The OGRIP Large Scale Features Classification Project

Final Report to the Framework Subcommittee of the Federal Geographic Data Committee

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Final Report

Preface

The Large Scale Features Classification Project was officially launched on October 1, 1996, as a twelve-month effort. This report documents the project results over the past year. The report includes the following main sections: (I) Background/Project Summary; (II) Project Activities/Results; (III) Project Challenges/Implementation Issues; (IV) Impacts and Continuing Efforts; and eight appendices. We welcome continuing dialog on the issues explored in this project and on its conclusions and recommendations.

As a result of our work, we strongly urge that a series of large scale feature standards be developed at the earliest opportunity. Such an effort must receive a greater emphasis and timeliness in our national priorities, if we are ever to achieve the goal of a consistent national spatial data infrastructure that integrates key large scale data.

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I. Background/Project Summary

Large Scale Features Classification Project

Standardized feature definitions are essential when there is a need to transfer GIS information from one environment to another. The current situation is chaotic. Each data supplier, each vendor, and each individual project manager can and usually does improvise categories to suit an immediate application's specific purpose.

- Robert D. Rugg

1 Introduction

The Large Scale Features Classification Project, formally conducted from October 1996 to September 1997, was a cooperative effort between the Federal Geographic Data Committee (FGDC), the Ohio Geographically Referenced Information Program (OGRIP), and the following OGRIP member organizations:

Ohio Department of Natural Resources
The Ohio State University Center for Mapping
Corporation for Public Information
City of Kent
Ohio Environmental Protection Agency
Dodson-Stilson, Inc.
Ohio University

In addition, many local organizations contributed large scale feature data (feature names, descriptions, etc.) that comprised the working set for the project's feature matching efforts. The project's purpose was to reduce barriers to data exchange and transfer efforts, by demonstrating ways to improve feature data exchange and transfer between diverse constituencies of users and producers.

2 Original Plan

The outcome of the project, as originally proposed, was to be a Proof-of-Concept of a method to help integrate large scale (e.g., scale greater than 1:24,000) feature data into smaller scale regional, state, and federal spatial datasets. We use the term "feature data" to mean *word descriptions* of spatial features represented on a map (e.g., road) and their definitions (e.g., a paved surface used as a means of conveyance of people or goods from place to place).

The original plan was based on the belief that local organizations capture many of the same features in the same way, and the main problem is simply that different words and definitions are used to describe the same spatial feature. The primary task was to develop common feature definitions and link corresponding features in a database. To support this task, two methodologies were to be adapted for use: the USGS 1:24,000 Feature Classification methodology and the USGS DLG-E Feature Template methodology. The Feature Classification methodology was to aid in developing common definitions, while the Feature Template database structure was to be extended to accommodate large-scale features in a hierarchical structure.

3 Revised Plan

The need for project restructuring became evident as the work progressed. Fundamental problems in matching became evident across the datasets and between the datasets and the DLG-E template. Moreover, of the twelve different organizational datasets of large scale features that were collected, a widespread lack of descriptive definitions was noted. As the matching efforts continued in more detail, not a single feature detail was found that matched the DLG-E feature template! This fact represented a significant departure from our expectations. The primary reason for the wide disparity became apparant: each local organization's feature classification scheme was custom-designed and tailored to the specific organization. Different feature groupings and ways of perceiving the world had worked to produce a truly "hodgepodge" environment.

An initial goal was to match feature data from a variety of large scale datasets to DLG-E features that are part of the framework. Once we saw that the tactic was not working, we modified the matching effort to determine correspondence of local features to a simpler matching set, the framework features described in Circular A-16, *Development of a National Digital Geospatial Data Framework*. Framework features include general feature data and brief descriptions for the six themes of geodetic control, elevation, transportation, hydrography, governmental units, and cadastral. Digital orthoimagery was excluded because, as a raster format, the data lack explicit feature lists and definitions.

The need for standards to enable easy exchange of feature data became abundantly clear over the course of the project, and some project effort was also directed at studying feature classification standards. Due to the widely varying groupings of feature data across organizations, it became obvious that matching schemes of any kind to merge features across one-of-a-kind datasets are necessarily a highly difficult and time-consuming exercise. Any success in matching--if it can be termed that--results in much data loss and compromising the data's integrity. Not only that, continuing efforts are necessary to merge updates to the data. Not even the best transfer formats (e.g., AutoCAD .DXF to Arc/Info .EOO) and transfer schemes (e.g., STDS) can help the fundamental problem of different feature classifications.

