2.8 Attribute Measurement Frequency -- the frequency with which attribute values are added.
Type: real
Domain: "Unknown" "As needed" "Irregular" "None planned" free text
Short Name: attrmfrq

5.2 Overview Description -- summary of, and citation to detailed description of, the information content of the data set.
Type: compound
Short Name: overview

5.2.1 Entity and Attribute Overview -- detailed summary of the information contained in a data set.
Type: text
Domain: free text
Short Name: eaover

5.2.2 Entity and Attribute Detail Citation -- reference to the complete description of the entity types, attributes, and attribute values for the data set.
Type: text
Domain: free text
Short Name: eadetcit

Distribution Information

6 Distribution Information -- information about the distributor of and options for obtaining the data set.

Type: compound
Short Name: distinfo

```
Distribution_Information =
                    Distributor +
                    0{Resource_Description}1 +
                    Distribution_Liability +
                    0{Standard_Order_Process}n +
                    0{Custom_Order_Process}1 +
                    (Technical_Prerequisites) +
                    (Available_Time_Period)

    Distributor =
                    Contact_Information  (see section 10 for production rules)

    Standard_Order_Process =
                    [Non-digital_Form |
                        1{Digital_Form}n ] +
                    Fees +
                    (Ordering_Instructions) +
                    (Turnaround)

        Digital_Form =
                    Digital_Transfer_Information +
                    Digital_Transfer_Option

            Digital_Transfer_Information =
                    Format_Name +
                    ([Format_Version_Number |
                        Format_Version_Date] +
                            (Format_Specification) ) +
                    (Format_Information_Content) +
                    0{File_Decompression_Technique}1 +
                    (Transfer_Size)

            Digital_Transfer_Option =
                    1{ [Online_Option |
                        Offline_Option] }n

                Online_Option =
                    1{Computer_Contact_Information}n +
                    (Access_Instructions) +
                    (Online_Computer_and_Operating_System)

                    Computer_Contact_Information =
                        [Network_Address |
```

Dialup_Instructions]

Network_Address =
1{Network_Resource_Name}n

Dialup_Instructions =
Lowest_BPS +
0{Highest_BPS}1 +
Number_DataBits +
Number_StopBits +
Parity +
0{Compression_Support}1 +
1{Dialup_Telephone}n +
1{Dialup_File_Name}n

Offline_Option =
Offline_Media +
0{Recording_Capacity}1
1{Recording_Format}n +
0{Compatibility_Information}1

Recording_Capacity =
1{Recording Density}n +
Recording_Density_Units

Available_Time_Period =
Time_Period_Information *(see section 9 for production rules)*

6.1 Distributor -- the party from whom the data set may be obtained.
Type: compound
Short Name: distrib

6.2 Resource Description -- the identifier by which the distributor knows the data set.
Type: text
Domain: free text
Short Name: resdesc

6.3 Distribution Liability -- statement of the liability assumed by the distributor.
Type: text
Domain: free text
Short Name: distliab

6.4 Standard Order Process -- the common ways in which the data set may be obtained or received, and related instructions and fee information.
Type: compound
Short Name: stdorder

6.4.1 Non-digital Form -- the description of options for obtaining the data set on non-computer-compatible media.
Type: text

Domain: free text
Short Name: nondig

6.4.2 Digital Form -- the description of options for obtaining the data set on computer-compatible media.
Type: compound
Short Name: digform

6.4.2.1 Digital Transfer Information - description of the form of the data to be distributed.
Type: compound
Short Name: digtinfo

6.4.2.1.1 Format Name -- the name of the data transfer format.
Type: text
Domain: domain values from the table below; free text
Short Name: formname

Domain Value	Definition
"ARCE"	ARC/INFO Export format
"ARCG"	ARC/INFO Generate format
"ASCII"	ASCII file, formatted for text attributes, declared format
"BIL"	Imagery, band interleaved by line
"BIP"	Imagery, band interleaved by pixel
"BSQ"	Imagery, band interleaved sequential
"CDF"	Common Data Format
"CFF"	Cartographic Feature File (U.S. Forest Service)
"COORD"	User-created coordinate file, declared format
"DEM"	Digital Elevation Model format (U.S. Geological Survey)
"DFAD"	Digital Feature Analysis Data (National Imagery and Mapping Agency)
"DGN"	Microstation format (Intergraph Corporation)
"DIGEST"	Digital Geographic Information Exchange Standard
"DLG"	Digital Line Graph (U.S. Geological Survey)
"DTED"	Digital Terrain Elevation Data (MIL-D-89020)
"DWG"	AutoCAD Drawing format
"DX90"	Data Exchange '90
"DXF"	AutoCAD Drawing Exchange Format
"ERDAS"	ERDAS image files (ERDAS Corporation)
"GRASS"	Geographic Resources Analysis Support System
"HDF"	Hierarchical Data Format
"IGDS"	Interactive Graphic Design System format (Intergraph Corporation)
"IGES"	Initial Graphics Exchange Standard
"MOSS"	Multiple Overlay Statistical System export file
"netCDF"	network Common Data Format
"NITF"	National Imagery Transfer Format
"RPF"	Raster Product Format

	(National Imagery and Mapping Agency)
"RVC"	Raster Vector Converted format (MicroImages)
"RVF"	Raster Vector Format (MicroImages)
"SDTS"	Spatial Data Transfer Standard (Federal Information Processing Standard 173)
"SIF"	Standard Interchange Format (DOD Project 2851)
"SLF"	Standard Linear Format (National Imagery and Mapping Agency)
"TIFF"	Tagged Image File Format
"TGRLN"	Topologically Integrated Geographic Encoding and Referencing (TIGER) Line format (Bureau of the Census)
"VPF"	Vector Product Format (National Imagery and Mapping Agency)

6.4.2.1.2 Format Version Number -- version number of the format.
Type: text
Domain: free text
Short Name: formvern

6.4.2.1.3 Format Version Date -- date of the version of the format.
Type: date
Domain: free date
Short Name: formverd

6.4.2.1.4 Format Specification -- name of a subset, profile, or product specification of the format.
Type: text
Domain: free text
Short Name: formspec

6.4.2.1.5 Format Information Content -- description of the content of the data encoded in a format.
Type: text
Domain: free text
Short Name: formcont

6.4.2.1.6 File Decompression Technique -- recommendations of algorithms or processes (including means of obtaining these algorithms or processes) that can be applied to read or expand data sets to which data compression techniques have been applied.
Type: text
Domain: "No compression applied", free text
Short Name: filedec

6.4.2.1.7 Transfer Size -- the size, or estimated size, of the transferred data set in megabytes.
Type: real
Domain: Transfer Size > 0.0
Short Name: transize

6.4.2.2 Digital Transfer Option -- the means and media by which a data set is obtained from the distributor.
Type: compound
Short Name: digtopt

6.4.2.2.1 Online Option -- information required to directly obtain the data set electronically.
Type: compound
Short Name: onlinopt

6.4.2.2.1.1 Computer Contact Information -- instructions for establishing communications with the distribution computer.
Type: compound
Short Name: computer

6.4.2.2.1.1.1 Network Address -- the electronic address from which the data set can be obtained from the distribution computer.
Type: compound
Short Name: networka

6.4.2.2.1.1.1.1 Network Resource Name -- the name of the file or service from which the data set can be obtained.
Type: text
Domain: free text
Short Name: networkr

6.4.2.2.1.1.2 Dialup Instructions -- information required to access the distribution computer remotely through telephone lines.
Type: compound
Short Name: dialinst

6.4.2.2.1.1.2.1 Lowest BPS -- lowest or only speed for the connection's communication, expressed in bits per second.
Type: integer
Domain: Lowest BPS >= 110
Short Name: lowbps

6.4.2.2.1.1.2.2 Highest BPS -- highest speed for the connection's communication, expressed in bits per second. Used in cases when a range of rates are provided.
Type: integer
Domain: Highest BPS > Lowest BPS
Short Name: highbps

6.4.2.2.1.1.2.3 Number DataBits -- number of data bits in each character exchanged in the communication.
Type: integer
Domain: 7 <= Number DataBits <= 8
Short Name: numdata

6.4.2.2.1.1.2.4 Number StopBits -- number of stop bits in each character exchanged in the communication.
Type: integer
Domain: 1 <= Number StopBits <= 2
Short Name: numstop

6.4.2.2.1.1.2.5 Parity -- parity error checking used in each character exchanged in the communication.
Type: text
Domain: "None" "Odd" "Even" "Mark" "Space"
Short Name: parity

6.4.2.2.1.1.2.6 Compression Support -- data compression available through the modem service to speed data transfer.
Type: text
Domain: "V.32" "V.32bis" "V.42" "V.42bis"
free text
Short Name: compress

6.4.2.2.1.1.2.7 Dialup Telephone -- the telephone number of the distribution computer.
Type: text
Domain: free text
Short Name: dialtel

6.4.2.2.1.1.2.8 Dialup File Name -- the name of a file containing the data set on the distribution computer.
Type: text
Domain: free text
Short Name: dialfile

6.4.2.2.1.2 Access Instructions -- instructions on the steps required to access the data set.
Type: text
Domain: free text
Short Name: accinstr

6.4.2.2.1.3 Online Computer and Operating System -- the brand of distribution computer and its operating system.
Type: text
Domain: free text
Short Name: oncomp

6.4.2.2.2 Offline Option -- information about media-specific options for receiving the data set.
Type: compound
Short Name: offoptn

6.4.2.2.2.1 Offline Media -- name of the media on which the data set can be received.

Type: text
Domain: "CD-ROM" "3-1/2 inch floppy disk" "5-1/4 inch floppy disk" "9-track tape" "4 mm cartridge tape" "8 mm cartridge tape" "1/4-inch cartridge tape" free text
Short Name: offmedia

6.4.2.2.2.2 Recording Capacity -- the density of information to which data are written. Used in cases where different recording capacities are possible.
Type: compound
Short Name: reccap

6.4.2.2.2.2.1 Recording Density -- the density in which the data set can be recorded.
Type: real
Domain: Recording Density > 0.0
Short Name: recden

6.4.2.2.2.2.2 Recording Density Units -- the units of measure for the recording density.
Type: text
Domain: free text
Short Name: recdenu

6.4.2.2.2.3 Recording Format -- the options available or method used to write the data set to the medium.
Type: text
Domain: "cpio" "tar" "High Sierra" "ISO 9660" "ISO 9660 with Rock Ridge extensions" "ISO 9660 with Apple HFS extensions" free text
Short Name: recfmt

6.4.2.2.2.4 Compatibility Information --- description of other limitations or requirements for using the medium.
Type: text
Domain: free text
Short Name: compat

6.4.3 Fees -- the fees and terms for retrieving the data set.
Type: text
Domain: free text
Short Name: fees

6.4.4 Ordering Instructions -- general instructions and advice about, and special terms and services provided for, the data set by the distributor.
Type: text
Domain: free text
Short Name: ordering

6.4.5 Turnaround -- typical turnaround time for the filling of an order.
Type: text

Domain: free text
Short Name: turnarnd

6.5 Custom Order Process -- description of custom distribution services available, and the terms and conditions for obtaining these services.
Type: text
Domain: free text
Short Name: custom

6.6 Technical Prerequisites -- description of any technical capabilities that the consumer must have to use the data set in the form(s) provided by the distributor.
Type: text
Domain: free text
Short Name: techpreq

6.7 Available Time Period -- the time period when the data set will be available from the distributor.
Type: compound
Short Name: availabl

Metadata Reference Information

7 Metadata Reference Information -- information on the currentness of the metadata information, and the responsible party.

Type: compound
Short Name: metainfo

Metadata_Reference_Information =
Metadata_Date +
(Metadata_Review_Date) +
(Metadata_Future_Review_Date) +
Metadata_Contact +
Metadata_Standard_Name +
Metadata_Standard_Version +
0{Metadata_Time_Convention}1 +
(Metadata_Access_Constraints) +
(Metadata_Use_Constraints) +
(Metadata_Security_Information) +
0{Metadata_Extensions}n

Metadata_Contact =
Contact_Information *(see section 10 for production rules)*

Metadata_Security_Information =
Metadata_Security_Classification_System +
Metadata_Security_Classification +
Metadata_Security_Handling_Description

Metadata_Extensions =
0{Online_Linkage}n +
0{Profile_Name}1

7.1 Metadata Date -- the date that the metadata were created or last updated.

Type: date
Domain: free date
Short Name: metd

7.2 Metadata Review Date -- the date of the latest review of the metadata entry.

Type: date
Domain: free date; Metadata Review Date later than Metadata Date
Short Name: metrd

7.3 Metadata Future Review Date -- the date by which the metadata entry should be reviewed.

Type: date
Domain: free date; Metadata Future Review Date later than Metadata Review Date
Short Name: metfrd

7.4 Metadata Contact -- the party responsible for the metadata information.

Type: compound

Short Name: metc

7.5 Metadata Standard Name -- the name of the metadata standard used to document the data set.
Type: text
Domain: "FGDC Content Standard for Digital Geospatial Metadata" free text
Short Name: metstdn

7.6 Metadata Standard Version -- identification of the version of the metadata standard used to document the data set.
Type: text
Domain: free text
Short Name: metstdv

7.7 Metadata Time Convention -- form used to convey time of day information in the metadata entry. Used if time of day information is included in the metadata for a data set.
Type: text
Domain: "local time" "local time with time differential factor" "universal time"
Short Name: mettc

7.8 Metadata Access Constraints -- restrictions and legal prerequisites for accessing the metadata. These include any access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the metadata.
Type: text
Domain: free text
Short Name: metac

7.9 Metadata Use Constraints -- restrictions and legal prerequisites for using the metadata after access is granted. These include any metadata use constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on using the metadata.
Type: text
Domain: free text
Short Name: metuc

7.10 Metadata Security Information -- handling restrictions imposed on the metadata because of national security, privacy, or other concerns.
Type: compound
Short Name: metsi

7.10.1 Metadata Security Classification System -- name of the classification system for the metadata.
Type: text
Domain: free text
Short Name: metscs

7.10.2 Metadata Security Classification -- name of the handling restrictions on the metadata.
Type: text
Domain: "Top secret" "Secret" "Confidential" "Restricted" "Unclassified" "Sensitive" free text
Short Name: metsc

7.10.3 Metadata Security Handling Description -- additional information about the restrictions on handling the metadata.

Type: text
Domain: free text
Short Name: metshd

7.11 Metadata Extensions – a reference to extended elements to the standard which may be defined by a metadata producer or a user community. Extended elements are elements outside the Standard, but needed by the metadata producer. If extended elements are created, they must follow the guidelines in Appendix D, Guidelines for Creating Extended Elements to the Content Standard for Digital Geospatial Metadata.

Type: compound
Short Name: metextns

7.11.1 Online Linkage -- the name of an online computer resource that contains the metadata extension information for the data set. Entries should follow the Uniform Resource Locator convention of the Internet.

Type: text
Domain: free text
Short Name: onlink

7.11.2 Profile Name -- the name given to a document that describes the application of the Standard to a specific user community.

Type: text
Domain: free text
Short Name: metprof

Citation Information

8 Citation Information -- the recommended reference to be used for the data set. *(Note: this section provides a means of stating the citation of a data set, and is used by other sections of the metadata standard. This section is never used alone.)*

Type: compound
Short Name: citeinfo

```
Citation_Information =
                    1{Originator}n +
                    Publication_Date +
                    (Publication_Time) +
                    Title +
                    0{Edition}1 +
                    0{Geospatial_Data_Presentation_Form}1 +
                    0{Series_Information}1 +
                    0{Publication_Information}1 +
                    0{Other_Citation_Details}1 +
                    (1{Online_Linkage}n) +
                    0{Larger_Work_Citation}1

Series_Information =
                    Series_Name +
                    Issue_Identification

Publication_Information =
                    Publication_Place +
                    Publisher

Larger_Work_Citation =
                    Citation_Information
```

8.1 Originator -- the name of an organization or individual that developed the data set. If the name of editors or compilers are provided, the name must be followed by "(ed.)" or "(comp.)" respectively.