4 Revised Objectives

Based on project restructuring, objectives were revised to the following:

- To provide a method to help integrate large scale feature data that correspond to FGDC framework features into smaller scale regional, state and federal datasets.
- To provide a method of identifying additional attributes and definitions for data analysis and collection at the various (large scale) levels of spatial resolution.
- To provide a foundation for large scale features in the National Spatial Data Infrastructure framework through applying and extending DLG-F definitions and feature codes to large scale features.

5 Project Results

As a result of project efforts, we learned that a great deal of large scale data, related to the framework, are being collected and used. We collected feature descriptions from twelve contributors, including county auditors, utilities, and others. Relevant data attributes were compared and assigned to the twenty-six framework features that comprise the six themes. We found that much of the data collected by local agencies bears some degree of correspondence to framework features. Of the organizations' features that were examined, between 1% and 50% of their features related in some way to framework features. However, surprisingly, no exact matches were found even at this generalized level. The large fold-out table in the report demonstrates the correspondence, but inexact matching, of similar feature elements across datasets.

We conducted a literature search and investigated existing large scale standards. The purpose of this part of the effort was to (a) locate existing work that described the need for large scale feature classifications, (b) find out what other work has been done on establishing standards for large scale feature classification, and (c) see how those efforts have fared, including an examination of "carrots and sticks" to promote adoption of standards by local agencies. We found a strong discussion on the theoretical problems of feature classification on the Open GIS Consortium's web site (www.opengis.org/guide [section 6] and www.opengis.org/abstract [section 2]) but little material in the way of existing, applicable large scale feature standards. We compiled a limited set of incentives and disincentives to encourage the adoption of standards by local agencies.

It is possible to adapt any good standard or model for feature classification to this problem. We examined a number of standards and models, and found very little guidance in the area of *large scale* standards. In the end, we narrowed our candidates to the Digital Line Graph (DLG) and the Tri-Services Spatial Data Standard (TSSDS). The DLG is the dominant standard in use by federal civilian agencies, at the scale of 1:24,000 or smaller. The TSSDS is the dominant standard in use by the armed services, originally for scales of 1:4800 and larger. The TSSDS is now being extended to scales both larger and smaller than 1:4800 and to civilian applications.

Our comparisons of large scale data with the federal DLG standard indicates that very major extentions/reworking of the DLG would be necessary to make it a standard for local databases. The DLG was designed for map scales of 1:24,000 and smaller, and the gap between representation of features at that scale as compared to local scales is great. Furthermore, because of the rigorous and time-consuming nature of DLG definition and database creation, we believe that, even if the DLG were extended to include features for local agencies, local agencies would find it difficult to adopt due to its complexity. Moreover, such an effort would probably take many years, and the longer it takes, the more one-of-a-kind databases will be generated, reducing the likelihood of wide-based standards adoption.

By contrast, the TSSDS--a huge collection of large scale features with an accompanying database--is gaining acceptance by users of large scale spatial data. The TSSDS represents features in a way compatible with large-scale data needs, supports multiple data formats, and is easily extendable by adding new features. Subsets of features can be extracted and easily packaged for a specific user community. Adoption of TSSDS for large scale data is proceeding at the state and local levels, independent of other national standards efforts.

6 Conclusions and Recommendations

The Problem

- Today, nearly all local agencies that develop GIS databases use a one-of-a-kind design to meet their own immediate data needs, and data are poorly documented.
- Each of these agencies develops its own categorization of the world as unique feature classifications.
- These unique classifications make it very difficult, if not impossible, to later transfer data between organizations where common features need to be merged, or similar data need to be tiled to comprise a larger region.

The Answer

- Therefore, to realize data transfer of this kind among organizations, standard feature classifications are essential. This problem is more fundamental than metadata, clearinghouse efforts, and data transfer mechanisms such as SDTS. If various spatial datasets are totally heterogeneous, then features cannot be combined or tiled with similar features in other datasets.
- Some variation in feature classification among different user communities is necessary as a matter of varying function and/or scale. However, other variation is totally arbitrary. If a series of standards could be developed for similar user communities (county auditors, for example), arbitrary variation for key features of interest could be largely eliminated.
- Existing large scale databases will take some time to be revised and integrated into the new standard; additional incentives for migration of existing datasets may be necessary.

The Implementation

Based on our investigations, we believe that the most promising standard available today for large scale feature classification is the Tri-Services Spatial Data Standard (TSSDS). The FGDC or other national body must become involved in the development of standards for classifying large scale features, to help ensure maximum utility of features of common interest to society such as framework features. Without this involvement, and even with TSSDS as a base, continued variations of feature descriptions will make it difficult to use large scale data for multiple purposes, or for local data to be a meaningful part of the national spatial data infrastructure. Therefore,

- We recommend that the FGDC (in partnership with state and local agencies) fund the development of large scale feature standards based on TSSDS for key communities of users. Key communities of users are those that capture a significant set of framework features. The result will be the development of a series of standards that promote the development of a coherent set of national large scale framework data.

Based on our understanding of and association with local agencies, once new standards are in place we believe their adoption for new mapping efforts will follow as a matter of course, without undue effort or further incentives. The TSSDS is relatively simple and easy to implement, and standards will represent a savings to agencies because start-up costs for database design will be reduced. On the other hand, the existence of new standards will be a disincentive to local agencies that already have databases in place because of the high cost of conversion. Additional incentives for eventual database conversion may be necessary for agencies with operational databases.

II. Project Activities/Results

1 Project Objectives

Project objectives, as revised, were the following:

- To provide a method to help integrate large scale feature data that correspond to FGDC framework features into smaller scale regional, state and federal datasets.
- To provide a method of identifying additional attributes and definitions for data analysis and collection at the various (large scale) levels of spatial resolution.
- To provide a foundation for large scale features in the National Spatial Data Infrastructure framework through applying and extending DLG-E definitions and feature codes to large scale features.

The objectives were addressed by a series of tasks that are described below. Frequent references are made to the appendices that contain the experimental and detailed work in the project, which formed the basis for project conclusions and recommendations given in Report Section I.

2 Project Activities: Tasks and Results

Task 1: **Collect and establish an extensive list of large scale features.**

Subtask A: *Create a database using established U.S. Geological Survey data structures.*

The USGS data structures were installed on a computer supplied by the Ohio State University's Center for Mapping and a database was established.

Subtask B: *Add to the database to include new information.*

Database structures were created and modified for the purpose of aiding in the analysis of large-scale features. However, as further analysis of the data was conducted, it became apparent that the modified structures would not meet the needs of the project due to theoretical and practical problems in comparing large scale features.

Subtask C: *Confirm and gather contributions from level 3 participants.*

Letters were sent out to over forty prospective participants. Of this group, twelve provided feature data for study:

Tri-Service CADD/GIS Tech. Ctr
Delaware County, Ohio Auditor's Office
City of Kent, Ohio Engineering Division
CAGIS project, Hamilton County, Ohio
City of Hamilton, Ohio
ODOT Bureau of Aerial Engineering
Franklin County, Ohio Auditor's Office

American Electric Power
Loudin County, Virginia
Fairfax County, Virginia
FGDC Cadastral Data Standard
Orange County, California

We found the twelve datasets to be representative enough and therefore comprised the test datasets that were evaluated.

Subtask D: Receive existing features and definitions from a selected source.

The data were entered into a simplified database, which in the end was modified into a simple spreadsheet format.

Subtask E: Identify target features to be reconciled with the FGDC framework.

A meeting was held with Keven Roth of the U.S. Geological Survey and Michael Domaratz of the FGDC Framework subcommittee. They suggested that we take as our set of features from the DLG-E standard, those features that are listed in the FGDC's publication, *Development of a National Digital Geospatial Data Framework*.

Subtask F: Confer with the U.S. Geological Survey on selected set for further processing.

After the meeting with Keven Roth and Michael Domaratz, the project members accepted the FGDC's suggestion to use DLG-E features corresponding to framework features as the set against which other datasets would be matched.

Task 2: Evaluate, modify, and use U.S. Geological Survey Feature Classification Methodology and Feature Templates to convert a pilot set of data.