Type: text
Domain: "Unknown" free text
Short Name: origin

8.2 Publication Date -- the date when the data set is published or otherwise made available for release.

Type: date
Domain: "Unknown" "Unpublished material" free date
Short Name: pubdate

8.3 Publication Time -- the time of day when the data set is published or otherwise made available for release.

Type: time
Domain: "Unknown" free time
Short Name: pubtime

8.4 Title -- the name by which the data set is known.

Type: text
Domain: free text
Short Name: title

8.5 Edition -- the version of the title.
Type: text
Domain: free text
Short Name: edition

8.6 Geospatial Data Presentation Form -- the mode in which the geospatial data are represented.
Type: text
Domain: (the listed domain is partially from pp. 88-91 *in* Anglo-American Committee on Cataloguing of Cartographic Materials, 1982, Cartographic materials: A manual of interpretation for AACR2: Chicago, American Library Association):
"atlas" “audio” "diagram" “document” "globe" "map" "model" “multimedia presentation” "profile" “raster digital data” "remote-sensing image" "section" “spreadsheet” “tabular digital data” “vector digital data” “video” "view" free text
Short Name: geoform

8.7 Series Information -- the identification of the series publication of which the data set is a part.
Type: compound
Short Name: serinfo

8.7.1 Series Name -- the name of the series publication of which the data set is a part.
Type: text
Domain: free text
Short Name: sername

8.7.2 Issue Identification -- information identifying the issue of the series publication of which the data set is a part.
Type: text
Domain: free text
Short Name: issue

8.8 Publication Information -- publication details for published data sets.
Type: compound
Short Name: pubinfo

8.8.1 Publication Place -- the name of the city (and state or province, and country, if needed to identify the city) where the data set was published or released.
Type: text
Domain: free text
Short Name: pubplace

8.8.2 Publisher -- the name of the individual or organization that published the data set.
Type: text
Domain: free text
Short Name: publish

8.9 Other Citation Details -- other information required to complete the citation.

Type: text
Domain: free text
Short Name: othercit

8.10 Online Linkage -- the name of an online computer resource that contains the data set. Entries should follow the Uniform Resource Locator convention of the Internet.
Type: text
Domain: free text
Short Name: onlink

8.11 Larger Work Citation -- the information identifying a larger work in which the data set is included.
Type: compound
Short Name: lworkcit

Time Period Information

9 Time Period Information -- information about the date and time of an event. *(Note: this section provides a means of stating temporal information, and is used by other sections of the metadata standard. This section is never used alone.)*

Type: compound
Short Name: timeinfo

```
Time_Period_Information =
                    [Single_Date/Time |
                        Multiple_Dates/Times |
                        Range_of_Dates/Times ]

Single_Date/Time =
                    Calendar_Date +
                    (Time_of_Day)

Multiple_Dates/Times =
                    2{Single_Date/Time}n

Range_of_Dates/Times =
                    Beginning_Date +
                    (Beginning_Time) +
                    Ending_Date +
                    (Ending_Time)
```

9.1 Single Date/Time -- means of encoding a single date and time.

Type: compound
Short Name: sngdate

9.1.1 Calendar Date -- the year (and optionally month, or month and day).

Type: date
Domain: "Unknown" free date
Short Name: caldate

9.1.2 Time of Day -- the hour (and optionally minute, or minute and second) of the day.

Type: time
Domain: "Unknown" free time
Short Name: time

9.2 Multiple Dates/Times -- means of encoding multiple individual dates and times.

Type: compound
Short Name: mdattim

9.3 Range of Dates/Times -- means of encoding a range of dates and times.

Type: compound
Short Name: rngdates

9.3.1 Beginning Date -- the first year (and optionally month, or month and day) of the event.

Type: date

Domain: "Unknown" free date
Short Name: begdate

9.3.2 Beginning Time -- the first hour (and optionally minute, or minute and second) of the day for the event.
Type: time
Domain: "Unknown" free time
Short Name: begtime

9.3.3 Ending Date -- the last year (and optionally month, or month and day) for the event.
Type: date
Domain: "Unknown" "Present" free date
Short Name: enddate

9.3.4 Ending Time -- the last hour (and optionally minute, or minute and second) of the day for the event.
Type: time
Domain: "Unknown" free time
Short Name: endtime

Contact Information

10 Contact Information -- Identity of, and means to communicate with, person(s) and organization(s) associated with the data set. *(Note: this section provides a means of identifying individuals and organizations, and is used by other sections of the metadata standard. This section is never used alone.)*

Type: compound
Short Name: cntinfo

```
Contact_Information =
                    [Contact_Person_Primary |
                        Contact_Organization_Primary] +
                    (Contact_Position) +
                    1{Contact_Address}n +
                    1{Contact_Voice_Telephone}n +
                    (1{Contact_TDD/TTY_Telephone}n) +
                    (1{Contact_Facsimile_Telephone}n) +
                    (1{Contact_Electronic_Mail_Address}n) +
                    (Hours_of_Service) +
                    (Contact_Instructions)

Contact_Person_Primary =
                    Contact_Person +
                    (Contact_Organization)

Contact_Organization_Primary =
                    Contact_Organization +
                    (Contact_Person)

Contact_Address =
                    Address_Type +
                    0{Address}n +
                    City +
                    State_or_Province +
                    Postal_Code +
                    (Country)
```

10.1 Contact Person Primary -- the person, and the affiliation of the person, associated with the data set. Used in cases where the association of the person to the data set is more significant than the association of the organization to the data set.

Type: compound
Short Name: cntperp

10.1.1 Contact Person -- the name of the individual to which the contact type applies.

Type: text
Domain: free text
Short Name: cntper

10.1.2 Contact Organization -- the name of the organization to which the contact type applies.

Type: text

Domain: free text
Short Name: cntorg

10.2 Contact Organization Primary -- the organization, and the member of the organization, associated with the data set. Used in cases where the association of the organization to the data set is more significant than the association of the person to the data set.
Type: compound
Short Name: cntorgp

10.3 Contact Position -- the title of individual.
Type: text
Domain: free text
Short Name: cntpos

10.4 Contact Address -- the address for the organization or individual.
Type: compound
Short Name: cntaddr

10.4.1 Address Type -- the information provided by the address.
Type: text
Domain: "mailing" "physical" "mailing and physical", free text
Short Name: addrtype

10.4.2 Address -- an address line for the address.
Type: text
Domain: free text
Short Name: address

10.4.3 City -- the city of the address.
Type: text
Domain: free text
Short Name: city

10.4.4 State or Province -- the state or province of the address.
Type: text
Domain: free text
Short Name: state

10.4.5 Postal Code -- the ZIP or other postal code of the address.
Type: text
Domain: free text
Short Name: postal

10.4.6 Country -- the country of the address.
Type: text
Domain: free text
Short Name: country

10.5 Contact Voice Telephone -- the telephone number by which individuals can speak to the organization or individual.

Type: text
Domain: free text
Short Name: cntvoice

10.6 Contact TDD/TTY Telephone -- the telephone number by which hearing-impaired individuals can contact the organization or individual.
Type: text
Domain: free text
Short Name: cnttdd

10.7 Contact Facsimile Telephone -- the telephone number of a facsimile machine of the organization or individual.
Type: text
Domain: free text
Short Name: cntfax

10.8 Contact Electronic Mail Address -- the address of the electronic mailbox of the organization or individual.
Type: text
Domain: free text
Short Name: cntemail

10.9 Hours of Service -- time period when individuals can speak to the organization or individual.
Type: text
Domain: free text
Short Name: hours

10.10 Contact Instructions -- supplemental instructions on how or when to contact the individual or organization.
Type: text
Domain: free text
Short Name: cntinst

Appendix A
Glossary

[Most of the terms and definitions are from Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington: Department of Commerce, National Institute of Standards and Technology.]

abscissa -- the coordinate of a point in a plane Cartesian coordinate system obtained by measuring parallel to the x-axis ("the 'x' value").

accuracy -- the closeness of results of observations, computations or estimates to the true values or the values accepted as being true.

altitude -- elevation above or below a reference datum, as defined in Federal Information Processing Standard 70-1. See also elevation.

area -- a generic term for a bounded, continuous, two-dimensional object that may or may not include its boundary.

area chain -- a chain that explicitly references left and right polygons and not start and end nodes. It is a component of a two-dimensional manifold.

area point -- a representative point within an area usually carrying attribute information about that area.

arc -- a locus of points that forms a curve that is defined by a mathematical expression.

attribute -- a defined characteristic of an entity type (e.g. composition).

attribute value -- a specific quality or quantity assigned to an attribute (e.g., steel), for a specific entity instance.

cardinality --the number of elements in an extended compound element

chain -- a directed nonbranching sequence of nonintersecting line segments and (or) arcs bounded by nodes, not necessarily distinct, at each end. Area chain, complete chain, and network chain are special cases of chain, and share all characteristics of the general case as defined above.

child -- the name of the data element which may occur under this data element. A child element may be an extended or a standard element.

clearinghouse -- see National Geospatial Data Clearinghouse.

complete chain -- a chain that explicitly references left and right polygons and start and end nodes. It is a component of a two-dimensional manifold.

compound element -- a group of data elements and other compound elements. Compound elements represent higher-level concepts that cannot be represented by individual data elements.

coordinates -- pairs of numbers expressing horizontal distances along orthogonal axes; alternatively, triplets of numbers measuring horizontal and vertical distances.

data element -- a logically primitive item of data.

data set -- a collection of related data.

depth -- perpendicular distance of an interior point from the surface of an object.

developable surface -- a surface that can be flattened to form a plane without compressing or stretching any part of it. Examples include cones and cylinders.

digital image -- a two-dimensional array of regularly spaced picture elements (pixels) constituting a picture.

digital volume -- a three-dimensional array of regularly spaced volume elements (voxels) constituting a volume.

domain -- in the definition of the elements in the metadata standard, the domain identifies valid values for a data element.

Edge, Topology Level 0 -- VPF term for a string.

Edge, Topology Level 1 -- VPF term for a network chain in a network (in SDTS, a "Network chain, non-planar graph").

Edge, Topology Level 2 -- VPF term for a network chain in a planar graph (in SDTS, a "Network chain, planar graph").

Edge, Topology Level 3 -- VPF term for a complete chain.

elevation -- conforming to Federal Information Processing Standard 70-1, the term "altitude" is used in this standard, rather than the common term elevation.

entity instance -- a spatial phenomenon of a defined type that is embedded in one or more phenomena of different type, or that has at least one key attribute value different from the corresponding attribute values of surrounding phenomena (e.g., the 10 Street Bridge).

entity point -- a point used for identifying the location of point features (or areal features collapsed to a point), such as towers, buoys, buildings, places, etc.

entity type -- the definition and description of a set into which similar entity instances are classified (e.g., bridge).

explicit -- method of identifying positions directly by pairs (for horizontal positions) or triplets (for horizontal and vertical positions) of numbers.

extended element -- a user-defined metadata element included in a metadata collection. Extended elements may be defined by a data set producer or a user community. Extended elements are elements

outside the Standard, but needed by the data set producer. If extended elements are created, they must follow the guidelines in Appendix D, Guidelines for Creating Extended Elements in the Content Standard for Digital Geospatial Metadata.

Face, Topology Level 3 -- VPF term for a GT-polygon composed of rings.

G-polygon -- an area consisting of an interior area, one outer G-ring and zero or more nonintersecting, nonnested inner G-rings. No ring, inner or outer, shall be collinear with or intersect any other ring of the same G-polygon.

G-ring --a string composed of pairs of longitude and latitude coordinates that define a closed non-intersecting boundary.

G-ring point -- a scalar consisting of a set of ordered pairs of floating-point numbers, separated by commas, in which the first number in each pair is the longitude of a point and the second is the latitude of the point. Longitude and latitude are specified in decimal degrees with north latitudes positive and south negative, east longitude positive and west negative.

geospatial data -- information that identifies the geographic location and characteristics of natural or constructed features and boundaries on the earth. This information may be derived from, among other things, remote sensing, mapping, and surveying technologies.

graph -- a set of topologically interrelated zero-dimensional (node), one-dimensional (link or chain), and sometimes two-dimensional (GT-polygon) objects that conform to a set of defined constraint rules. Numerous rule sets can be used to distinguish different types of graphs. Three such types, planar graph, network, and two-dimensional manifold, are used in this standard. All three share the following rules: each link or chain is bounded by an ordered pair of nodes, not necessarily distinct; a node may bound one or more links or chains; and links or chains may only intersect at nodes. Planar graphs and networks are two specialized types of graphs, and a two-dimensional manifold is an even more specific type of planar graph.

grid -- (1) a set of grid cells forming a regular, or nearly regular, tessellation of a surface; (2) a set of points arrayed in a pattern that forms a regular, or nearly regular, tessellation of a surface. The tessellation is regular if formed by repeating the pattern of a regular polygon, such as a square, equilateral triangle, or regular hexagon. The tessellation is nearly regular if formed by repeating the pattern of an "almost" regular polygon such as a rectangle, non-square parallelogram, or non-equilateral triangle.

grid cell -- a two-dimensional object that represents the smallest nondivisible element of a grid.

GT-polygon -- an area that is an atomic two-dimensional component of one and only one two-dimensional manifold. The boundary of a GT-polygon may be defined by GT-rings created from its bounding chains. A GT-polygon may also be associated with its chains (either the bounding set, or the complete set) by direct reference to these chains. The complete set of chains associated with a GT-polygon may also be found by examining the polygon references on the chains.

GT-ring -- a ring created from complete and (or) area chains.

horizontal -- tangent to the geoid or parallel to a plane that is tangent to the geoid.

implicit -- method of identifying positions by a place in an array of values.

interior area -- an area not including its boundary.

label point -- a reference point used for displaying map and chart text (e.g., feature names) to assist in feature identification.

latitude -- angular distance measured on a meridian north or south from the equator.

layer -- an integrated, areally distributed, set of spatial data usually representing entity instances within one theme, or having one common attribute or attribute value in an association of spatial objects. In the context of raster data, a layer is specifically a two-dimensional array of scalar values associated with all of part of a grid or image.

line -- a generic term for a one-dimensional object.

line segment -- a direct line between two points.

link -- a topological connection between two nodes. A link may be directed by ordering its nodes.

longitude -- angular distance between the plane of a meridian east or west from the plane of the meridian of Greenwich.

map -- a spatial representation, usually graphic on a flat surface, of spatial phenomena.
media -- the physical devices used to record, store, and (or) transmit data.

meridian -- a great circle on the Earth that passes through the geographic poles.

metadata -- data about the content, quality, condition, and other characteristics of data.

name -- the name of an extended element. The extended element name must not be the name of any other element in the Standard.

National Geospatial Data Clearinghouse -- a distributed network of geospatial data producers, managers, and users linked electronically. Building on initiatives such as the national information infrastructure, the clearinghouse uses a distributed, electronically connected network, such as the Internet. Each data provider will describe available data in an electronic form, and provide these descriptions (or "metadata") using means that can be accessed over a communications network. Thus, the data for the clearinghouse are located at the sites of data producers (or, where more efficient, at the sites of intermediaries) throughout the country. Using the network, users will search these descriptions to locate data that are suitable for their applications.

network -- a graph without two dimensional objects. If projected onto a two-dimensional surface, a network can have either more than one node at a point and (or) intersecting links or chains without corresponding nodes.

network chain -- a chain that explicitly references start and end nodes and not left and right polygons. It is a component of a network.

node -- a zero-dimensional object that is a topological junction of two or more links or chains, or an end point of a link or chain.

Node, Topology Level 0 -- VPF term for a point (in SDTS, a "point").

Node, Topology Level 1 -- VPF term for a node on a network (in SDTS, a "node, network").

Node, Topology Level 2 -- VPF term for a node on a planar graph (in SDTS, a "node, planar graph").

Node, Topology Level 3 -- VPF term for a point used to represent isolated features. These are topologically linked to a containing face.

object -- a digital representation of all or part of an entity instance.

optionality - The optionality of a section or compound element always takes precedence over the elements that it contains. Once a section or compound element is recognized by the data set producer as applicable, then the optionality of its subordinate elements is to be interpreted. See Production Rules section for additional interpretive guidance.

ordinate -- the coordinate of a point in a plane cartesian coordinate system obtained by measuring parallel to the y-axis ("the 'y' value").

parent -- the name of the data element under which a given data element may occur. A parent element may be an extended or a standard element.

phenomenon -- a fact, occurrence or circumstance. Route 10, George Washington National Forest, and Chesterfield County are all phenomena.

pixel -- two-dimensional picture element that is the smallest nondivisible element of a digital image.

planar graph -- the node and link or chain objects of the graph occur or can be represented as though they occur upon a planar surface. Not more than one node may exist at any given point on the surface. Links or chains may only intersect at nodes.

point -- a zero-dimensional object that specifies geometric location. One coordinate pair or triplet specifies the location. Area point, entity point, and label point are special implementations of the general case.

primitive -- the quality of not being subdivided; atomic.

quality -- an essential or distinguishing characteristic necessary for cartographic data to be fit for use.

raster -- one or more overlapping layers for the same grid or digital image.

raster object - one or more images and/or grids, each grid or image representing a layer, such that corresponding grid cells and/or pixels between layers are congruent and registered.

rationale - a component of an extended element. The rationale is provided by the user creating the extended element to explain the reason for its creation and its expected uses.

repeatability --whether or not an extended element can be repeated and optionally a minimum or maximum number of occurrences or both

resolution-- the minimum difference between two independently measured or computed values which can be di stinguished by the measurement or analytical method being considered or used.

ring -- sequence of nonintersecting chains or strings and (or) arcs, with closure. A ring represents a closed boundary, but not the interior area inside the closed boundary.

SDTS -- the Spatial Data Transfer Standard defined by Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, Department of Commerce, National Institute of Standards and Technology.

short name -- a unique name for each compound or primitive data element consisting of eight alphabetic characters or less. When creating extended element short names, do not duplicate an existing standard element short name.

source --a component of an extended element. the name of the individual or organization creating an extended element

spatial data -- see geospatial data.

stratum -- one of a series of layers, levels, or gradations in an ordered system. For this standard, the term is used in the sense of (1) a region of sea, atmosphere, or geology that is distinguished by natural or arbitrary limits; (2) a socioeconomic level of society comprised of persons of the same or similar status, especially with regard to education or culture; or (3) a layer of vegetation, usually of the same or similar height.

string -- a connected non-branching sequence of line segments specified as the ordered sequence of points between those line segments. Note: A string may intersect itself or other strings.

two-dimensional manifold -- a planar graph and its associated two dimensional objects. Each chain bounds two and only two, not necessarily distinct, GT-polygons. The GT-polygons are mutually exclusive and completely exhaust the surface.

type -- in the definition of the elements in the metadata standard, a compound element has the type "compound" to provide a unique way to identify compound elements. For a data element, the type identifies the kind of value that can be assigned to the data element. The choices are "integer" for integer numbers, "real" for real numbers, "text" for ASCII characters, "date" for day of the year, and "time" for time of the day.

universe polygon -- defines the part of the universe that is outside the perimeter of the area covered by other GT-polygons ("covered area") and completes the two-dimensional manifold. This polygon completes the adjacency relationships of the perimeter links. The boundary of the universe polygon is represented by one or more inner rings and no outer ring. Attribution of the universe polygon may not exist, or may be substantially different from the attribution of the covered area.

vector -- composed of directed lines.

vertical -- at right angles to the horizontal; includes altitude and depth.