Subtask A: Reconcile conflicting descriptions/relate redundant feature names.

This classification method is outlined in the U.S. Geological Survey Circular 1048, An Enhanced Digital Line Graph. Classification is necessary for merging data collected from sources and from different scales. In order for classification to occur, the definitions of the meaning of the features are necessary. It became rapidly evident on examining local data sets that most, if not all, producers of large-scale spatial data do not document their data sets, nor do they provide definitions of their features. Results of our classification exercise and comments on classifying large scale data using the DLG-E model are given in **Appendix A: Classification of Large Scale Features**.

Subtask B: Distribute reconciled feature list and descriptions for review and comment.

Basic conceptual problems in reconciling or matching features became evident, making this task difficult to complete. As a result, task 4 (below) was added to the scope of work: to quantify the feature-matching problem.

Subtask C: Prepare progress report and submit to the FGDC.

A six-month Progress report was written and submitted. The report was an accounting of accomplishments to date and planned directions.

Task 3: **Match Selected Local Data to DLG-E Framework Features.**

Subtask A: Identify DLG-E feature template descriptions that match both the FGDC framework and local features.

DLG-E feature template descriptions were identified that corresponded to FGDC framework features. We attempted to match this subset of the DLG-E feature template to our local datasets. However, we were unable to conclusively identify *even a single local feature* that closely matched a DLG-E feature. Therefore, in consultation with the FGDC we modified the problem to one of determining correspondence of local data to a more general matching set: the framework itself. The set of features that were identified as the core matching set are given in **Appendix B: The Framework**.

Subtask B: Using local datasets that have already been collected, select the subset of data that corresponds to FGDC framework elements. Match these elements to the subset of DLG-E feature templates identified in subtask A.

Feature sets from the various databases were manually assigned to categories that corresponded to the framework categories. A large fold-out allows the reader to compare feature sets across different databases, arranged by framework theme. **Appendix C: Matching Local Features to Framework Data** summarizes the matching process and problems, contains the fold-out of dataset matches, and describes the individual datasets, their characteristics, and specific problems in matching them to the framework data.

Task 4: **Quantify the Feature-Matching Problem.**

Subtask A: Describe, document, and illustrate conceptual problems in matching large scale feature data that correspond to FGDC framework data, to datasets of similar and different scales.

Early in the project, we came to understand that the difficulties we found in feature matching were due to fundamental differences in the ways that features were classified by different organizations. Feature definitions varied in many ways, primarily due to different partitioning of the world. A discussion of the conceptual problems is given in **Appendix D: Conceptual Problems in Merging Geospatial Data due to Different Feature Classifications**.

Subtask B: Determine the degree of mismatch in the matching work of Part A and quantify results.

A brief section in Appendix C attempted (with mixed success) to tally the degree of mismatch and quantify results. Results are not intuitive to tally in this way but, nonetheless, give a limited measure. Perhaps the most significant observation of this exercise was that between 1% and 50% of features collected by local agencies correspond to framework features in some way.

Michael Domaratz of the FGDC suggested that the project team take a look at other FGDC projects involved in matching and merging data from multiple sources, and see what we could learn from their efforts. A summary and analysis of these efforts is provided in **Appendix E: Survey of Other FGDC Projects**.

Task 5: Apply 1048 Method to Large Scale Data

Subtasks A and B: For FGDC framework elements of large scale data that do not fit easily in existing DLG-E categories, develop new methods for classifying them using the 1048 method. Recommend extensions to the 1048 method and to the DLG-E feature templates, to accommodate important large scale features that would be valuable additions to the FGDC framework but are not now included in the DLG-E's.

During the course of the project it became evident that the DLG-E standard would not meet the needs of local government building spatial databases. The standard, while extendible and rigorous with full data extraction and representation rules, was implemented for mapping at scales of 1:24,000 and smaller. Although it could in theory be extended for mapping at larger scale, the effort in doing so would be tremendous and very time consuming. The biggest problem with using the DLG-E standard is that the framework features at the local level do not have the same meaning and structure as those defined for smaller scale mapping. This is because local governments have a different view of the world. A larger-scale standard such as Tri-Services is better suited for larger-scale data (e.g., larger than 1:24,000), than to try to fit large-scale databases into a smaller-scale standard. If a goal is to have a smaller scale, generalized national database, then mapping from a larger scale standard to a smaller scale standard is an easier problem to solve than extending a smaller-scale standard to larger scale data.