VPF -- the Vector Product Format defined by Department of Defense, 1992, Vector Product Format (MIL-STD-600006): Philadelphia, Department of Defense, Defense Printing Service Detachment Office.

void polygon -- defines a part of the two-dimensional manifold that is bounded by other GT-polygons, but otherwise has the same characteristics as the universe polygon. The geometry and topology of a void polygon are those of a GT-polygon. Attribution of a void polygon may not exist, or may be substantially different from the attribution of the covered area.
voxel -- a three-dimensional element that is the smallest nondivisible element of a digital volume.

Appendix B
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Appendix D
Guidelines for Creating Extended Elements in the Content Standard for Digital Geospatial Metadata

Extended elements to the Standard may be defined by a data set producer or a user community. Extended elements are elements outside the Standard, but needed by the data set producer. If extended elements are created, they must follow the guidelines presented here. The Online_Linkage data element within Metadata_Extensions points to a formal document containing the necessary documentation for a subsequent metadata producer to reuse the extended element. If extended elements are used in a profile, the Profile_Name can also be included in the Metadata_Extensions compound data element. See Appendix E for Guidelines on Creating a Profile for the Content Standard for Digital Geospatial Metadata.

It should be noted here that metadata capture and exploitation tools need to be updated to adjust to these minor modifications. At the end of Section 7, Metadata Reference Information, the following elements were added in order to handle extended elements:

Extended elements may also be created for use with non-geospatial data holdings when this practice does not conflict with other Federal standards, directives, or statutes.

Metadata_Extensions=
0{Online_Linkage}n +
0{Profile_Name}1

If a metadata producer does not have the capability to provide online linkage, he or she may list the information in the data set.

The Online Linkage element references a structured file (or uniform resource locator) containing the following information about the extended element in the production rule dictated below: name, data type, domain values, short name, parent element, optionality (Mandatory, Mandatory-if-applicable, or Optional), cardinality, for example, (0, 1, ..., n) or (> 1 but < 10), repeatability, definition, rationale, and source. The compound element Extension_Information is repeatable, but the primitive data elements occurring in Extension_Information are not. Note that these elements do not appear in the metadata record itself.

Extension_Information =
Name +
Short_Name +
Type +
[Domain | [0{Child}n | Rule]] +
1{Parent}n +
(Optionality) +
(Repeatability) +
(Definition) +
(Rationale) +
(Source)

The following rules must be followed when defining extended elements:

- Extended elements must be formally documented within the hierarchical structure of the Standard (Section 0 - "Metadata"). When metadata extended elements are used, their existence must be documented in the Metadata Reference Information, element Metadata_Extensions. Every effort should be made to logically organize extended elements within the existing sections and structure. Where there is no logical or natural "fit", new section(s) and/or subsections may be defined.

- Extended elements must not be used to change the name, definition, type, or domain of a standard element. In particular, an extended element cannot be nested under a data element.

- Extended elements may be defined as compound and may include extended and standard elements as components. If a standard element is included in an extended compound element, no components of the standard element are changed.

- Extended elements, like the standard element "Single_Date/Time" may appear in multiple places in the metadata set.

Extended_Element_Name -- (Mandatory) -- the name of the element. The name given to the element must not be the name of any other element in the Standard.
Domain: free text (Do not duplicate any other Standard element name.)

Definition -- (Mandatory) -- the definition of the element.
Domain: free text

Rationale -- (Optional) -- the reason for creating the Extended element, and its expected uses.
Domain: free text

Source -- (Mandatory) -- the name of the entity creating the Extended element.
Domain: free text

Type -- (Mandatory) -- the kind of value to be provided, or "compound" if the Extended element contains other elements.
Domain: integer, real, text, date, time, compound

Domain -- (Mandatory) -- valid values that can be assigned to the data element. The same rules as those for Standard elements are applied here.
Domain: free text

Short Name -- (Mandatory) -- a unique short name consisting of eight alphabetic characters or less.
Domain: free text (Do not duplicate another short name used by the Standard or any other short name in the Extension Registry.)

Parent -- (Mandatory) -- The name of the element(s) under which this element may appear. The name(s) may be standard or other extended element(s).
Domain: none, free text (Must be the name of an existing standard or extended element. If the extended element is not part of any other compound element, its

parent is the section name as defined by the Standard. If the extended element is defining a whole new section, then its parent is Section 0 - “Metadata”.)

Child -- (Mandatory-if-applicable) -- The name of the element(s) which may appear under this element. The name(s) may be standard or other extended element(s).

Domain: none, free text (Must be the name of an existing Standard or extended element.)

Rule: production rule for the element, specified using the form given in this Standard.

Appendix E
Guidelines for Creating a Profile for the Content Standard for Digital Geospatial Metadata

The current Content Standard for Digital Geospatial Metadata provides metadata collectors with formally defined elements known as standard elements. The metadata Standard attempts to standardize the content of metadata elements for a wide range of digital geospatial data. However, some users may determine that modifications to the Standard are needed to create meaningful metadata for their data sets. The Standard allows the user to create extended elements and profiles. Extended elements are user-defined elements outside the Standard needed by the metadata producer. A profile is a document that describes the application of the Standard to a specific user community.

A profile always contains the Standard, plus modifications to the optionality or repeatability of non-mandatory elements in the Standard. Modifications to the domains of standard elements can also be made where permitted by the Standard. Profiles may also contain extended elements.

Profiles may be formalized through the FGDC standards process or may be used informally by a user community. FGDC is the approval authority for profiles. To become recognized by the FGDC, a metadata profile must go through the FGDC standards review and approval process. FGDC approved profiles must specify a maintenance authority. While the FGDC is the designated maintenance authority for the Metadata Standard the organization or agency sponsoring a profile will be considered the maintenance authority for that profile.

Profiles may also be created for use with non-geospatial data holdings when this practice does not conflict with other Federal standards, directives, or statutes.

Requirements

A profile must include:

- the basic, minimum set of metadata collected to the specification of this Standard
- all mandatory elements in all mandatory sections. These are known as the core metadata elements
- all mandatory- if-applicable elements in all mandatory sections, if the data set has the characteristic documented in the element
- all mandatory elements in all mandatory-if-applicable sections if the data set has the characteristic documented in the section
- all mandatory-if-applicable elements in all mandatory-if-applicable sections, if the data set has the characteristic documented in the section

Guidelines

The guidelines for creating a profile follow:

- A profile must not change the name, definition, or data type of a standard element.
- A profile may impose more stringent conditionality on standard elements than the Standard requires. (Elements that are optional in the Standard may be mandatory in a profile.)

- A profile may contain elements with domains that are more restrictive than the Standard. (Elements whose domains have free text in the Standard may have a closed list of appropriate values in the profile.)

- A profile may restrict the use of domain values allowed by the Standard. For example, if the Standard contains five domain values for a standard element, the profile may specify that its domain consist of three domain values identified in the profile. The profile may require that the user select a value from the three domain values.)

- A profile will not permit anything not allowed by the Standard. (If the Standard element has a domain of three values, without a free text element, the profile will not allow a user to enter anything other than those 3 values.)

- Before creating a profile, the metadata producer will check existing registered profiles.

- A profile must be made available to anyone receiving metadata that was collected according to that profile.

- The profile document submitted to the FGDC for formal approval shall contain the same six sections as the introduction section of this Standard.

The format of a profile document shall meet the directives of the FGDC Standards Working Group and shall consist of the following:

1. Objectives
2. Scope
3. Applicability
4. Related Standards
5. Standards Development Process
6. Maintenance Authority
7. A section stating that the mandatory elements from the Standard must be provided.
8. A section describing the changes to the domains and conditionality of Standard elements being modified from their original use in the Standard. These changes should be presented in the same manner used by the Standard.
9. A section describing the extended elements created under this profile. This section must include all of the components of an extended element described in the Standard.

National Mapping Program
Technical Instructions

Standards for National Hydrography Dataset - High Resolution

DRAFT

U.S. Environmental Protection Agency
U.S. Department of the Interior
U.S. Geological Survey
National Mapping Division

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ANCHORAGE - An area where a vessel anchors or may anchor, either because of suitability or designation.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Anchorage Type	Function or purpose
Explosives Isolation	Area designated for the detainment of ships carrying explosives
Quarantine	Area designated for the detainment of quarantined ships
Seaplane	Area designated for the anchoring of seaplanes
Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 99
Unspecified	The value is not known and is not required

DELINEATION

The limit of ANCHORAGE is the extent of the area suitable or designated for anchoring.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If ANCHORAGE is for seaplanes,
Then ANCHORAGE is represented as a 0-dimensional basic feature object.

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If ANCHORAGE is for explosives isolation or quarantine,
Then ANCHORAGE is represented as a 2-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

For topographic/bathymetric editions only, if ANCHORAGE is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

AREA OF COMPLEX CHANNELS - An area where a stream or river flows in an intricate network of interlacing channels.

ATTRIBUTE/ATTRIBUTE VALUE LIST

N/A

DELINEATION

The limit of AREA OF COMPLEX CHANNELS is the outer bank of the outermost channel.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT
Is Above		UNDERPASS

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If AREA OF COMPLEX CHANNELS contains at least five subchannels and is ≥ 0.88" along the shortest axis and ≥ 2.64" along the longest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If AREA OF COMPLEX CHANNELS coincides with SWAMP/MARSH or with a 2-dimensional STREAM/RIVER,
Then capture both AREA OF COMPLEX CHANNELS and the other feature.

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If AREA OF COMPLEX CHANNELS is part of WATERCOURSE,
Then collect the name with WATERCOURSE.

Graphic

Brown sand areas within AREA OF COMPLEX CHANNELS are captured as BARREN LAND (Nonvegetative Surface Cover theme).

Revision - General

Revision - Standard

Revision - Limited

Do not add new features. Modify existing features only if there are obvious changes in the stream channels.

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AREA TO BE SUBMERGED - The known extent of the intended lake that will be created behind a dam under construction.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Elevation	The vertical distance from a given datum
(Floating Point Value)	Minimum Value: -392.8 Maximum Value: 8848.3 Precision: 1 Length: 6 Increment: 0.1 Units: meters
Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of AREA TO BE SUBMERGED is the line corresponding to the average water elevation of the intended lake.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If AREA TO BE SUBMERGED is ≥ 0.5" along the shortest axis and the perimeter coincides DAM/WEIR that meets capture conditions,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

All features inside of AREA TO BE SUBMERGED will be captured as they normally would, if they meet capture conditions.

Graphic

Capture all.

DAM/WEIR under construction on an existing graphic may be completed by the time it is captured digitally. Regardless, remain true to the date of the graphic and capture DAM/WEIR with Operational Status = Under Construction and the intended lake as AREA TO BE SUBMERGED.

Revision - General

DRAFT

Revision - Standard

Revision - Limited

The limits for AREA TO BE SUBMERGED and the values for the Attributes of Elevation and Name may have to be obtained from the operating agency or other ancillary sources.

DRAFT

ARTIFICIAL PATH - An abstraction to facilitate hydrologic modeling through open water bodies and along coastal and Great Lakes shorelines and to act as a surrogate for lakes and other water bodies.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Open Water Body ID	The ID of the open water body an artificial flow path represents
(Integer Value)	Minimum Value: 1 Maximum Value: 999999999 Precision: 0 Length: 9 Increment: 1 Units:
Unspecified	The value is not known and is not required

DELINEATION

The limit of ARTIFICIAL PATH is:
the connection between the inflow and outflow points of an in-line open water body ;

the line through a head or terminal open water body that connects to the inflow or ouflow point;

shorelines for the Atlantic Ocean, Pacific Ocean, Gulf of Mexico, and the Great Lakes

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT
Is Above		UNDERPASS

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If ARTIFICIAL PATH is associated with an in-line 2-dimensional feature,
Then ARTIFICIAL PATH is represented as a 1-dimensional basic feature object.

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If ARTIFICIAL PATH is associated with a headwater or terminal 2-dimensional feature,
Then ARTIFICIAL PATH is represented as a 0-dimensional basic feature object.

If ARTIFICIAL PATH is associated with a coastal shoreline (Pacific Ocean, Atlantic Ocean, Gulf of Mexico) or the Great Lakes,
Then ARTIFICIAL PATH is represented as a 1-dimensional basic feature object.

If ARTIFICIAL PATH is associated with an isolated 2-dimensional feature,
Then ARTIFICIAL PATH is represented as a 0-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

Attribute Information

Source Interpretation Guidelines

All

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

BAY/INLET - A water area that is an opening of the sea/ocean into the land, or of an estuary, lake, or river into its shore.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of BAY/INLET is SHORELINE of ESTUARY, LAKE/POND, SEA/OCEAN, or STREAM/RIVER, and the extension of shoreline across the mouth of BAY/INLET and across any area where a river enters BAY/INLET.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

DRAFT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If BAY/INLET is named,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

The feature BAY/INLET is included in the GNIS feature class "bay". According to GNIS, bays can be described by about 40 generics. GNIS maintains a list of feature classes and related generics. Contact GNIS for more information.

If BAY/INLET meets capture conditions,
Then capture BAY/INLET, and ESTUARY, LAKE/POND, SEA/OCEAN, or STREAM/RIVER.

Graphic

Revision - General

Revision - Standard

Revision - Limited

Do not collect new features. Modify existing features to accomodate a change in SHORELINE.

DRAFT

BRIDGE - A structure spanning and providing passage over a waterway, railroad, or other obstacle.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of BRIDGE is the extent of the span as defined by the edges of the deck and the end abutments.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If BRIDGE is < 0.0625" along the shortest axis, and does not meet the Representation Conditions for a

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0-dimensional basic feature object,
Then BRIDGE is represented as a 1-dimensional basic feature object.

If BRIDGE IS ≥ 0.0625" along the shortest axis, and does not meet the Representation Conditions for a 0-dimensional basic feature object,
Then BRIDGE is represented as a 2-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

If BRIDGE is ≥ 0.12" along the longest axis and carries a hydrographic feature,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If BRIDGE meets capture conditions and carries CANAL/DITCH.
Then capture both BRIDGE and CANAL/DITCH.

If a bridge does not meet capture conditions and carries RAILWAY, ROAD, or TRAIL over CANAL/DITCH or STREAM/RIVER,
Then capture only RAILWAY, ROAD, or TRAIL.

If a bridge does not meet capture conditions and carries CANAL/DITCH over another CANAL/DITCH or STREAM/RIVER,
Then capture CANAL/DITCH and UNDERPASS to allow definition of the relationship between CANAL/DITCH and the feature over which it passes.

If BRIDGE carries multiple features,
Then it is delineated and represented at the greatest horizontal extent.

If BRIDGE carries a transportation feature,
Then collect in the theme Transportation.

If BRIDGE is captured,
Then also capture UNDERPASS.

Graphic

Named BRIDGES over double-line drains, symbolized without bridge wing ticks, are captured from shoreline to shoreline.

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BRIDGES symbolized with bridge wing ticks are captured from wing tick to wing tick.

Revision - General

Revision - Standard

Revision - Limited

Deck Status = Unspecified for newly collected BRIDGES, if the number of decks is not readily discernible. Retain Deck Status on existing BRIDGES.

DRAFT

CANAL/DITCH - An artificial open waterway constructed to transport water, to irrigate or drain land, to connect two or more bodies of water, or to serve as a waterway for watercraft.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Canal/Ditch Type	Function or purpose
Aqueduct	A structure designed to transport domestic or industrial water from a supply source to a distribution point, often by gravity
Unspecified	The value is not known and is not required
Elevation	The vertical distance from a given datum
(Floating Point Value)	Minimum Value: -392.8 Maximum Value: 8848.3 Precision: 1 Length: 6 Increment: 0.1 Units: meters
Stage	Height of water surface
Normal Pool	The stage of an artificially impounded water body that prevails for the greater part of the year
Not Applicable	The attribute does not apply and therefore cannot be valued
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of CANAL/DITCH is the top of the banks of the artificial waterway.

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REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT
Is Above		UNDERPASS

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		< 0.025"	
2-dimensional		≥ 0.025"	

Special Conditions:

To accomodate variations in the shortest axis of CANAL/DITCH:

If shortest axis of CANAL/DITCH is:

< 0.025" but ≥ 0.01" for a distance < 2.64", and is connected at both ends to a 2-dimensional CANAL/DITCH,
Then CANAL/DITCH is represented as a 2-dimensional basic feature object.

< 0.025" but ≥ 0.01" for a distance ≥ 2.64", or < 0.01" regardless of distance, and is connected at both ends to a 2-dimensional CANAL/DITCH,
Then CANAL/DITCH is represented as a 1-dimensional basic feature object.

≥ 0.025" but < 0.04" for a distance < 2.64", and is connected at both ends to a 1-dimensional CANAL/DITCH,
Then CANAL/DITCH is represented as a 1-dimensional basic feature object.

≥ 0.025" but < 0.04" for a distance ≥ 2.64", or ≥ 0.04" regardless of distance, and is connected at both ends to a 1-dimensional CANAL/DITCH,
Then CANAL/DITCH is represented as a 2-dimensional basic feature object.

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DATA EXTRACTION

Capture Conditions

If CANAL/DITCH is named,
Or
If CANAL/DITCH is ≥ 0.005" along the shortest axis,
Then capture.

Attribute Information

If water level of CANAL/DITCH is controlled by GATE with Gate Type = Lock, and CANAL/DITCH is ≥ 0.025" along the shortest axis and ≥ 0.5" along the longest axis and is not coincident with LOCK CHAMBER,
Then Elevation = (Integer Value),
Else Elevation = Not Applicable.

Source Interpretation Guidelines

All

If CANAL/DITCH is part of WATERCOURSE,
Then collect the name with WATERCOURSE.

If CANAL/DITCH meets capture conditions, and coincides with BRIDGE, LOCK CHAMBER, or TUNNEL,
Then capture both CANAL/DITCH and the other feature.