Task 6: Large-Scale Standards

Subtask A. Conduct a literature search on large-scale standards; summarize the benefits and difficulties of implementing large-scale feature standards for FGDC framework data.

Appendix F: Investigation of Large Scale Feature Classification Standards presents the results of our investigation in this area. It includes a discussion of the literature search and personal interviews of experts, along with a bibliography. The purpose was to locate other sources that recognized the need for large scale feature classification standards, and to examine successes and failures in standards implementation that can contribute towards the development of a successful model. The end results of this study are incorporated in the project conclusion and recommendations, presented in report section I.

Appendix G: Tri-Service Spatial Data Standard presents information and an overview of this growing standard for large scale mapping efforts. Summary conclusions and recommendations for Tri-Service implementation are also presented in report section I.

Subtask B. Establish feasibility of applying DLG-E standards to FGDC framework features at the local level. Describe potential incentives (carrot/stick) for local participation.

This subtask was addressed above in task 5 and in Appendix F.

Task 7. Other

Subtask A: Review interim results on a monthly basis and provide feedback and suggestions.

The project team met on a weekly to monthly basis to exchange results and assign the next phases of work. Team members were from local, state, and (occasionally) federal government; academia; and the private sector. The wide range of backgrounds of the team proved an excellent forum for discussion and provided greater insight into the problems and possible solutions than would have been the case otherwise.

Subtask B: Presentation of Project Results at Professional Conferences

To date, we delivered presentations at the OGRIP Forum, the statewide GIS Ohio conference, and the Tri-Service CADD/GIS conference in St. Louis. The process of disseminating the project information is just beginning. We currently plan on presenting the project results at the statewide Professional Land Surveyors of Ohio (PLSO) conference, possibly at a national conference, and publishing one or more papers. The Internet-accessible final report will also help achieve public awareness of the results. Copies of presentations are given in **Appendix H: Presentations to Date.**

3 Success in Accomplishing Objectives

We did not accomplish all of the project objectives: in particular, we were unable to match local datasets corresponding to the framework to the DLG-E template, or recommend DLG-E extensions for additional large scale features. In response, we investigated the nature of the problem more deeply. The investigation showed that the problems were more fundamental and not well-suited to the original, proposed solutions. At this point we changed the scope of work to better define the problem and develop an improved approach.

We did accomplish these refined objectives by:

- Providing a strong rationale, replete with ample examples, of
  - the extensive problems in matching/merging feature data from multiple datasets that occur in the absence of standards and
  - the need for feature classification standards for large scale data, and

- Proposing a workable solution that is better suited to the needs of local agencies, yet will contribute towards build a national spatial data framework.

A wealth of material was generated in this process, found in the various report appendices.

We express our appreciation to the FGDC for allowing us free rein in our investigations and considerable support and direction as we carried them out.

III. Project Challenges/Implementation Lessons

In this section we describe problems encountered and lessons learned during the course of the project. Following the suggested outline for the FGDC CCAP (Competitive Cooperative Agreements Program) project final report, we address the following areas:

People

What were the advantages and disadvantages of forming project partnerships with other organizations?

Many *advantages* became evident during the course of the project of having a project team representing state and local government, academia, and the private sector, with occasional input from the FGDC. The issues under examination were highly complex, ranging from theoretical aspects of the problem, to understanding both the federal perspective and the environment at state and local agencies, to practical database concepts. Each team member provided essential input into understanding the whole picture and formulating viable solutions.

Several *disadvantages* of the team approach were noted: time for project work was an overload for all except the graduate student, whose time was dedicated to the project; a single agency (OGRIP) was awarded the CCAP project, and subcontracts required several months to put in place; and one team member was located 2.5 hours away by car, which made his regular participation in meetings difficult. Although there was potential for accountability problems due to a workload distributed across agencies, performance was not adversely affected because team members were dedicated and cooperative.

Has there been an increased level of collaboration between partners as a result of this project?

Due to the need for frequent communication and meetings on the project, increased collaboration has certainly occurred.

What recommendations do you have for other groups regarding the formation and maintenance of strong, effective partner relationships?