If CANAL/DITCH meets capture conditions, and coincides with a structure, but that structure does not meet the definition and capture conditions for another feature (BRIDGE, FLUME, PIPELINE with Pipeline Type = Siphon, TUNNEL),
Then capture CANAL/DITCH and, if required, capture UNDERPASS to allow definition of the relationship between CANAL/DITCH and the feature over or under which it passes.

Structures which carry CANAL/DITCH over another feature are captured as FLUME or BRIDGE.

Do not capture underground aqueducts that are not in TUNNEL as CANAL/DITCH. See PIPELINE with Product = Water, Pipeline Type = Aqueduct, and Relationship to Surface = Underground.

Do not capture rivers that have been channelized to control flooding or erosion, or to maintain flow for navigation as CANAL/DITCH. See STREAM/RIVER. Capture as CANAL/DITCH only those inland navigation waterways that are cut through land to bypass outcrops or rapids, or to connect two bodies of water.

If a canal or ditch passes through a siphon that meets capture conditions for PIPELINE with Pipeline Type = Siphon,
Then do not capture CANAL/DITCH. See PIPELINE.

DRAFT

Do not capture ditches associated with a cranberry bog.

If 2-dimensional CANAL/DITCH meets capture conditions, and coincides with NONEARTHEN SHORE or WALL,
Then capture both CANAL/DITCH and the other feature.

Graphic

Capture all, except ditches associated with a cranberry bog.

Revision - General

Revision - Standard

Revision - Limited

Use ancillary source when the collection of Elevation is required.

DRAFT

CONNECTOR - A known, but nonspecific, connection between two nonadjacent network segments.

ATTRIBUTE/ATTRIBUTE VALUE LIST

N/A

DELINEATION

The limit of CONNECTOR is the imaginary line connecting two nonadjacent network segments.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

If CONNECTOR is required to maintain connectivity between two network feature objects that represent AREA OF COMPLEX CHANNELS, CANAL/DITCH, ESTUARY, LAKE/POND, RESERVOIR, SEA/OCEAN, or STREAM/RIVER,
Then capture.

Attribute Information

N/A

Source Interpretation Guidelines

All

The following list of conditions indicates when and why the capture of CONNECTOR is important:

1) When CONNECTOR is part of a network that is represented as being connected.

DRAFT

2) When there is a gap with no collected network feature object between pieces of the network, for example, at a 2-dimensional DAM/WEIR that causes a gap between an upstream LAKE/POND and a downstream STREAM/RIVER.

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

CREVASSE FIELD - An area of deep fissures in the surface of an ice mass caused by breaking or parting.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 99
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of CREVASSE FIELD is the extent of the field.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If outline of CREVASSE FIELD is provided to NMD by USGS Geologic Division, Then capture.

Attribute Information

Source Interpretation Guidelines

All

Graphic

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

DAM/WEIR - A barrier constructed to control the flow or raise the level of water.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Construction Material	Predominant material used
Earthen	Constructed of earth, or a combination of earth and rock
Nonearthen	Constructed of concrete, brick or stone
Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Operational Status	State or condition
Operational	Usable and intended for use
Under Construction	Construction has begun but is not completed
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of DAM/WEIR is the extent of the exposed built-up barrier.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		< 0.02"	
2-dimensional		≥ 0.02"	

Special Conditions:

DATA EXTRACTION

Capture Conditions

If DAM/WEIR is earthen, and is named, and is ≥ 0.02" along the shortest axis,
Or
If DAM/WEIR is nonearthen and is named,
Or
If the DAM/WEIR is nonearthen and is ≥ 0.05" along the longest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If DAM/WEIR with Construction Material = Nonearthen meets capture conditions,
Then capture DAM/WEIR and NONEARTHEN SHORE.

If a dam/weir does not meet capture conditions,
Then capture only SHORELINE.

If DAM/WEIR with Construction Material = Earthen meets capture conditions,
Then capture both DAM/WEIR and SHORELINE.

If DAM/WEIR covers part of the same area as SPILLWAY,
Then capture both DAM/WEIR and SPILLWAY where the features overlap.

DRAFT

If DAM/WEIR has an overflow spillway,
Then capture only DAM/WEIR (do not capture as SPILLWAY).

SPILLWAY may exist completely apart from the feature DAM/WEIR.

If DAM/WEIR meets capture conditions and carries ROAD that meets capture conditions,
Then capture both DAM/WEIR and ROAD.

Do not capture check dams as DAM/WEIR. See EMBANKMENT (Built-up theme).

If a lock and DAM/WEIR share a name, as in "Lock and Dam #6,"
Then only collect the name with DAM/WEIR.

If DAM/WEIR is 1-dimensional,
Then capture NONEARTHEN SHORE or SHORELINE only for the portion of DAM/WEIR that separates land from water.

Graphic

If named earthen dams are shown by contours,
Then capture DAM/WEIR as the area defined by the portion of the shoreline that runs parallel to the squared-off contours and the arbitrary line surrounding the built-up barrier as indicated by the contours.

Revision - General

If Operational Status = Under Construction,
Then the limits of DAM/WEIR must be obtained from the operating agency.

Revision - Standard

Revision - Limited

DRAFT

ESTUARY - The lower end of a river, or a semienclosed coastal body of water with access to the open ocean, which is affected by the tides and where fresh and salt water mix.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of ESTUARY is the extent of the area where fresh and salt water mix, as defined by National Wetlands Inventory.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If ESTUARY has been identified as an Estuarine area by National Wetlands Inventory (NWI),
Then capture.

Attribute Information

If ESTUARY has a Name which applies to ESTUARY itself, and not to WATERCOURSE of which ESTUARY is a part,
Then Name = (Alphanumeric),
Else Name = Unspecified.

Source Interpretation Guidelines

All

The minimum size for islands within ESTUARY is 0.03" along the shortest axis.

Graphic

Revision - General

DRAFT

Revision - Standard

Revision - Limited

Do not collect new features. Modify existing features to accomodate a change in SHORELINE.

DRAFT

FISH LADDER - A facility consisting of a series of small pools, each one slightly higher than the preceding, built around an obstruction to enable fish to make their way upstream.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of FISH LADDER is the extent of the small pools.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		< 0.025"	< 0.25"
1-dimensional		< 0.025"	≥ 0.25"
2-dimensional		≥ 0.025"	

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If FISH LADDER is ≥ 0.1" along the longest axis,
Then capture.

Attribute Information

N/A

Source Interpretation Guidelines

All

Displace segments of FISH LADDER that overlap each other.

Graphic

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

FLUME - An open, inclined, artificial channel constructed of wood, metal, or concrete; generally elevated.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 99
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of FLUME is the extent of the structure.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		< 0.025"	
2-dimensional		≥ 0.025"	

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If FLUME is ≥ 0.12" along the longest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If FLUME meets capture conditions and carries CANAL/DITCH that meets capture conditions,
Then capture FLUME, CANAL/DITCH, and UNDERPASS.

If a flume does not meet capture conditions and carries CANAL/DITCH,
Then capture CANAL/DITCH and, if required, capture UNDERPASS to allow definition of the relationship between CANAL/DITCH and the feature over which it passes.

Graphic

If a section of CANAL/DITCH is labeled "AQUEDUCT" where it passes over another feature,
Then capture that section as CANAL/DITCH, and BRIDGE or FLUME, if capture conditions are met.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

FORESHORE - The part of a seashore between high-water and low-water marks.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of FORESHORE is the approximate line of mean high water, and the approximate line of mean lower low water.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

DRAFT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

For a topographic/bathymetric edition only, if FORESHORE is on the final compilation provided to USGS by NOS,
Or
If FORESHORE is ≥ 0.1" along the longest axis and ≥ 0.04" along the shortest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If FORESHORE is captured,
Then also capture ESTUARY, LAKE/POND, SEA/OCEAN, or STREAM/RIVER, and capture BARREN LAND (Nonvegetative Surface Cover) to describe the composition of the area.

FORESHORE does not have to be attached to the shore.

Areas that uncover and are within or alongside REEF are captured as FORESHORE.

Graphic

All black sand stipple (USGS 17) should be captured as FORESHORE if it meets the capture conditions. (This does not include oil sumps that are shown with the same pattern.)

Revision - General

Revision - Standard

DRAFT

Revision - Limited

Do not collect new features. Modify existing features to accommodate a change in SHORELINE.

DRAFT

FUMAROLE - A hole in the earth's crust from which steam and gases are emitted.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of FUMAROLE is the extent of the hole from which vapors are emitted.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If FUMAROLE is not within an area of closely spaced fumaroles,
Or
If FUMAROLE is within an area of closely spaced fumaroles, and is necessary to accurately represent the pattern of fumaroles (see Source Interpretation Guidelines to determine how to accurately represent the pattern),
Then capture.

Attribute Information

Source Interpretation Guidelines

All

The feature FUMAROLE is not a GNIS feature class. According to GNIS, FUMAROLE is included in the GNIS feature class "geyser". However, not all GNIS "geysers" can be classified as the feature FUMEROLE.

If FUMAROLE is in an area of closely spaced fumaroles,
Then first capture named FUMAROLES, then those that are on the perimeter of the area, then those that are most prominent, then finally capture a representative pattern of FUMAROLES internal to the area. Capture as many as can be shown in correct position. The symbols must not overlap.

Graphic

If a geyser or water well symbol is shown in a geothermal area and is labeled "vent" or "gas vent",
Then capture as FUMAROLE.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

GAGING STATION - A structure used to measure the characteristics of a hydrographic feature.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of GAGING STATION is the extent of the housing of the equipment.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If GAGING STATION is published in the most recent "USGS Water Resources Data for (State)" report or is a tide station recognized by NOS, and it is permanent, automatic, continuous reading, and housed,
Or
If GAGING STATION is on the compilation manuscript provided by the State of Florida,
Then capture.

Attribute Information

Operational Status = Dismantled, only if a nonexisting station has been positioned on the compilation manuscript by the State of Florida.

Station Designator = (Integer Value), only if a value is provided on a compilation manuscript by the State of Florida.

Source Interpretation Guidelines

All

If two or more GAGING STATIONS are closely spaced,
Then capture as many as can be shown in correct position. The symbols must not overlap.

Graphic

Capture all.

A spot elevation adjacent to or on GAGING STATION is captured as SPOT ELEVATION.

Revision - General

Revision - Standard

Revision - Limited

Revise only when a compilation manuscript is provided by the State of Florida. Retain existing features.

DRAFT

GATE - A structure that may be swung, drawn, or lowered to block an entrance or passageway.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Gate Type	Function or purpose
Drydock	Gate at the entrance to a drydock
Floodgate	Gate placed across/along a channel to control floodwater or a gate across a roadway in a levee
Lock	Gate at either end of a lock chamber, to control the flow of water through the lock
Tidegate	Gate with a free-swinging barrier that is placed near or at the outlet of a conduit flowing into a body of water subject to high water from tides in order to separate fresh from salt water
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of GATE is the extent of the structure.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If GATE is associated with a 1-dimensional feature,
Then GATE is represented as a 0-dimensional basic feature object.

If GATE is associated with a 2-dimensional feature,
Then GATE is represented as a 1-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

If GATE is a floodgate or of unspecified type and is ≥ 0.02" along the longest axis,
Or
If GATE is a tidegate and is on a 2-dimensional STREAM/RIVER which is ≥ 1.32" along the longest axis,
Or
If GATE is a drydock gate and it is associated with a non-floating DRYDOCK that meets capture conditions,
Or
If GATE is a lock gate and is associated with a lock that is ≥ 0.025" along the shortest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If GATE is associated with a hydrographic feature,
Then collect in the theme Hydrography.

DRAFT

GATE is captured as a straight chain across the end of LOCK CHAMBER.

If GATE is associated with a transportation feature,
Then collect in the theme Transportation.

Graphic

If GATE has been symbolized by a single V-shaped symbol and is on a 2-dimensional feature (such as a DRYDOCK gate),
Then capture GATE as a line from bank to bank, tangent to the apex of the symbol and perpendicular to a line bisecting the symbol.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

GEYSER - A natural fountain that intermittently ejects a column of water into the air from a hole in the Earth's crust.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of GEYSER is the extent of the hole from which the eruption occurs.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

DRAFT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

If GEYSER is not within an area of closely spaced geysers,
Or
If GEYSER is within an area of closely spaced geysers and is necessary to accurately represent the pattern of geysers (see Source Interpretation Guidelines to determine how to accurately represent the pattern),
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If GEYSER is in an area of closely spaced geysers,
Then first capture named GEYSERS, then those that are on the perimeter of the area, then those that are most prominent, then finally capture a representative pattern of GEYSERS internal to the area. Capture as many as can be shown in correct position. The symbols must not overlap.

If a group of GEYSERS is named,
Then the group name is captured on the feature LOCALE (Built-up theme).

Graphic

An elevation on GEYSER is captured as SPOT ELEVATION.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

DRAFT

HAZARD ZONE - An area identified as a danger to maritime navigation.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Hazard Zone Category	Form or nature
Crib Area	Containing one or more cribs, (frames of logs or beams filled with heavy material that are sunk and used as foundations or retaining walls for docks, piers or similar structures, or as supports for pipelines)
Foul Ground	Area where the holding qualities for an anchor are poor, or where danger exists of striking or fouling the ground or other obstructions
Mine Danger Area	Area having a danger from unexploded ordnance
Piling Area	Containing one or more structures consisting of piles (long heavy timbers or sections of steel, concrete etc., forced into the earth to serve as a support, as for a pier)
Platform Area	Containing one or more platforms (horizontal surfaces raised above the level of the surrounding area for the purpose of supporting equipment used in drilling)
Reef Area	Containing one or more chains of rocks or coral, at or near the surface of the water
Rock Area	Containing one or more rocks
Shoal	Containing an underwater offshore ridge, bank or bar
Snag/Stump Area	Containing one or more tree trunks or stems near the surface of the water
Unspecified	The value is not known and is not required
Well Area	Containing one or more wells
Wreckage	Containing the ruined remains of one or more vessels
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required

DRAFT

Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of HAZARD ZONE is the extent of the area that is dangerous to navigation. This extent is provided to the USGS by NOS.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If HAZARD ZONE contains rocks, shoals (bars), or wreckage; and HAZARD ZONE is on an existing NOS chart,
Or
For a topographic/bathymetric edition only, if HAZARD ZONE is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

DRAFT

Graphic

Capture HAZARD ZONE as the area enclosed by the dotted line symbol.

Any symbols within the dotted line are captured independently under the appropriate feature. (e.g. ROCK, REEF, WELL etc.)

There will be features on topographic edition maps produced prior to 2/1/61, that do not meet capture conditions. These will not be captured. (Anchorages, barges, buoys, dolphins, duck blinds, dumping gounds, fish stakes, fish traps, foul areas, harbor limits, lightships, limiting danger lines, measured courses, pilings, project depths of channels, restricted areas, sailing lines, sewage outlets, snags, sunken rocks, sunken wrecks, tide rips, breakers, types of offshore bottom).

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

ICE MASS - A field of ice, formed in regions of perennial frost.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Ice Mass Category	Form or nature
Alpine Glacier	Body of ice and snow, originating in a mountain range, showing evidence of past or present flow
Continental Glacier	
Continental Glaciation Category	Form or nature
Ice Shelf	Seaward extension of an Ice Sheet, floating but attached to the land on at least one side and bounded on the seaward side by a steep cliff rising 2 to 50 m or more above sea level
Inland Ice Sheet	Very thick ice, completely covering and obscuring over 50,000 sq km of land
Pack Ice	Areas of floating broken ice driven and jammed together
Snowfield	Broad expanse of permanent snow
Unspecified	The value is not known and is not required
Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DRAFT

DELINEATION

The limit of ICE MASS is the extent of the ice or snow.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If ICE MASS is ≥ 0.0625 square inches,
Then capture.

Attribute Information

For all ICE MASSES within the Continental United States,
Ice Mass Category = Alpine Glacier.

Source Interpretation Guidelines

All

If named Glaciers are contiguous,
Then the dividing line is the approximate line of divergence or confluence, as determined by the topography of the ice masses, or by the changes in color or texture, or both.

Graphic

DRAFT

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

INUNDATION AREA - An area of land subject to flooding.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Elevation	The vertical distance from a given datum
(Floating Point Value)	Minimum Value: -392.8 Maximum Value: 8848.3 Precision: 1 Length: 6 Increment: 0.1 Units: meters
Stage	Height of water surface
Flood Elevation	The stage of an artificially impounded water body as determined by the highest controlling structure
Unspecified	The value is not known and is not required
Inundation Control Status	Existence of functional control structures
Controlled	Structures, such as DAM/WEIR or EMBANKMENT, exist to control the water and inundate specific areas
Inundation Area Type	Function or purpose
Debris Basin	Area to catch and temporarily store debris and sediment from runoff
Dewatering Area	Area that is seasonally drained by TVA to control mosquitoes
Duck Pond	Commercially developed areas, inundated for duck hunting (normally found along the Pacific Coast Flyway)
General Case	Common use
Percolation Basin	Area to temporarily store excess runoff and return water to the ground-water reservoir; also called spreading ground
Retarding Basin	Basin or embanked area for retarding the flow of flood waters
Not Controlled	No controlling structures exist. Flooding is natural and periodic
Name	Proper name, specific term, or expression

DRAFT

(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

In flat coastal areas where the shoreline varies with the tide and meteorological conditions, the limit of INUNDATION AREA is the approximate mean low or mean lower low water line, and the approximate limit of flooding.

The limit of INUNDATION AREA controlled by DAM/WEIR is the average water line and the line corresponding to the highest controlling structure.

For all other controlled INUNDATION AREAS, the limit is the average water line and the crest of EMBANKMENT or, if there is no EMBANKMENT, the limit of flooding.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If INUNDATION AREA is controlled and is ≥ 0.06" along the shortest axis,
Or
If INUNDATION AREA is uncontrolled, and is ≥ 0.06" along the shortest axis, and is along SEA/OCEAN or ESTUARY,
Then capture.