1. *A solid organizational commitment to the partnership is essential*. Ideally, each organization's management must buy in to the value and importance of the partnership, and be willing to contribute organizational resources to support it. Partnerships take effort, and financial incentives (such as CCAP project support) will only offset part of the expense and effort. Even if an individual is dedicated to a partnership, without management support participation becomes difficult and is significantly impeded.

2. *Most successful partnerships are based on prior associations*. In the case of Ohio, the OGRIP program provided a forum for the formation of the project team. Most of the team members had known each other and explored similar topics over a period of several years, before coming together in the CCAP project. An ongoing forum is helpful to bring together people and organizations around topics of common interests and to develop and maintain long-term professional relationships and partnerships.

Technology and Software Tools

What are the challenges you faced in selecting the best technology for your project? How did you finally come to a decision?

A lot of effort was expended at the outset of the project in identifying the best technology (hardware/software/database system) in which to conduct the original scope of work. The core of the initial work was to enter multiple databases and match common elements across them, while developing a common data dictionary. However, once the nature of the data was better understood, it became clear that no software was capable of matching data that was, in its essence, unmatchable. In the end we used a simple spreadsheet (Excel) because it was easily available and met the revised project requirements to depict loose associations across the datasets.

Is it always important that the technology be state-of-the-art?

Clearly, no, in our case. Spreadsheets have been around for years.

In developing your project, what was your experience in getting the technology up and operational? Were the costs in line with expectations? Was the time line for project completion realistic?

As stated above, an emphasis on technology was counter-productive in our case. The final technology cost of producing the large spreadsheet and word processing for reports was nominal. Since our project was more exploratory and open-ended, we were able to adjust the tasks to be accomplished according to the available time.

Standards

Understanding the Metadata Standard and creating metadata are often cited as being the most challenging hurdles in many project efforts. Was this the case with your project? Can you describe (quantify) your results in documenting data, i.e. how long did it take to create the first few records vs. your results at the end of the project effort, or current activity?

As a result of this project we learned that the generation and adoption of large scale standards is more fundamental than a metadata standard. A large scale standard should include a metadata standard as part of the whole, but a metadata standard by itself serves only a limited purpose. *What good is it towards realization of the framework concept, to fully document existing data sets, only to learn that you are unable to merge similar datasets across regions because each organization classifies or groups features in entirely different ways*?

Other

Did staff or end-user training require significantly more time than originally anticipated? Specifically, what areas?

A considerable amount of time was necessary to understand and interpret the conceptual problems of semantic feature matching. The first standard that we studied was the USGS DLG-E standard. This standard was explored as to its extensibility to large-scale mapping. Both the DLG-E templates and its classification methodology were difficult and time-consuming to understand. We found the Tri-Services Spatial Data Standard to be a

considerably simpler data model, more easily adaptable to large scale features and thus more likely to be readily adopted by local agencies.

Where there any other significant obstacles that had to be overcome?

We have to admit that changing the project scope and tasks midway through the project was a significant obstacle. We are grateful to the FGDC for their assistance in guiding us through the changes. We feel that the final project outcome is far more significant and far-reaching as a result of their guidance and suggestions.

IV. Impacts and Continuing Efforts

The focus of this section is on identifying the impact of your effort on your own organization and on other target audiences, and to call attention to activities that are continuing beyond the grant funding. The questionnaire which follows has been prepared to facilitate answering this section and is to be filled-out and included with the final report. While filling-out the questionnaire will suffice for addressing this section, the grantee is encouraged to elaborate on any answers to the questionnaire and include other information in this section that will help assess the project's impact and its contributions towards building the NSDI.

The intent of this questionnaire is to gain an understanding of the success of this partnerships program and how to maximize its impact. Questions have been grouped to identify the impacts of your project effort, to examine the ingredients for sustaining project efforts, and to assess the impact of the Cooperative Agreements Program itself. The questions can be completed by circling answers (on a 1 - 5 scale) and/or in some cases by providing written responses.