Attribute Information

If Inundation Control Status = Controlled, and Inundation Area Type = General Case,
Then Elevation = (Integer Value),
Else Elevation = Unspecified.

If Name applies to INUNDATION AREA only, and not to an associated LAKE/POND or STREAM/RIVER,
Then Name = (Alphanumeric),
Else Name = Unspecified.

Source Interpretation Guidelines

All

All features inside INUNDATION AREA will be captured as they normally would, if they meet capture conditions.

DRAFT

Graphic

Revision - General

Revision - Standard

Revision - Limited

Do not collect new features. Modify existing features to accomodate a change in SHORELINE.

The limits for INUNDATION AREA and the values for the Attributes of Elevation and Name may have to be obtained from the operating agency or other ancillary sources.

DRAFT

LAKE/POND - A standing body of water with a predominantly natural shoreline surrounded by land.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Elevation	The vertical distance from a given datum
(Floating Point Value)	Minimum Value: -392.8 Maximum Value: 8848.3 Precision: 1 Length: 6 Increment: 0.1 Units: meters
Stage	Height of water surface
Average Water Elevation	The stage of a natural water body that prevails for the greater part of the year
Date of Photography	The stage that exists at the date of photography
High Water Elevation	The stage that prevails when a natural water body is at or near capacity
Normal Pool	The stage of an artificially impounded water body that prevails for the greater part of the year
Spillway Elevation	The stage of an artificially impounded water body as determined by the spillway
Unspecified	The value is not known and is not required
Hydrographic Category	Portion of the year the feature contains water
Intermittent	Contains water for only part of the year, but more than just after rainstorms and at snowmelt
Perennial	Contains water throughout the year, except for infrequent periods of severe drought
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required

DRAFT

Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Water Characteristics	Distinctive properties of the water
Salt	
Unspecified	The value is not known and is not required

DELINEATION

The limit of LAKE/POND where STREAM/RIVER enters or leaves, is determined by the conformation of the land.

The limit of a naturally formed, perennial LAKE/POND is the position of SHORELINE when the water is at the stage that prevails for the greater part of the year (Average Water Elevation), or if this limit cannot be determined, the visible edge of the water body (Date of Photography).

The limit of an artificially formed, perennial LAKE/POND is the position of SHORELINE when the water is at the stage that prevails for the greater part of the year (Normal Pool), or if this limit cannot be determined, the limits defined by the spillway (Spillway Elevation), or the visible edge of the water body (Date of Photography).

The limit of an intermittent LAKE/POND is the position of SHORELINE when the water is at the stage that prevails when the feature is at or near capacity (High Water Elevation) or, if this limit cannot be determined, the visible edge of the water body (Date of Photography).

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		< 0.025"	
1-dimensional			
2-dimensional		≥ 0.025"	

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If LAKE/POND is in an arid area,
Or
If LAKE/POND is not in an arid area and is ≥ 0.05" along the shortest axis,
Then capture.

Attribute Information

If Hydrographic Category = Intermittent,
Then Stage = High Water Elevation,
Or
If High Water Elevation cannot be determined,
Then Stage = Date of Photography.

If LAKE/POND is a natural lake, and Hydrographic Category = Perennial,
Then Stage = Average Water Elevation,
Or
If Average Water Elevation cannot be determined,
Then Stage = Date of Photography.

If LAKE/POND is an artificially impounded lake, and Hydrographic Category = Perennial, and the water level is reasonably constant,
Then Stage = Normal Pool.

If LAKE/POND is an artificially impounded lake, and Hydrographic Category = Perennial, and the water level is not reasonably constant,
Then Stage = Spillway Elevation.

If LAKE/POND is an artificially impounded lake, and Hydrographic Category = Perennial, and the Normal Pool or Spillway Elevation cannot be determined,
Then Stage = Date of Photography.

See INUNDATION AREA for capture of flood elevation.

If LAKE/POND has a printed elevation on a 1:24,000-scale graphic,
Then Elevation = (Integer Value)
Else Elevation = Unspecified.

Source Interpretation Guidelines

All

Do not capture dry lakes as LAKE/POND. See PLAYA.

DRAFT

Refer to the feature definition to decide how to categorize a given feature instance. Do not use the proper name of the feature as a guide. Many features that are known as "Reservoirs" or labeled on the graphic as "Reservoirs" will be captured as LAKE/PONDS. "Stock Tanks" may be RESERVOIR or LAKE/POND depending on their form. As a general rule, if a water body has a geometric shape or other information indicates it is contained by a constructed basin, capture it as RESERVOIR. If it does not appear to be contained by a constructed basin, capture it as LAKE/POND.

The minimum size for islands within LAKE/POND is 0.03" along the shortest axis.

Graphic

If Elevation shown on map is preceded by "Spillway",
Then Stage = Spillway.

If Elevation is collected from the graphic, and LAKE/POND is artificially impounded, and "Spillway (elevation)" is not printed,
Then Stage = Normal Pool.

Revision - General

If image shows lower than average water level,
Then capture LAKE/POND at a normal pool or average water level by using ancillary sources or evidence of water marks on images.

If image shows lower than average water level and the average water elevation or normal pool elevation cannot be determined,
Then capture LAKE/POND at the visible edge of the water body.

If image shows higher than average water level,
Then capture LAKE/POND at a normal pool or average water level by using ancillary sources.

If image shows higher than average water level and the average water elevation or normal pool elevation cannot be determined,
Then capture LAKE/POND at the visible edge of the water body.

Within a newly added manmade LAKE/POND, retain contours, single and double-line drains, blue water tint, drain names, PLSS subdivisions, and civil boundaries. All other features are deleted.

Revision - Standard

Revision - Limited

Use ancillary source when the collection of Elevation is required.

Value Hydrographic Category by looking at the surrounding drainage.

DRAFT

LOCK CHAMBER - An enclosure on a waterway used to raise and lower vessels as they pass from one level to another.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of LOCK CHAMBER is the GATE and WALL that enclose the portion of a waterway to be raised or lowered.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If LOCK CHAMBER is on a 1-dimensional STREAM/RIVER or CANAL/DITCH and LOCK CHAMBER has been symbolized on existing graphic with only one wing tick, and the graphic product is the only source used,
Then LOCK CHAMBER is represented as a 0-dimensional basic feature object.

If LOCK CHAMBER is on a 1-dimensional STREAM/RIVER or CANAL/DITCH and does not meet the conditions for a 0-dimensional LOCK CHAMBER,
Then LOCK CHAMBER is represented as a 1-dimensional basic feature object.

If LOCK CHAMBER is on a 2-dimensional STREAM/RIVER or CANAL/DITCH,
Then LOCK CHAMBER is represented as a 2-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

Capture all.

Attribute Information

Source Interpretation Guidelines

All

If LOCK CHAMBER and DAM/WEIR share a name, as in "Lock and Dam #6,"
Then only collect the name with DAM/WEIR.

If a 1-dimensional or 2-dimensional LOCK CHAMBER is captured,
Then also capture STREAM/RIVER or CANAL/DITCH.

DRAFT

If a 2-dimensional LOCK CHAMBER and STREAM/RIVER are captured,
Then also capture SHORELINE, NONEARTHEN SHORE, or WALL along the sidewalls of the chamber.

If a 1-dimensional or 2-dimensional LOCK CHAMBER is captured,
Then also capture GATE at each end of the LOCK CHAMBER.

Graphic

If LOCK CHAMBER has been symbolized by a single V-shaped symbol,
Then capture LOCK CHAMBER at the apex of the V-shaped symbol.

If LOCK CHAMBER has been symbolized by a pair of V-shaped symbols and is on a single-line STREAM/RIVER or CANAL/DITCH,
Then capture LOCK CHAMBER as a line connecting the apexes of the V-shaped symbols.

If LOCK CHAMBER has been symbolized by a pair of V-shaped symbols and is on a double-line STREAM/RIVER or CANAL/DITCH,
Then capture LOCK CHAMBER as the water area between the V-shaped symbols. The ends of the chamber should be collected as straight lines passing through the apex of the V-shaped symbols.

Revision - General

Revision - Standard

Revision - Limited

Revise only if LOCK CHAMBER is on a 2-dimensional CANAL/DITCH or STREAM/RIVER.
Retain existing features.

DRAFT

MUD POT - A pool of mud from which gas or vapors issue.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of MUD POT is the extent of the pool of mud.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If MUD POT is not within an area of closely spaced mud pots,
Or
If MUD POT is within an area of closely spaced mud pots and is necessary to accurately represent the pattern of mud pots (See Source Interpretation Guidelines to determine how to accurately represent the pattern),
Then capture.

Attribute Information

Source Interpretation Guidelines

All

The feature MUD POT is not a GNIS feature class. According to GNIS, MUD POT is included in the GNIS feature class "spring". However, not all GNIS "springs" can be classified as the feature MUD POT.

If MUD POT is within an area of closely spaced mud pots,
Then first capture named MUD POTS, then those that are on the perimeter of the area, then those that are most prominent, then finally capture a representative pattern of MUD POTS internal to the area. Capture as many as can be shown in correct position. The symbols must not overlap.

Graphic

Mud pots have been shown with the spring symbol. Unless name or label indicate that it is a mud pot, capture as SPRING.

Capture features labeled "Paint Pot" as MUD POT.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

NONEARTHEN SHORE - A structure built of stone, brick, concrete, or other building materials that borders a body of water.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of NONEARTHEN SHORE is the extent of the structure.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If NONEARTHEN SHORE is ≥ 0.05" along the longest axis and separates land from water,
Then capture.

Attribute Information

N/A

Source Interpretation Guidelines

All

The line of contact between a body of water and the land is captured as either SHORELINE or NONEARTHEN SHORE. Other structures, such as DAM/WEIR, PIER/BREAKWATER/JETTY, or WHARF may coincide with the SHORELINE or NONEARTHEN SHORE, in which case both features are captured.

If a nonearthen shore does not meet capture conditions,
Then see SHORELINE or WALL.

If NONEARTHEN SHORE meets capture conditions and coincides 2-dimensional CANAL/DITCH,
Then capture both NONEARTHEN SHORE and CANAL/DITCH.

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

PIPELINE - A closed conduit, with pumps, valves and control devices, for conveying fluids, gases, or finely divided solids.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Product	Principal commodity involved
Water	
Pipeline Type	Function or purpose
Aqueduct	A structure designed to transport domestic or industrial water from a supply source to a distribution point, often by gravity
General Case	Common use
Penstock	Designed to convey water into the turbine of a hydroelectric generating plant
Siphon	Designed to convey water by gravitational force over, or under, an obstruction
Relationship to Surface	Vertical location relative to the surface
At or Near	At or slightly above the surface
Elevated	Supported above the earth
Underground	Buried
Underwater	Always submerged
Unspecified	The value is not known and is not required

DRAFT

DELINEATION

The limit of PIPELINE that is underground is the edge of the ground scars or linear clearings.

The limit of PIPELINE that is at or near the ground or elevated, is the extent of the structure.

The limit of PIPELINE that is underwater is as shown on the final compilation provided to USGS by NOS.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

If PIPELINE is an aqueduct,
Or
If PIPELINE is aboveground and is outside of a congested area; and is a trunk line; and is ≥ 0.25" from a paralleling road, railway, or other linear feature,
Or
If PIPELINE is underground and surface scars are present; and is outside of a congested area; and is a trunk line; and is ≥ 0.25" from a paralleling road, railway, or other linear feature,
Or
If PIPELINE is a penstock or siphon and is ≥ 0.12" along the longest axis,
Then capture.

Attribute Information

If Pipeline Type = Siphon,
Then Relationship to Surface = Unspecified.

DRAFT

Source Interpretation Guidelines

All

If PIPELINE, with Pipeline Type = Siphon, causes a gap in CANAL/DITCH,
Then capture PIPELINE only.

If a siphon does not meet capture conditions for PIPELINE,
Then capture CANAL/DITCH and, if required, capture UNDERPASS to allow definition of the relationship between CANAL/DITCH and the feature over or under which it passes.

If PIPELINE is elevated over a depression by a structure built for that purpose,
Then capture only PIPELINE, with Relationship to Surface = Elevated.

If PIPELINE is within TUNNEL,
Then capture both PIPELINE and TUNNEL.

If PIPELINE conveys water,
Then collect in the theme Hydrography.

If PIPELINE conveys a product other than water,
Then collect in the theme Built-up.

Graphic

If PIPELINE is labeled "Pipeline Bridge",
Then capture PIPELINE, with Relationship to Surface = Elevated.

Revision - General

Revision - Standard

Revision - Limited

Revise aboveground pipelines only. Retain existing features.

DRAFT

PLAYA - The flat area at the lowest part of an undrained desert basin, generally devoid of vegetation.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of PLAYA is the extent of the lowest part of the basin.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

DRAFT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If PLAYA is ≥ 0.1" along the shortest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If PLAYA is captured,
Then also capture BARREN LAND (Nonvegetative Surface Cover) to describe the composition of the area.

Graphic

Lakes that are labeled "Dry" or "Alkalai" are captured as PLAYA.

Revision - General

The edge of a Playa may be indicated by vegetation, discoloration, or sediment line.

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

POST - An upright piece of timber or other material, in or adjacent to a body of water, used for mooring ships or supporting other structures.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Post Type	Function or purpose
Dolphin	
Piling	

DELINEATION

The limit of POST is the extent of the timber or other material.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

For a topographic/bathymetric edition only, if POST is on the final compliation provided to USGS by NOS, Then capture.

Attribute Information

Source Interpretation Guidelines

All

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

RAPIDS - An area of swift current in a stream or river, characterized by standing waves or by boulders and rocks.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of RAPIDS is the extent of the turbulent water.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If RAPIDS are on a 1-dimensional STREAM/RIVER and are < 0.02" along the STREAM/RIVER,

DRAFT

Then RAPIDS are represented as a 0-dimensional basic feature object.

If RAPIDS are on a 1-dimensional STREAM/RIVER and are ≥ 0.02" along the STREAM/RIVER,
Then RAPIDS are represented as a 1-dimensional basic feature object collinear with the feature object that represents STREAM/RIVER.

If RAPIDS are on a 2-dimensional STREAM/RIVER,
Then RAPIDS are represented as a 2-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

If RAPIDS are named,
Or
If RAPIDS are ≥ 0.01" as measured perpendicular to stream flow,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If RAPIDS are captured,
Then also capture STREAM/RIVER.

If distance between RAPIDS is ≥ 0.05",
Then capture as separate RAPIDS.

If distance between RAPIDS is < 0.05",
Then capture as one RAPIDS.

Graphic

Capture all.

If RAPIDS are symbolized by hachures,
Then capture as 2-dimensional using the extent of the hachures.

Revision - General

Revision - Standard

DRAFT

Revision - Limited

Do not revise. Retain existing features.

DRAFT

REACH - A segment of surface water having a unique identifier.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Reach Code	Unique identifier composed of two parts. The first eight digits are the Cataloging Unit Code as defined by FIPS 103. The next six digits are randomly assigned, sequential numbers that are unique within a Catologing Unit.
(Identification)	Length Value: 14
Reach Code Assignment Date	The date the Reach Code was assigned
(Alphanumeric)	Length Value: 99
Stream Level	The level of the path which contains the feature
(Integer Value)	Minimum Value: 1 Maximum Value: 99 Precision: 0 Length: 2 Increment: 1 Units:
Unspecified	The value is not known and is not required

DELINEATION

The limit of REACH is a significant piece of surface water, generally defined as a stretch of stream between confluences or a lake.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT
Connects To		REACH REACH
Flows To		REACH REACH
Is Composed Of		ARTIFICIAL PATH CANAL/DITCH CONNECTOR LAKE/POND PIPELINE STREAM/RIVER

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

REACH is represented as a compound feature object.

Only 1-dimensional CANAL/DITCH and STREAM/RIVER can be part of REACH.

DATA EXTRACTION

Capture Conditions

Attribute Information

Terminal REACHES are assigned Stream Levels according to the manner in which the network terminates:
Stream Level = 1 when the outlet is the Atlantic Ocean, the Pacific Ocean, or Gulf of Mexico.
Stream Level = 2 when the outlet is one of the Great Lakes or the Great Salt Lake.
Stream Level = 3 when the REACH exits the US into Canada or Mexico.
Stream Level = 4 when the REACH is an isolated drainage flowing into the ground.

Non-terminal REACHES are assigned Stream Levels one greater than the REACH into which they flow.

Non-networked REACHES have Stream Level = Unspecified

DRAFT

Source Interpretation Guidelines

All

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

REEF - A chain of rocks or coral at or near the surface of the water.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of REEF is the edge of the rock or coral.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

For a topographic/bathymetric edition only, if REEF is on the final compilation provided to USGS by NOS,
Or
If REEF is on an existing NOS chart,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Numerous closely spaced ROCKS that form a chain along the coastline or close to the shore are collected as REEF. (Quantified rules are TBD)

Areas within or next to REEF may be land areas, areas that uncover, or water areas. If the area uncovers, see FORESHORE. If the area is water, see SEA/OCEAN.

The characteristics of the REEF, such as coral, are associated with the area that uncovers. See FORESHORE and BARREN LAND (Nonvegetative Surface Cover Theme).

Graphic

Capture all.

The area next to REEF that uncovers is shown with the brown sand pattern on topographic-bathymetric editions and with the black sand pattern on topographic editions. For collection of these areas see FORESHORE and BARREN LAND (Nonvegetative Surface Cover Theme).