A. PROJECT IMPACTS

1. Do you believe you achieved your project goals? *AS REVISED*

No, definitely not	Minimally	Achieved some of the goals	Achieved most of the goals	Yes, Definitely
1	2	3	4	**5**

2. Of what value has your particular project effort been to you?

Of little or no importance	Below average importance	Of moderate importance	Above average importance	Of very great importance
1	2	3	4	**5**

3a. If you answered either 3, 4, or 5 please describe its importance:

A central part of the mission of the Ohio Geographically Referenced Information Program (OGRIP) is to foster the ability to easily access and use geographic data of value to multiple users. The project described and documented wide variations in feature classifications of framework data across local agencies. Although up to 50% of the GIS data collected by local agencies are related to framework features, variations in feature classifications are an enormous hindrance to effective data sharing. This problem is more fundamental than topics of current national focus (e.g., mechanics of data transfer, development of metadata, clearinghouse

activities) and demands serious and prompt attention if the framework concept is to be realized.

The project also demonstrated the urgent need for large scale feature standards, and examined and recommended approaches for developing standards. A thorough understanding of the nature of the problem lays essential groundwork for developing an effective solution. This project both (1) described and thoroughly documented the problem and (2) presented directions for solution. The project results are central towards realization of both OGRIP's mission of data sharing and, we believe, to the mission of the FGDC.

4. Has this project made geospatial data more affordable or accessible than before?

No, definitely not		Difficult to tell		Yes, definitely
1	2	3	4	**5**

In the future, the eventual adoption of large scale feature classification standards will help make geospatial data more affordable and accessible.

4a. If possible, quantify (or describe) this change, ex. Increase in # of users of % increase in sales, etc.?

n/a

5. How has this project affected the targeted end users for whom you developed your data service? (i.e. What difference did it make for them?)

The mature development and acceptance of large scale feature standards may lie several years in the future. Once implemented, large cost savings and efficiency would result to benefit many.

6. Will you continue to implement the NSDI? Yes or No

Yes

6a. If yes, please describe in general terms, the essence of these implementation activities.

OGRIP and this project confirm the importance of a consistent set of framework data for geospatial data users at all levels. OGRIP is committed to continue efforts towards developing and implementing large scale feature standards to enable easy data exchange among multiple levels of users and will help support the concept and realization of the framework.

6b. Has the project effort and/or tenets of the NSDI been institutionalized within the other organizations involved in the project?

Only very little	Some	Moderate	Considerable	Substantial
1	2	**3**	4	5

To date, the effects are only moderate because project results are just beginning to be disseminated. NSDI tenets have been and will continue to be promoted by OGRIP.

7. Have you had inquiries from other organizations about your project?

Very seldom or never	Seldom	Occasionally	Often	Frequently
1	**2**	3	4	5

Since project results have not yet been widely disseminated, we have not expected outside inquiries. We expect this kind of activity to accelerate once results become more widely known.

7a. Are you aware of other organizations that have initiated similar efforts as a result of your project work? Yes or No

We have observed wide recognition of the problem of varying feature classifications by GIS professionals once the problem is explained. These "enlightened" professionals are now looking to OGRIP/FGDC to develop standards and solutions.

8. What are three observable, measurable benefits of your project to date (ex., improved data management, improved understanding / interest in metadata creation by state and university community, recognition as a central facility for data distribution)?

1. *We developed a conceptual framework and documented many instances of incompatibility of feature definitions from one spatial dataset to another.*
2. *We established the need for large scale feature classification standards, explored alternative approaches, and recommended directions for development of large scale standards.*
3. *We investigated "carrot and stick" incentives to encourage adoption of such standards by local agencies.*

8a. The benefits you've experienced have been:

Much less than expected	Less than expected	Pretty much as expected	More than expected	Much more than expected
1	2	3	4	**5**

The final project results carry far broader implications than originally expected, for both Ohio and the nation.

9. Describe how you've disseminated information about your project. What have been the most effective ways of achieving public awareness of your project?

To date, we delivered presentations at the OGRIP Forum, the statewide GIS Ohio conference, and the Tri-Service CADD/GIS conference in St. Louis. The process of disseminating the project information is just beginning. We currently plan on presenting the project results at the statewide Professional Land Surveyors of Ohio (PLSO) conference, possibly at a national conference, and publishing one or more papers. The Internet-accessible final report will also help achieve public awareness of the results.

10. Did the results and experiences from <u>other</u> NSDI Competitive Cooperative Agreements Program projects help your effort?