REEF is collected along a line that connects the high points of the closed, outer portion of the reef symbol.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

RESERVOIR - A constructed basin formed to contain water or other liquids.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Construction Material	Predominant material used
Earthen	Constructed of earth, or a combination of earth and rock
Nonearthen	Constructed of concrete, brick or stone
Unspecified	The value is not known and is not required
Elevation	The vertical distance from a given datum
(Floating Point Value)	Minimum Value: -392.8 Maximum Value: 8848.3 Precision: 1 Length: 6 Increment: 0.1 Units: meters
Unspecified	The value is not known and is not required
Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Reservoir Type	Function or purpose

DRAFT

Aquaculture	For rearing of finfish, shellfish, or aquatic plants
Decorative Pool	For improving the aesthetic appearance of the landscape
Disposal	For disposal
Disposal Type	Function or purpose
Tailings Pond	Containing, in aqueous form, ore and waste materials discarded in ore-treatment processes
Unspecified	The value is not known and is not required
Evaporator	For the natural evaporation of water to allow harvesting of mineral concentrates
Swimming Pool	For swimming
Treatment	For treatment
Treatment Type	Function or purpose
Cooling Pond	For cooling industrial waste water
Filtration Pond	For removing foreign elements from water
Settling Pond	For precipitating solid matter from a liquid
Sewage Treatment Pond	For the treatment of domestic water-born waste
Unspecified	The value is not known and is not required
Water Storage	For long- or short-term storage of water
Cover Status	Existence of a cover
Covered	
Not Covered	
Unspecified	The value is not known and is not required
Hydrographic Category	Portion of the year the feature contains water
Intermittent	Contains water for only part of the year, but more than just after rainstorms and at snowmelt

DRAFT

Perennial	Contains water throughout the year, except for infrequent periods of severe drought
Unspecified	The value is not known and is not required

DELINEATION

The limit of RESERVOIR is the rim of the constructed basin.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		< 0.03"	
1-dimensional			
2-dimensional		≥ 0.03"	

Special Conditions:

DATA EXTRACTION

Capture Conditions

If RESERVOIR is a sewage treatment pond or a filtration pond,
Or
If RESERVOIR is for water storage and is in an arid region,
Or
If RESERVOIR is not a sewage treatment pond or filtration plant, and is ≥ 0.03" along the shortest axis,
Then capture.

Attribute Information

If RESERVOIR has a printed elevation on a 1:24,000-scale graphic,
Then Elevation = (Integer Value),
Else Elevation = Unspecified.

If Reservoir Type = Water Storage and Cover Status = Covered,
Then Hydrographic Category = Unspecified.

DRAFT

If Reservoir Type = Water Storage and Construction Material = Nonearthen,
Then Hydrographic Category = Unspecified.

If Disposal Type = Tailings Pond,
Then Construction Material = Earthen.

Reservoir Type = Unspecified only in limited update. See Source Interpretation Guidelines, Revision.

If Reservoir Type = Decorative Pool or Swimming Pool,
Then Construction Material = Nonearthen.

If Cover Status = Covered,
Then Construction Material = Nonearthen.

If Reservoir Type = Aquaculture or Treatment,
Then Construction Material = Unspecified.

Source Interpretation Guidelines

All

Refer to the feature definition to decide how to categorize a given feature instance. Do not use the proper name of the feature as a guide. Many features that are known as "Reservoirs" or labeled on the graphic as "Reservoirs" will be captured as LAKE/PONDS. "Stock Tanks" may be RESERVOIR or LAKE/POND depending on their form. As a general rule, if a water body has a geometric shape or other information indicates it is contained by a constructed basin, capture it as RESERVOIR. If it does not appear to be contained by a constructed basin, capture it as LAKE/POND.

If RESERVOIR is identified as a Minnow Pond, Fish Hatchery, Rearing Pond, Fish Pond, or similar facility,
Then capture RESERVOIR with Reservoir Type = Aquaculture.

Fish ponds in natural water bodies are not captured as RESERVOIR. See ESTUARY, LAKE/POND or SEA/OCEAN.

If RESERVOIR is < 0.03" along the shortest axis and is within 0.02" of another RESERVOIR with the same attribute values,
Then capture as one RESERVOIR only if the combined areas are ≥ 0.03" along the shortest axis.

If two RESERVOIRS are < 0.005" apart and have the same attribute values,
Then capture as two RESERVOIRS with a shared perimeter line.

If two RESERVOIRS are < 0.005" apart and do not have the same attribute values,
Then displace the perimeter lines equally and capture so that the perimeter lines are 0.005" apart.

If RESERVOIR is an oil sump or sludge pit,
Then collect in the theme Built-Up.

DRAFT

If RESERVOIR is divided by wire mesh, screens, or grates,
Then do not capture the resulting divisions as separate RESERVOIRS.

If RESERVOIR is identified as a sewage disposal pond,
Then capture RESERVOIR with Reservoir Type = Treatment and Treatment Type = Sewage Treatment Pond.

Graphic

If RESERVOIR is symbolized with a black outline,
Then Construction Material = Nonearthen.

If RESERVOIR is symbolized with a blue or brown outline,
Then Construction Material = Earthen.

If RESERVOIR is < 0.03" along the shortest axis, and shares an outline with another RESERVOIR with the same attribute values, and their combined area is ≥ 0.03" along the shortest axis,
Then capture the combined areas as one RESERVOIR.

Revision - General

Revision - Standard

Revision - Limited

Reservoir Type = Unspecified for newly collected RESERVOIRS. Retain Reservoir Type on existing RESERVOIRS.

Elevation = Unspecified for newly collected RESERVOIRS. Retain Elevation on existing RESERVOIRS.

DRAFT

ROCK - A concreted mass of stony material.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Relationship to Surface	Vertical location relative to the surface
Abovewater	Exposed at mean lower low water
Underwater	Always submerged

DELINEATION

The limit of ROCK that is abovewater is the edge of the mass exposed at mean lower low water.

The limit of ROCK that is underwater is as shown on the final compilation provided to USGS by NOS.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

If ROCK is exposed at mean lower low water and is < 0.03" in the longest axis, and is on an existing NOS chart,
Or
For a topographic/bathymetric edition only, if ROCK is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Do not capture exposed rocks ≥ 0.03" as ROCK. See rules for islands within LAKE/POND, SEA/OCEAN, and STREAM/RIVER. See ISLAND if named.

Groups of rocks are sometimes surrounded by limiting danger lines, as delineated by NOS. Capture individual rocks as ROCK. Capture the extent of the limiting danger line as HAZARD ZONE.

Numerous closely spaced ROCKS that form a chain along the coastline or close to the shore are collected as REEF. (Quantified rules are TBD)

Graphic

Capture all ROCKS, except submerged rocks shown on topographic maps. ROCKS on pre-1961 maps that are not consistent with current capture conditions are not captured.

DRAFT

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

SEA/OCEAN - The great body of salt water that covers much of the earth.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Sea/Ocean Category	Form or nature
Reef Pool	Pocket of SEA/OCEAN completely surrounded by a coral reef
Unspecified	The value is not known and is not required

DELINEATION

The limit of SEA/OCEAN is the approximate line of mean high water.

In areas where rivers enter SEA/OCEAN, the limit is where the conformation of the land and water make the division obvious, or, if the land and water do not suggest an obvious limit, the limit is where the river reaches a width of 1 nautical mile (6076.1 feet, or 1.15 statute miles) with no further constrictions.

In an area where ESTUARY enters SEA/OCEAN, the limit is where ESTUARY ends.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

Capture all.

Attribute Information

Source Interpretation Guidelines

All

The minimum size for islands within SEA/OCEAN is 0.03" along the shortest axis.

Graphic

If the reef symbol encircles an area shown with the blue water symbol, and the reef symbology points inward,
Then collect the area as SEA/OCEAN, with Sea/Ocean Category = Reef Pool.

Revision - General

Revision - Standard

Revision - Limited

Do not collect new features. Modify existing features to accomodate a change in SHORELINE.

DRAFT

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SINK/RISE - The place at which a stream disappears underground or reappears at the surface in a karst area.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 99
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of SINK/RISE is the extent of the hole where the stream disappears or reappears.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If SINK/RISE is on a 1-dimensional STREAM/RIVER,

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Then SINK/RISE is represented as a 0-dimensional basic feature object.

If SINK/RISE is on a 2-dimensional STREAM/RIVER,
Then SINK/RISE is represented as a 1-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

If SINK/RISE is on STREAM/RIVER,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Do not capture indeterminate points where streams dissipate into the ground as SINK/RISE. These points are indicated by the end of the feature STREAM/RIVER.

Do not capture the point where streams enter into manmade features as SINK/RISE. These points are indicated by the end of the feature STREAM/RIVER.

Graphic

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

SNAG/STUMP - A firmly attached stem or trunk of a tree near the surface of water.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Relationship to Surface	Vertical location relative to the surface
Abovewater	Exposed at mean lower low water
Underwater	Always submerged
Snag/Stump Type	
Snag	
Stump	

DELINEATION

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

For a topographic/bathymetric edition only, if SNAG/STUMP is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

SOUNDING DATUM LINE - A line representing the tidal datum to which bathymetric contours are referenced.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Positional Accuracy	The accuracy within which a feature can be confidently positioned
Approximate	Conditions permit the feature to be confidently positioned between 0.02" and 0.1", at map scale, of its true ground position.
Definite	Conditions permit the feature to be confidently positioned. Horizontal data are confidently positioned within 0.02", at map scale, of the true ground position. Vertical data are confidently positioned within one-half contour interval of the true ground position

DELINEATION

The limit of SOUNDING DATUM LINE is the line of mean lower low water.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

For a topographic/bathymetric edition only, if SOUNDING DATUM LINE is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If SOUNDING DATUM LINE is not symbolized on the source (as when the position of the line is indicated by the edge of the FORESHORE tint on graphic source, rather than by a unique line symbol),
Then Positional Accuracy = Approximate.

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

SPECIAL USE ZONE - An area where distinctive types of maritime activities occur.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Operational Status	State or condition
Abandoned	Intact but not maintained or intended for use
Operational	Usable and intended for use
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Special Use Zone Type	Function or purpose
Dump Site	For dumping of discarded materials
Spoil Area	For the disposal of material obtained by dredging

DELINEATION

The limit of SPECIAL USE ZONE is the extent of the area used for distinctive activities.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

For a topographic/bathymetric edition only, if SPECIAL USE ZONE is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If SPECIAL USE ZONE is within LAKE/POND, SEA/OCEAN, or STREAM/RIVER,
Then capture both SPECIAL USE ZONE and the other feature.

SPECIAL USE ZONE may coincide with FORESHORE, SWAMP/MARSH, or land areas.

Islands in rows, and islands that do not match the pattern of islands in adjacent non-SPECIAL USE ZONE areas, should not be included in the SPECIAL USE ZONE.

Graphic

Revision - General

DRAFT

Revision - Standard

Revision - Limited

DRAFT

SPECIAL USE ZONE LIMIT - The limit of an area used for distinctive types of maritime activities.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Positional Accuracy	The accuracy within which a feature can be confidently positioned
Definite	Conditions permit the feature to be confidently positioned. Horizontal data are confidently positioned within 0.02", at map scale, of the true ground position. Vertical data are confidently positioned within one-half contour interval of the true ground position
Indefinite	Conditions prevent the feature from being confidently positioned. Horizontal data cannot be confidently positioned within 0.02", at map scale, of the true ground position. Vertical data cannot be confidently positioned within one-half contour interval of the true ground position

DELINEATION

The position of SPECIAL USE ZONE LIMIT is determined by the extent of SPECIAL USE ZONE.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

For a topographic/bathymetric edition only, if SPECIAL USE ZONE LIMIT is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

If SPECIAL USE ZONE LIMIT is indicated only by a change in fill patterns on the source,
Then Positional Accuracy = Indefinite.

If SPECIAL USE ZONE LIMIT coincides with definite SHORELINE or definite SOUNDING DATUM LINE,
Then Positional Accuracy = Definite.

Source Interpretation Guidelines

All

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

SPILLWAY - A constructed passage for surplus water to run over or around a dam.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of SPILLWAY is the extent of the structure over which water flows.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If SPILLWAY is constructed of masonry and is ≥ 0.02" along the shortest axis,
Then capture.

Attribute Information

N/A

Source Interpretation Guidelines

All

If SPILLWAY is captured,
Then also capture NONEARTHEN SHORE along the edge of any adjacent water body.

Tunnel or closed-conduit spillways, including glory-holes and risers, are not captured as SPILLWAY. See WATER INTAKE/OUTFLOW or PIPELINE.

Do not capture overflow spillways as SPILLWAY. See DAM/WEIR.

Graphic

Revision - General

Revision - Standard

Revision - Limited

DRAFT

SPRING/SEEP - A place where water issues from the ground naturally.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Water Characteristics	Distinctive properties of the water
Alkaline	Water shows evidence of alkali salts
Hot	Water temperature is higher than that of the human body (98.6 degrees F)
Sulphur	
Unspecified	The value is not known and is not required

DELINEATION

The limit of SPRING/SEEP is the extent of the place where water issues from the ground.

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REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

If SPRING/SEEP is in an arid region,
Or
If SPRING/SEEP is not in an arid region and is large or well known,
Or
If SPRING/SEEP is within an area of closely spaced springs and is necessary to accurately represent the pattern of springs (see Source Interpretation Guidelines to determine how to accurately represent the pattern),
Then capture.

Attribute Information

If "Hot", "Sulphur", or "Alkali" appear in the proper name of SPRING/SEEP,
Then give like value to Water Characteristics.

Source Interpretation Guidelines

All

If SPRING/SEEP is in an area of closely spaced springs,
Then first capture named SPRING/SEEPS, then those that are on the perimeter of the area, then those that are most prominent, then finally capture a representative pattern of SPRING/SEEPS internal to the area. Capture as many as can be shown in correct position. The symbols must not overlap.

See Appendix 2A for location of arid regions.

DRAFT

Graphic

An elevation on SPRING/SEEP is captured as SPOT ELEVATION.

Do not capture springs labelled ’dry’. See LOCALE (Built-Up theme).

If SPRING/SEEP is identified as "Salt" on the graphic,
Then Water Characteristics = Alkaline.

If Water Characteristics of SPRING/SEEP are not specifically identified on the graphic,
Then Water Characteristics = Unspecified.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

STREAM/RIVER - A body of flowing water.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Elevation	The vertical distance from a given datum
(Floating Point Value)	Minimum Value: -392.8 Maximum Value: 8848.3 Precision: 1 Length: 6 Increment: 0.1 Units: meters
Stage	Height of water surface
Normal Pool	The stage of an artificially impounded water body that prevails for the greater part of the year
Not Applicable	The attribute does not apply and therefore cannot be valued
Hydrographic Category	Portion of the year the feature contains water
Intermittent	Contains water for only part of the year, but more than just after rainstorms and at snowmelt
Perennial	Contains water throughout the year, except for infrequent periods of severe drought
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Positional Accuracy	The accuracy within which a feature can be confidently positioned
Definite	Conditions permit the feature to be confidently positioned. Horizontal data are confidently positioned within 0.02", at map scale, of the true ground position. Vertical data are confidently positioned within one-half contour interval of the

DRAFT

	true ground position
Indefinite	Conditions prevent the feature from being confidently positioned. Horizontal data cannot be confidently positioned within 0.02", at map scale, of the true ground position. Vertical data cannot be confidently positioned within one-half contour interval of the true ground position
Not Applicable	The attribute does not apply and therefore cannot be valued

DELINEATION

The limit of a perennial STREAM/RIVER is the position of the shoreline when the water is at the stage that prevails for the greater part of the year.

The limit of an intermittent STREAM/RIVER is the position of the shoreline when the water is at the stage that prevails when the feature is at or near capacity.

The upper limit of STREAM/RIVER is where the feature first becomes evident as a channel.

The limit of STREAM/RIVER where it enters or leaves LAKE/POND is determined by the conformation of the land.

The limit of STREAM/RIVER where it enters SEA/OCEAN is where the conformation of the land and water make the division obvious, or, if the land and water do not suggest an obvious limit, the limit is where the stream reaches a width of 1 nautical mile (6076.1 feet or 1.15 statute miles) with no further constrictions.

The limit of STREAM/RIVER where it enters ESTUARY is where ESTUARY ends.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT
Is Above		UNDERPASS

DRAFT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		< 0.025"	
2-dimensional		≥ 0.025"	

Special Conditions:

To accommodate variations in the shortest axis of STREAM/RIVER:

If shortest axis of STREAM/RIVER is:

< 0.025" but ≥ 0.01" for a distance < 2.64", and is connected at both ends to a 2-dimensional STREAM/RIVER,
Then STREAM/RIVER is represented as a 2-dimensional basic feature object.

< 0.025" but ≥ 0.01" for a distance ≥ 2.64", or < 0.01" regardless of distance, and is connected at both ends to a 2-dimensional STREAM/RIVER,
Then STREAM/RIVER is represented as a 1-dimensional basic feature object.

≥ 0.025" but < 0.04" for a distance < 2.64", and is connected at both ends to a 1-dimensional STREAM/RIVER,
Then STREAM/RIVER is represented as a 1-dimensional basic feature object.

≥ 0.025" but < 0.04" for a distance ≥ 2.64", or ≥ 0.04" regardless of distance, and is connected at both ends to a 1-dimensional STREAM/RIVER,
Then STREAM/RIVER is represented as a 2-dimensional basic feature object.

DRAFT

DATA EXTRACTION

Capture Conditions

If STREAM/RIVER flows from LAKE/POND or SPRING/SEEP,
Or
If STREAM/RIVER is ≥ 1.25" along the longest axis,
Or
If STREAM/RIVER is perennial and is in an arid region,
Then capture.

Attribute Information

If the water level of STREAM/RIVER is controlled for navigation by DAM/WEIR or GATE with Gate Type = Lock,
Then Elevation = (Integer Value),
Else Elevation = Not Applicable.

If STREAM/RIVER coincides with LOCK CHAMBER,
Then Elevation = Not Applicable.

If STREAM/RIVER is represented as a 2-dimensional basic feature object,
Then Positional Accuracy = Not Applicable.

Source Interpretation Guidelines

All

If STREAM/RIVER is part of WATERCOURSE,
Then collect a name with WATERCOURSE.

See Appendix 2A for location of arid regions.

In arid areas it is difficult to distinguish between narrow intermittent and ephemeral drains and no distinction will be made. All drainages < 0.025" are collected as 1-dimensional intermittent streams. Thin drainage in arid areas to appropriately represent the "wetness" of the area. Rules for thinning intermittent streams in arid areas will be documented as more information becomes available.

If a portion of STREAM/RIVER flows through SWAMP/MARSH,
Then select the appropriate Hydrographic Category according to the definitions given.

Do not capture areal dry washes, arroyos, dry gulches and ephemeral streams as STREAM/RIVER. See WASH.

The minimum size for islands within STREAM/RIVER is 0.03" along the shortest axis.

If a stream flows in a braided pattern,

DRAFT

Then see AREA OF COMPLEX CHANNELS.

Graphic

If STREAM/RIVER flows from SPRING/SEEP,
Then capture STREAM/RIVER starting at the center of SPRING/SEEP symbol.

Revision - General

If the headwaters of STREAM/RIVER are closer than 0.5" from a saddle or divide,
Then capture STREAM/RIVER starting 0.5" from the saddle or divide.

If image shows lower than average water level,
Then capture STREAM/RIVER at a normal pool or average water level by using ancillary sources or evidence of water marks on images.

If image shows lower than average water level and the average water elevation or normal pool elevation cannot be determined,
Then capture STREAM/RIVER at the visible edge of the water body.

If image shows higher than average water level,
Then capture STREAM/RIVER at a normal pool or average water level by using ancillary sources.

If image shows higher than average water level and the average water elevation or normal pool elevation cannot be determined,
Then capture STREAM/RIVER at the visible edge of the water body.

Revision - Standard

Revision - Limited

Do not add new features. Modify existing features only if there are obvious changes in the stream channel.

Use ancillary source if Elevation is required.

Value Hydrographic Category by looking at the surrounding drainage.

DRAFT

SUBMERGED STREAM - An old river course inundated by an impounded water body.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of SUBMERGED STREAM is the extent of the banks as previously mapped.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If SUBMERGED STREAM is published as a double-line stream on previous mapping at the same or larger scale and the stream has since been submerged by an impounded lake or stream,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

SUBMERGED STREAM must be coincident with LAKE/POND. Therefore, SUBMERGED STREAM cannot be collected outside of the impounded water area.

If SUBMERGED STREAM is captured,
Then also capture LAKE/POND.

Graphic

Capture all.

If the dashed symbol ends within 0.01" of the limits of the impounded water area,
Then delineate the area using the limits of the impounded water area.

If the end of dashed symbol is greater than 0.01" from the limits of the impounded water area,
Then delineate the area by connecting the ends of the dashed outline with a straight line.

Revision - General

Revision - Standard

Revision - Limited

DRAFT

SWAMP/MARSH - A noncultivated, vegetated area that is inundated or saturated for a significant part of the year. The vegetation is adapted for life in saturated soil conditions.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of SWAMP/MARSH is the extent of the wet, spongy area.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

DRAFT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If SWAMP/MARSH is ≥ 0.1" along the shortest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Break SWAMP/MARSH for RAILWAYS and for Class 1 and Class 2 ROADS.

Break SWAMP/MARSH for clearings that are ≥ 0.05" along the shortest axis, or for linear clearings that are ≥ 0.025" along the shortest axis.

Do not capture mangrove areas as SWAMP/MARSH, see TREES (Vegetative Surface Cover theme).

SWAMP/MARSH may be coincident with AREA OF COMPLEX CHANNELS, ESTUARY, LAKE/POND, SEA/OCEAN, STREAM/RIVER, or TREES (Vegetative Surface Cover theme).

Do not capture cranberry bogs and other cultivated cropland as SWAMP/MARSH. See CULTIVATED CROPLAND (Vegetative Surface Cover theme). Rice fields are not captured.

Graphic

Capture as SWAMP/MARSH any areas filled with the marsh and swamp symbol.

Revision - General

Revision - Standard

DRAFT

Revision - Limited

Do not revise. Retain existing features.

DRAFT

TUNNEL - An underground or underwater passage.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of TUNNEL is the walls of and openings to the passage.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If TUNNEL provides passage for a hydrographic feature,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If TUNNEL meets capture conditions and provides passage for another feature (CANAL/DITCH, PIPELINE with Product = Water),
Then capture both TUNNEL and the other feature.

If a tunnel does not meet capture conditions and carries another feature,
Then capture that feature, and if required, capture UNDERPASS to allow definition of the relationship between that feature and any other feature over or under which it passes.

If TUNNEL provides passage for ROAD or RAILWAY,
Then collect in the theme Transportation.

If there are two TUNNEL passages and the overall width is < 100 ft,
Or
If there are two TUNNEL passages and the separation between the passages is < 20 ft,
Then capture one instance of TUNNEL.

Graphic

If TUNNEL is symbolized by a three line symbol,
Then capture as one instance of TUNNEL.

Water tunnels in Hawaii that are shown with the adit symbol are not captured as TUNNEL. See WELL.

Revision - General

Revision - Standard

Revision - Limited

If the alignment of TUNNEL is unknown,
Then align TUNNEL in a straight line between openings.

DRAFT

DRAFT

UNDERPASS - The grade separation where part or all of one feature instance is directly above part or all of another feature instance.

ATTRIBUTE/ATTRIBUTE VALUE LIST

N/A

DELINEATION

The limit of UNDERPASS is the extent of the horizontal area where the two separated feature instances overlap.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT
Is Above		AREA OF COMPLEX CHANNELS ARTIFICIAL PATH CANAL/DITCH STREAM/RIVER

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		>0	
1-dimensional			
2-dimensional			

Special Conditions:

If the feature object above UNDERPASS is 0-dimensional, and the feature object below UNDERPASS is 1-dimensional, or vice-versa,
Then UNDERPASS is represented as a 0-dimensional basic feature object.

If the feature object above and the feature object below UNDERPASS are both 1-dimensional, and they are not collinear in the planar graph,
Then UNDERPASS is represented as a 0-dimensional basic feature object.

If the feature object above and the feature object below UNDERPASS are both 1-dimensional, and they are at least partially collinear in the planar graph (they share at least one chain if in the same surface, or some linear portion of their chains match if in different surfaces),
Then UNDERPASS is represented as a 1-dimensional basic feature object.

If the feature object above UNDERPASS is 1-dimensional and the feature object below UNDERPASS is 2-dimensional, or vice-versa,
Then UNDERPASS is represented as a 1-dimensional basic feature object.

DRAFT

If the feature object above and the feature object below UNDERPASS are both 2-dimensional,
Then UNDERPASS is represented as a 2-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

If UNDERPASS occurs at BRIDGE,
Or
If UNDERPASS occurs where AREA OF COMPLEX CHANNELS, BUILDING, CANAL/DITCH, PIPELINE, RAILWAY, ROAD, RUNWAY/APRON/TAXIWAY, or STREAM/RIVER cross over each other at different levels, and if there is no captured structure indicating vertical relationship and the vertical relationship is not otherwise inferable,
Then capture.

Attribute Information

N/A

Source Interpretation Guidelines

All

Do not capture UNDERPASS, even if there is no captured separating structure, between ROAD or RAILWAY, and a waterbody. Without a structure, ROAD or RAILWAY is always assumed to be above the waterbody, never below.

Only two feature objects may be involved in instances of the Is Above relationship with an UNDERPASS feature object. In a case of three or more feature objects overpassing each other at the same place, only vertically adjacent feature objects are involved in Is Above relationship instances with any one UNDERPASS feature object. Thus, a triple level stacking of feature objects requires two UNDERPASS feature objects; one UNDERPASS between the top and middle feature objects, and the other UNDERPASS between the middle and bottom feature objects.

If the features that cross at UNDERPASS are in two different themes,
Then capture UNDERPASS in both themes.

Graphic

Revision - General

Revise if features participating in relationship are revised.

DRAFT

Revision - Standard

Revision - Limited

DRAFT

WALL - An upright structure of masonry, wood, plaster, or other building material serving to enclose, divide, or protect an area.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Wall Type	Function or purpose
General Case	Common use
Sea	A wall set back from the shoreline for the purpose of holding back the sea.

DELINEATION

The limit of WALL is the edge of the structure.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional		> 0	
2-dimensional			

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If WALL is a seawall,
Or
If WALL is associated with a 2-dimensional LOCK CHAMBER and WALL has water on both sides,
Or
If WALL extends into a body of water and is not a pier/breakwater/jetty or seawall,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If WALL is not associated with a hydrographic feature,
Then capture in the Built-Up theme.

If the edge of LOCK CHAMBER separates water from land,
Then do not capture WALL. See NONEARTHEN SHORE or SHORELINE.

If DAM/WEIR, NONEARTHEN SHORE, PIER/BREAKWATER/JETTY, SHORELINE, or SPILLWAY is captured,
Then do not capture WALL.

If WALL meets capture conditions, and coincides 2-dimensional CANAL/DITCH,
Then capture both WALL and CANAL/DITCH.

Graphic

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain only those WALLS associated with LOCK CHAMBER.

DRAFT

WASH - The usually dry portion of a stream bed that contains water only during or after a local rainstorm or heavy snowmelt.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of WASH is the cut banks of the dry channel.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

DRAFT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional	> 0		

Special Conditions:

DATA EXTRACTION

Capture Conditions

If WASH is ≥ 0.025" along the shortest axis, and is ≥ 1.25" along the longest axis, and is greater than or equal to two times the width of any STREAM/RIVER within the WASH,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Capture the stream bed portion of the channel that contains water more than just during or after local rainstorms or heavy snowmelt as STREAM/RIVER.

If WASH is captured,
Then also capture BARREN LAND (Nonvegetative Surface Cover Theme).

If WASH contains STREAM/RIVER,
Then capture both.

Sand areas that do not meet capture conditions for WASH and which are associated with STREAM/RIVER may be considered for capture as just the feature BARREN LAND. (Nonvegetative Surface Cover theme)

If WASH is < 0.025" along the shortest axis,
Then capture as STREAM/RIVER with Hydrographic Category = Intermittent, if capture conditions for STREAM/RIVER are met.

Graphic

If a wash is represented as a single brown line, or as a sand area that is too small to meet capture conditions,
Then capture STREAM/RIVER with Hydrographic Category = Intermittent if capture conditions for STREAM/RIVER are met.

DRAFT

Revision - General

Revision - Standard

Revision - Limited

Do not add new features. Modify existing features only if there are obvious changes in the stream.

DRAFT

WATER INTAKE/OUTFLOW - A structure through which water enters or exits a conduit.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Water Intake/Outflow Type	Function or purpose
Intake	For controlling the level of a waterbody or for intaking water for hydroelectric power, irrigation or water supply
Outflow	For releasing water from a structure

DELINEATION

The limit of WATER INTAKE/OUTFLOW is the extent of the structure.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		< 0.04"	
1-dimensional			
2-dimensional		≥ 0.04"	

Special Conditions:

DRAFT

DATA EXTRACTION

Capture Conditions

If WATER INTAKE/OUTFLOW is an intake structure and is exposed at surface,
Or
If WATER INTAKE/OUFLOW is an outflow structure and is ≥ 0.04" along the shortest axis,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

Structures that provide access to a WATER INTAKE/OUTFLOW will be captured as BRIDGE, unless there is supporting evidence that they are PIER/BREAKWATER/JETTY.

If an intake structure is a tower,
Then capture as TOWER with Tower Type = Water Intake.

Graphic

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Delete existing features.

DRAFT

WATERFALL - A vertical or near vertical descent of water over a step or ledge in the bed of a river.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks

DELINEATION

The limit of WATERFALL is the extent of the vertical or nearly vertical descent, and the SHORELINES.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional			
1-dimensional			
2-dimensional			

Special Conditions:

If WATERFALL is on a 1-dimensional STREAM/RIVER,

DRAFT

Then WATERFALL is represented as a 0-dimensional basic feature object.

If WATERFALL is on a 2-dimensional STREAM/RIVER,
Then WATERFALL is represented as a 1-dimensional basic feature object.

DATA EXTRACTION

Capture Conditions

If WATERFALL is named,
Or
If WATERFALL is on a perennial STREAM/RIVER and has a vertical drop ≥ 10 ft, and extends from SHORELINE to SHORELINE,
Or
If WATERFALL is within an area of closely spaced waterfalls and is necessary to accurately represent the pattern of waterfalls (see Source Interpretation Guidelines to determine how to accurately represent the pattern),
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If WATERFALL is within an area of closely spaced waterfalls,
Then first capture upstream WATERFALL, then capture as many others as can be shown in correct position. The symbols must not overlap.

Graphic

Capture all.

Names that contain the word "Falls" may indicate the feature RAPIDS. Careful identification of the symbol will be required to accurately determine whether the feature should be captured as WATERFALL or RAPIDS.

If WATERFALL is on a single-line STREAM/RIVER,
Then capture at intersection of tick and STREAM/RIVER.

If WATERFALL is shown by a tick on a double-line STREAM/RIVER,
Then capture by connecting the intersection of tick and SHORELINES.

If WATERFALL is shown by hachures on a double-line STREAM/RIVER,
Then capture by connecting the upstream limit of the hachures and SHORELINES.

An elevation at the top and/or bottom of WATERFALL is captured as SPOT ELEVATION.

DRAFT

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

WELL - A pit or hole dug or bored into the earth for the extraction of oil, water, other fluids, or gases.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 8
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Product	Principal commodity involved
Heat	
Water	
Flow Status	State or condition
Flowing	Water flows to the surface naturally
Unspecified	The value is not known and is not required
Water Characteristics	Distinctive properties of the water
Alkaline	Water shows evidence of alkali salts
Hot	Water temperature is higher than that of the human body (98.6 degrees F)
Sulphur	
Unspecified	The value is not known and is not required

DRAFT

DELINEATION

The limit of WELL is the extent of the hole in the ground.

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

If WELL is a water well and is landmark,
Or
If WELL is a water well, and is in an arid area, and is ≥ 0.25" from a building,
Or
If WELL is a water well, and is in an arid agricultural area, and is used for irrigation,
Or
If WELL is a heat well,
Or
If WELL is a producing water well, and is within an area of closely spaced wells, and is necessary to accurately represent the pattern of wells (see Source Interpretation Guidelines to determine how to accurately represent the pattern),
Then capture.

Attribute Information

If Flow Status = Flowing,
Then Water Characteristics = Unspecified.

DRAFT

Source Interpretation Guidelines

All

If WELL is within an area of closely spaced wells,
Then first capture named WELLS, then those that are on the perimeter of the area, then those that are most prominent, then finally capture a representative pattern of WELLS internal to the area. Capture as many as can be shown in correct position. The symbols must not overlap.

IIf WELL is associated with WINDMILL,
Then do not capture WELL. See WINDMILL.

Irrigation wells are often enclosed in a structure and are usually found in wide areas along or at the end of field roads. They may be evidenced by a wide wet collection area leading into a linear channel.

If WELL produces a product other than water or heat,
Then collect in the theme Built-up.

Do not capture dry wells.

Graphic

If WELL is identified as "geothermal" or "steam" on the graphic,
Then Production Status = Producing and Product = Heat.

If WELL is identified as "artesian" on the graphic,
Then Product = Water and Flow Status = Flowing.

If a water WELL is identified as "salt" on the graphic
Then Water Characteristics = Alkaline.

If characteristics of a water WELL are not otherwise identified on the graphic,
Then Water Characteristics = Unspecified.

Water tunnels in Hawaii, shown with the adit symbol, are captured as WELL.

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

WRECK - The hulk or the ruins of a disabled vessel which is attached to or foul of the bottom or cast up on the shore.

ATTRIBUTE/ATTRIBUTE VALUE LIST

Name	Proper name, specific term, or expression
(Alphanumeric)	Length Value: 99
GNIS Identifier	The unique identifier assigned by GNIS beginning in 1996
(Alphanumeric)	Length Value: 99
Unspecified	The value is not known and is not required
Photorevision Category	Whether or not a feature was added or modified as part of a photorevision assignment
Not Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that included field checks, if required
Photorevised	Feature was compiled from aerial photographs and other sources as part of a revision assignment that did not include field checks
Relationship to Surface	Vertical location relative to the surface
Abovewater	Exposed at mean lower low water
Abovewater Portion	Portion exposed at mean lower low water
Hull and/or Superstructure	
Mast and/or Funnel	
Underwater	Always submerged

DELINEATION

The limit of WRECK is the extent of the hull or other remaining portion of the disabled vessel.

DRAFT

REPRESENTATION RULES

Feature Relationships

RELATIONSHIPS	INSTANCES (CARDINALITY)	WITH OBJECT

Representation Conditions

KIND OF FEATURE OBJECT	AREA	SHORTEST AXIS	LONGEST AXIS
0-dimensional		> 0	
1-dimensional			
2-dimensional			

Special Conditions:

DATA EXTRACTION

Capture Conditions

If WRECK is exposed at mean lower low water and is on an existing NOS chart,
Or
For topographic/bathymetric editions only, if WRECK is on the final compilation provided to USGS by NOS,
Then capture.

Attribute Information

Source Interpretation Guidelines

All

If WRECK meets capture conditions and Relationship To Surface = Abovewater with Abovewater Portion = Mast and/or Funnel,
Then capture both WRECK and HAZARD ZONE.

Do not capture bits and pieces of a wreck or scattered wreckage as WRECK. See HAZARD ZONE.

Graphic

Any dotted outline labeled "Exposed Wreckage" or "Wreckage" will not be collected as WRECK. See HAZARD ZONE.