Did not contribute	Contributed a little	Contributed moderately	Contributed considerably	Contributed a great deal
1	2	**3**	4	5

The results of our survey of other relevant CCAP projects contributed moderately to our project. Our investigation on how these projects resolved feature-matching problems helped our understanding in the following ways:

a. Other projects are just beginning to look at feature matching and resolution of framework data.
b. The methods used to resolve feature mismatches are costly, time-intensive, result in significant data loss, and cannot be automated for wide application nationally. The resultant data tends to be the lowest common denominator (only data that is most easily merged) and sacrifices much of the best, highest-resolution data.

B. SUSTAINING YOUR PROJECT

1. What are the sustainable results of your project (ex. creation of an operational C-2 level clearinghouse, development of agency metadata records)?

We expect that the project will provide substantive guidance for OGRIP and FGDC leadership in implementing standards for large-scale data.

2. How are the objectives of your project likely to be sustained, and where do you expect to find follow-on funding for it?

The OGRIP program has ongoing funding for regular staff through the Ohio Department of Administrative Services. OGRIP has a long-standing commitment and dedicated leadership for developing and promoting spatial data standards. OGRIP also coordinates an extensive network of GIS professionals across the state who are involved with similar issues.

As a follow-on to this project, we are exploring the development of a prototype large scale standard for one information community following this project's recommendations. We are considering the FGDC's CAP '98 program as a potential source of partial funding. Once a single standard has been successfully developed in this way, the method can be expanded for standards development for other information communities.

3. What recommendations regarding sustainability do you have for other groups? (This could be in the context of funding, program development, and/or program operations.)

Certainly the development of sets of geospatial data standards for key information communities must be elevated in importance. Regarding sustainability, dedicated and forward-looking leaders ("champions") are essential for sustainability over the long term. Funding issues are certainly important, but secondary.

4. Will the partnerships you've established be continued after the project's completion?

No, definitely	Probably not	Yes, with some of the partners	Yes, with most of the partners	Yes, definitely
1	2	3	**4**	5

5. What do you predict will be the three long-range most important observable, measurable contributions of your project?

a. A wide recognition that different feature classification schemes may be the single greatest impediment to effective data sharing.
b. A rationale has been established for the need for large-scale feature classification standards.
c. Directions are indicated for development of such standards for Ohio and the nation.

C. COOPERATIVE AGREEMENTS PROGRAM IMPACTS

1. Were you aware of the NSDI before participating in this Cooperative Agreements Program?

No, definitely not	Only very little	Somewhat	Moderately	Very much so
1	2	3	4	**5**

1a. Was the Program instrumental in making you more fully aware of the NSDI? Yes or No

Yes

2. Did the NSDI Cooperative Agreements Program help further your program efforts?

Only very little	Some	Moderate amount	Considerable	Substantially
1	2	3	4	**5**

2a. Please describe how this NSDI Cooperative Program helped further your efforts?

For several years, OGRIP volunteers have been investigating ways to merge spatial datasets and develop large scale standards with little progress. The project has made all the difference, enabling focused attention and providing a dedicated staff to investigate issues, explore problems in merging real datasets, and propose solutions in a short period. This has accelerated efforts substantially and provided great impetus to move the work forward.

3. Without the FGDC investment would you have undertaken your project?

No	Yes, already doing so	Yes, but 1 year later	Yes, but 2 years later	Yes, but much (>2 yrs) later
1	2	3	4	**5**

4. Did this Cooperative Agreements Program help you promote the NSDI tenets to others? Did it strengthen your ability to promote the NSDI to managers/peers?

Very little		Moderate amount		Very much so
1	2	3	4	**5**

We expect this to be the case in the coming months as the project results are further disseminated.

5. What else should we examine when evaluating the NSDI Competitive Cooperative Agreements Program?

Although outside the scope of the CCAP Program, the FGDC should consider wide implementation of a program for state spatial data advisors, similar to NOAA's NGS program of state geodetic advisors. Such a move would help coordinate development of the NSDI by placing advocates in the field, closer to the action of local, regional, and state agencies and support consistency in building framework elements.

6. What could the FGDC have done to help you be more successful?

The FGDC has been entirely supportive through the grant period, offering helpful information and guidance. FGDC involvement has allowed us to gain far greater insight into the problems and solutions than would have been the case otherwise.