DRAFT

WRECK

Revision - General

Revision - Standard

Revision - Limited

Do not revise. Retain existing features.

DRAFT

4. Cost Proposal

The AECOM project team is committed to keeping the costs associated with this project as low as possible for the State. We are proposing a total project cost of $1,290,000 which is in line with the total project baseline cost provided in section 2.5 of the RFP. AECOM's proposed cost for Phase I of the project is $154,000 – also in line with the cost estimate provided by the State. The costs provided by AECOM in the following tables are firm proposal prices and will remain in effect for 180 days, starting Monday, January 25th, 2010. We understand that work for Phase II will only begin once funding is available for the project and that work orders will be assigned based on local or regional priorities.

4.1 Phase 1 Project Costs

FEE – Per Square Mile: $23.52

Table 4-1: Phase 1 Project Costs.

Item	HUC 8	Name	Sq Mi	Fee
1(Pilot)	05120104	Upper Eel	816	$19,188
2	04040001	Little Calumet-Galien	537	$12,628
3	04050001	St. Joseph	1701	$39,999
4	04100003	St. Joseph - Maumee	604	$14,203
5	04100004	St. Marys	381	$8,959
6	04100005	Upper Maumee	202	$4,750
7	04100007	Auglaize	98	$2,304
8	07120001	Kankakee	2144	$50,416
9	07120003	Chicago	~66	$1,552
Phase 1 Total (Lump Sum):			**6549**	**$154,000**

4.2 Phase 2 Project Costs

FEE – Per Square Mile: $38.30

See Table 4-2 on the following page.

Table 4-2: Phase 2 Project Costs.

Item	HUC 8	Name	Sq Mi	Fee
10	05080001	Upper Great Miami	33	$1,264
11	05080002	Lower Great Miami	64	$2,452
12	05080003	Whitewater	1331	$50,989
13	05090203	Middle Ohio-Laughery	807	$30,915
14	05120101	Upper Wabash	1334	$51,104
15	05120102	Salamonie	560	$21,453
16	05120103	Mississinewa	788	$30,187
17	05120105	Middle Wabash-Deer	670	$25,667
18	05120106	Tippecanoe	1950	$74,702
19	05120107	Wildcat	805	$30,838
20	05120108	Middle Wabash-Little Vermilion	2066	$79,145
21	05120109	Vermilion	137	$5,248
22	05120110	Sugar	812	$31,106
23	05120111	Middle Wabash-Busseron	1124	$43,059
24	05120113	Lower Wabash	666	$25,513
25	05120201	Upper White	2722	$104,276
26	05120202	Lower White	1674	$64,128
27	05120203	Eel	1208	$46,277
28	05120204	Driftwood	1166	$44,668
29	05120205	Flatrock-Haw	599	$22,947
30	05120206	Upper East Fork White	813	$31,145
31	05120207	Muscatatuck	1141	$43,710
32	05120208	Lower East Fork White	2029	$77,728
33	05120209	Pakota	862	$33,022
34	05140101	Silver-Little Kentucky	678	$25,973
35	05140104	Blue-Sinking	1254	$48,039
36	05140201	Lower Ohio-Little Pigeon	990	$37,925
37	05140202	Highland-Pigeon	527	$20,189
38	07120002	Iroquois	844	$32,332
Phase 2 Total (Lump Sum):			**29654**	**$1,136,000**

*Any work completed in the 2nd and 3rd year of the Indiana local-resolution NHD project will be subject to a 4% increase in the subbasin fee provided in the table above.

**Costs are based on an approximation of 360,000 miles of 6 acre streams in the State of Indiana.

***Costs are based on an estimation of digitizing 20 miles of stream at a 6 acre limit per hour.

Deviations from the basis of estimates will result in a change in AECOM's project cost.

5. Indiana Economic Impact

The completed Indiana Economic Impact forms for the AECOM team are on the following pages.

INDIANA ECONOMIC IMPACT - PROPOSALS AND CONTRACTS

State Form 51778 (R4 / 1-06)
DEPARTMENT OF ADMINISTRATION
Approved by State Board of Accounts, 2006

This information is required by the Indiana Department of Administration for all contractors, vendors/suppliers to the State of Indiana (complete all 22 items).

1	**Legal Name of firm:**	AECOM Technical Services, Inc.
2	**Address/City/State/Zip Code:**	8902 Vincennes Circle, Suite D, Indianapolis, IN 46268
3	**Telephone #/Fax #/Website:**	317.735.3008 / 317.293.4295 / www.aecom.com
4	**Federal Tax Identification Number:**	95-2661922
5	**State/Country of domicile/incorporation:**	California; September 29, 1970
6	**Location of firm's headquarters or principal place of business:**	555 South Flower Street, Suite 3700, Los Angeles, CA 90071-2300
7	**Name of parent company or holding company (if applicable):**	AECOM Technology Corporation
8	**State/Country of domicile/incorporation of company listed in #7:**	Delaware; January 31, 1980
9	**Address of company listed in #7:**	555 South Flower Street, Suite 3700, Los Angeles, CA 90071-2300
10	**IN Department of Workforce Development (DWD) account number:**	566350
11	**IN Department of Revenue (DOR) account number:**	0006044450-001
12	**Number of Indiana resident employees per most recently completed IRS Form W-2 distribution:**	67 Active Employees
13	**Total number of employees per most recently completed IRS Form W-2 distribution:**	15,509 Active Employees
14	**Total amount of payroll paid to Indiana resident employees per most recently completed IRS Form W-2 distribution:**	$3,922,878.00
15	**Total amount of payroll paid to all employees per the most recently completed IRS Form W-2 distribution:**	$1,310,750,369
16	**Total amount of this proposal, bid, or current contract:**	$1,300,000

ACCOUNTING OF INDIANA RESIDENT EMPLOYEES

17	**Prime Contractor Company Name:**	AECOM Technical Services, Inc.
18	**Number of Full Time Equivalent (FTE) employees** that are Indiana residents specifically for this proposal or contract:	6

19	**Subcontractor Company Name:**	Paul I. Cripe, Inc. dba Cripe Architects + Engineers	Pinnacle Mapping Technologies, Inc.
20	Address/Contact Person/Telephone Number/Tax ID Number:	3939 Priority Way South Drive, Suite 400, Indianapolis, IN 46240/ Fredrick J. Green/ 317.844.6777/ Tax ID: 35-0254477	8021 Knue Road, Suite 113, Indianapolis, IN 46250/ Ryan King/ 317.585.2011/ Tax ID: 02-0696077
21	**Number of Full Time Equivalent (FTE) employees** that are Indiana residents specifically for this proposal or contract:	4	1.5

22 **Affirmation by authorized official:** I affirm under penalties of perjury that the foregoing representations are true to be the best of my knowledge and belief:

Signature:	L. Todd Frauhiger
Name of authorized official:	Todd Frauhiger, PE
Title:	Associate Vice President
Date:	1/22/2010

INDIANA ECONOMIC IMPACT - PROPOSALS AND CONTRACTS

State Form 51778 (R4 / 1-06)
DEPARTMENT OF ADMINISTRATION
Approved by State Board of Accounts, 2006

This information is required by the Indiana Department of Administration for all contractors, vendors/suppliers to the State of Indiana (complete all 22 items).

1	**Legal Name of firm:**	Paul I. Cripe, Inc. dba Cripe Architects + Engineers
2	**Address/City/State/Zip Code:**	3939 Priority Way South Drive, Suite 400, Indianapolis, Indiana 46240
3	**Telephone #/Fax #/Website:**	Phone: (317) 844-6777; Fax: (317) 706-6464; Website: www.cripe.biz
4	**Federal Tax Identification Number:**	35-0254477
5	**State/Country of domicile/incorporation:**	Indiana
6	**Location of firm's headquarters or principal place of business:**	Indianapolis, Indiana
7	**Name of parent company or holding company (if applicable):**	NA
8	**State/Country of domicile/incorporation of company listed in #7:**	NA
9	**Address of company listed in #7:**	NA
10	**IN Department of Workforce Development (DWD) account number:**	030078
11	**IN Department of Revenue (DOR) account number:**	0001762885-001
12	**Number of Indiana resident employees per most recently completed IRS Form W-2 distribution:**	81
13	**Total number of employees per most recently completed IRS Form W-2 distribution:**	84
14	**Total amount of payroll paid to Indiana resident employees per most recently completed IRS Form W-2 distribution:**	$3,815,164.55
15	**Total amount of payroll paid to all employees per the most recently completed IRS Form W-2 distribution:**	$4,510,713.49
16	**Total amount of this proposal, bid, or current contract:**	

ACCOUNTING OF INDIANA RESIDENT EMPLOYEES

17	**Prime Contractor Company Name:**	Paul I. Cripe, Inc. dba Cripe Architects + Engineers
18	**Number of Full Time Equivalent (FTE) employees** that are Indiana residents specifically for this proposal or contract:	4

19	**Subcontractor Company Name:**				
20	Address/Contact Person/Telephone Number/Tax ID Number:				
21	**Number of Full Time Equivalent (FTE) employees** that are Indiana residents specifically for this proposal or contract:				

22	**Affirmation by authorized official:** I affirm under penalties of perjury that the foregoing representations are true to be the best of my knowledge and belief.	
	Signature:	
	Name of auththorized official:	Fredrick J. Green, AIA, NCARB
	Title:	President and Chief Operating Officer
	Date:	January 15, 2010

INDIANA ECONOMIC IMPACT - PROPOSALS AND CONTRACTS

State Form 51778 (R4 / 1-06)
DEPARTMENT OF ADMINISTRATION
Approved by State Board of Accounts, 2006

This information is required by the Indiana Department of Administration for all contractors, vendors/suppliers to the State of Indiana (complete all 22 items).

1	**Legal Name of firm:**	Pinnacle Mapping Technologies, Inc.
2	**Address/City/State/Zip Code:**	8021 Knue Road, Suite 113, Indianapolis, IN 46250
3	**Telephone #/Fax #/Website:**	(317) 585-2011 / (317) 585-2014 / www.pinnaclemapping.com
4	**Federal Tax Identification Number:**	02-0696077
5	**State/Country of domicile/incorporation:**	Indiana
6	**Location of firm's headquarters or principal place of business:**	Indianapolis
7	**Name of parent company or holding company (if applicable):**	None
8	**State/Country of domicile/incorporation of company listed in #7:**	N/A
9	**Address of company listed in #7:**	N/A
10	**IN Department of Workforce Development (DWD) account number:**	518604
11	**IN Department of Revenue (DOR) account number:**	1136001350017
12	**Number of Indiana resident employees per most recently completed IRS Form W-2 distribution:**	18
13	**Total number of employees per most recently completed IRS Form W-2 distribution:**	20
14	**Total amount of payroll paid to Indiana resident employees per most recently completed IRS Form W-2 distribution:**	$650,000.00
15	**Total amount of payroll paid to all employees per the most recently completed IRS Form W-2 distribution:**	$810,000.00
16	**Total amount of this proposal, bid, or current contract:**	$18,480 for Phase 1, and $154,400 if entire state is funded by State of Indiana.

ACCOUNTING OF INDIANA RESIDENT EMPLOYEES

17	**Prime Contractor Company Name:**	N/A
18	**Number of Full Time Equivalent (FTE) employees** that are Indiana residents specifically for this proposal or contract:	N/A

19	**Subcontractor Company Name:**	Pinnacle Mapping			
20	Address/Contact Person/Telephone Number/Tax ID Number:	8021 Knue Road, Suite 113, Indianapolis, IN 46250/02-0696077			
21	**Number of Full Time Equivalent (FTE) employees** that are Indiana residents specifically for this proposal or contract:	1.5			

22	**Affirmation by authorized official:** I affirm under penalties of perjury that the foregoing representations are true to be the best of my knowledge and belief:	
	Signature:	
	Name of auththorized official:	Ryan King
	Title:	Treasurer
	Date:	1/21/2010

6. Buy Indiana Initiative

AECOM does not qualify as a business that makes a substantial positive economic impact on Indiana for category #4 or #5.

The Indiana Economic Impact form is included in Section 5.

7. Equal Opportunity and MWBE Commitment

AECOM is committed to exceeding the MWBE goals set forth in the RFP. We have allocated 24% of the contract value to MBE and WBE subcontractors.

Subcontractor Cripe Architects + Engineers is a certified MBE firm and Pinnacle Mapping, Inc. is a certified WBE firm in the State of Indiana. The completed Minority & Women's Business Enterprises RFP Subcontractor Commitment Form (Attachment A) is included on the following page. It is followed by teaming commitment letters from Cripe and Pinnacle.

STATE OF INDIANA MBE/WBE SUBCONTRACTOR COMMITMENT FORM

RFP# 10-47 Professional Services to develop Local Resolution NHD for the State of Indiana Watersheds

DUE DATE: January 25, 2010

TOTAL BID AMOUNT: $1,290,000

❒ **MBE Firm** ⦿ **WBE Firm**		
Company Name: Pinnacle Mapping Technologies, Inc.		**Contact Person: Brenda R King, C.P., GISP**
Address: 8021 Knue Road, Suite 113 Indianapolis, IN 46250		**E-mail: brking@pinnaclemapping.com**
		Telephone Number: (317) 585-2011 / **Fax Number: (317) 585-2014**
Sub-Contract Amount: $18,480 (Phase 1) minimum; $154,800 if project is funded statewide		**Describe service/product to be provided:**
Sub-Contract Percentage of Total Bid: 12% minimum		**GIS / Photogrammetry**
Provide approximate dates when Sub-Contractor will perform on this project: February 2010 – February 2013		

⦿ **MBE Firm** ❒ **WBE Firm**		
Company Name: Cripe Architects + Engineers		**Contact Person: Matt Riggs**
Address: 3939 Priority Way South Drive, Suite 400 Indianapolis, IN 46240		**E-mail: mriggs@cripe.biz**
		Telephone Number: (317) 706-6479 / **Fax Number: (317) 706-6479**
Sub-Contract Amount: $18,480 (Phase 1) minimum; $154,800 if project is funded statewide		**Describe service/product to be provided:**
Sub-Contract Percentage of Total Bid: 12% minimum		**GIS Mapping Services for NHD data conversion and digitization**
Provide approximate dates when Sub-Contractor will perform on this project: February 2010 – February 2013		

AECOM Technical Services, Inc.	317.735.3008
Respondent Firm	Telephone Number
8902 Vincennes Circle, Suite D	317.293.4295
Address	Fax Number
Indianapolis, IN 46268	Todd.Frauhiger@aecom.com
City/State/Zip Code	Email Address
Todd Frauhiger	L. Todd Frauhiger
Representative	Authorizing Signature
01/22/10	Todd Frauhiger, Associate Vice President
Date	Printed Name and Title

❒ Please check if additional forms are attached.

Page ___1_____ of ____1_____

FORM MUST BE COMPLETED IN ITS ENTIRETY WITH COMPLETED LETTERS OF COMMITMENT.

Cripe
Architects + Engineers
Solutions by Design Since 1937
Telephone 317 844 6777
Facsimile 317 706 6464
3939 Priority Way South Drive, Suite 400 Indianapolis, Indiana 46240
www.cripe.biz

January 21, 2010

Zsolt Nagy
Project Manager
AECOM
3333 Regency Parkway, Suite 120
Cary, North Carolina, 27518

Subject: Local Resolution National Hydrography Data for the State of Indiana, Solicitation: RFP 10-47

Dear Mr. Nagy,

This letter is to confirm that Cripe Architects + Engineers is pleased to join the AECOM Team as an exclusive subcontractor for RFP NO. 10-47 Local Resolution National Hydrography Data (NHD) for the State of Indiana.

Cripe Architects + Engineers understands that our role on the team is to support GIS mapping services for NHD data conversion and digitization. Cripe Architects + Engineers will utilize our existing public/private contractual partnership with PEN Products, Prison Enterprise Networks (an organization in the Indiana Department of Corrections) to meet project obligations. We understand our subcontract amount will be a minimum of 12% of the contract value. The subcontract value for Phase 1 is approximately $18,480 (12% of $154,000) based on the anticipated scope of work. We also understand that the amount of funding for the remainder of the state has not yet been secured by the State of Indiana. Cripe Architects + Engineers is ready to begin work on February 22, 2010 and is prepared to provide these services through February 21, 2013.

We look forward to working with you.

Sincerely,

CRIPE ARCHITECTS + ENGINEERS

Fredrick J. Green
President and Chief Operating Officer

PINNACLE MAPPING TECHNOLOGIES, INC.

8021 Knue Road
Suite 113
Indianapolis, IN 46250
(317) 585-2011 phone
(317) 585-2014 fax
www.pinnaclemapping.com

January 21, 2010

Zsolt Nagy
Project Manager
AECOM
3333 Regency Parkway, Suite 120
Cary, North Carolina 27518

Subject: Local Resolution National Hydrography Data for the State of Indiana, Solicitation: RFP 10-47

Dear Mr. Nagy,

This letter is to confirm that Pinnacle Mapping Technologies, Inc. is pleased to join the AECOM Team as an exclusive subcontractor for RFP NO. 10-47 ***Local Resolution National Hydrography Data (NHD)*** for the State of Indiana.

Pinnacle understands that our role on the team is to support GIS mapping services for NHD data conversion and digitization. We understand our subcontract amount will be a minimum of 12% of the contract value. The subcontract value for Phase 1 is approximately $18,480 (12% of $154,000). We also understand that the amount of funding for the remainder of the state has not yet been secured by the State of Indiana. Pinnacle is ready to begin work on February 22, 2010 and prepared to provide these services through February 21, 2013.

We look forward to working with you.

Sincerely,

Ryan M. King
Regional Business Development Manager
8021 Knue Road, Suite 113
Indianapolis, IN 46250

O: 317-585-2011
C: 317-509-5619
F: 317-585-2014