RECLAMATION
Managing Water in the West

Final Project Report

Linking Documents and Information Stored in SharePoint Libraries to Geospatial Representations of Reclamation Features

Project 2998
Science & Technology Program

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1 INTRODUCTION

1.1 Background

Increasingly, Reclamation offices are discovering the utility of the collaborative features of Windows SharePoint Services, in particular, document libraries. SharePoint document libraries provide an efficient way to store and share digital information such as documents, spreadsheets, and reports associated with Reclamation lands, facilities, or operations.

Generally, Reclamation tends to organize information in the form of documents in a largely ad hoc context of the more than 200 Congressionally-authorized Projects. Reclamation Projects are collections of lands, facilities, and associated features constructed and operated meet the mission of delivering water and/or power in the West. Documents associated with the various features of Projects tend to be the domain of one or more of Reclamation's programs. Typically each program manages its documents independent of other programs. For example, the Facilities Operations & Maintenance program manages documents related to inspections of constructed features like dams or canals, while the Dam Safety program manages documents about dams, and the Lands Resources Management program manages documents related to the land under these features. There is growing recognition that these "stove pipe" collections of document are not efficient and sometimes result in duplication of effort between programs.

At least in part, the practice of managing discrete document collections has been a result of no enterprise alternative. Although SharePoint is not in and of itself an enterprise solution, it does provide some attractive features. It is important to note that SharePoint does not have a built-in framework for structuring and organizing documents. That is still at the discretion of the users.

In the absence of another original framework, location can provide logical framework in which documents can be organized in association with the specific features (e.g., dams, reservoirs, canals, etc.). Although location is an inherent piece of information about Reclamation Project features, their specific locations are often only known locally. Location provides a fundamental framework to which otherwise unrelated data and information can be related. Building on the previous example, documents managed by the Facilities Operations & Maintenance can be related to documents managed by the Dam Safety program, and these can be related to documents associated with the land parcel on which the feature is located managed by the Lands Resources Management program. In this way, all the documents associated with a feature's location can be retrieved, as well as documents of other features that have a spatial relationship.

Windows SharePoint document libraries provide an interesting and flexible repository for digital documents, but lack a framework for organizing documents. Users must create a structure using folders and/or custom fields (metadata fields).

1.2 The SharePoint Platform

Windows SharePoint is a comprehensive collaboration platform that is as-yet not well understood by Reclamation. Although a number of offices are actively implementing SharePoint instances, no standards have been established to guide the offices and assist them in getting the most out of their efforts. As a result, existing SharePoint instances tend to implement components and functions with which they are familiar, such as calendar, document library, and list. The primary problem with this approach is that the more robust and potentially most beneficial aspects of SharePoint are overlooked.

Perhaps most overlooked are SharePoint's work flow capabilities. Reclamation generates a lot of reports and other documents as products of business and regulatory compliance operations. SharePoint work flow capabilities have the potential to dramatically improve the efficiency, quality, and accessibility of report generation. Many programs have very specific processes in which one or more documents are produced. These processes represent one or more work flows.

The first question that should be asked is "Why use SharePoint?" Unfortunately, the answer does not take into account the larger picture. Too often, attractive functions like an easy-to-use calendar group calendar, or easy access to shared documents, is the answer. This approach severely limits Reclamation's ability to fully leverage the capabilities of a collaboration platform like SharePoint, and therefore, limits the benefits and returns on investments in technology.

1.3 Definitions

Web Part	A reusable component of Windows SharePoint Services that provides a specific set of functions in the SharePoint web application (e.g., document library, list, image, etc.).
Document Library	A SharePoint web part specifically designed to allow users to upload and access documents through a web application. Documents are stored in binary format in the database associated with the SharePoint instance.
List	A SharePoint web part specifically designed to allow users to create a spreadsheet like list with custom fields that can be accessed and updated by many users.
FLEX	A programming environment from Adobe used to build custom web applications that run in Adobe Flash Player, a common browser plug-in.

1.4 Project Description

The initial goal of this project was to develop an approach to allow Reclamation personnel to use an interactive web-based map to link documents to the associated feature (e.g., land parcel or facility). Once linked, the interactive web-based map would provide a simple way to retrieve related documents. The link would also provide a way to display the map location of the feature(s) associated with a document. A major focus of the project was researching the feasibility of

developing interoperable web services between SharePoint and GIS to facilitate the storage and management of the sometime complex relationships between documents and features.

The major components were conceived and prototypes were developed during the first work session of the project team (January 2010). These components included:

- FLEX web application code to query SharePoint web service
- Prototype database with matrix table triggers to store document and feature IDs
- Custom database web service code

In mid-course, this project turned in a somewhat different direction than originally conceived. This new direction is described in Section 2 below.

2   Factors that Influenced Research Direction

Several issue identified during the course of this project required a change in research direction. Although the initial approach (described in the Conceptual Model Report) was found to be technically feasible, the project team identified some organizational and workflow related factors that would render the approach impractical for implementation.

The following subsections describe the issues that influenced the direction of this research project.

2.1   SharePoint Implementation

During project scoping with Reclamation Facilities Operation & Maintenance and Lands Resource Management programs in two Regions, it was discovered that while there was an interest in putting documents in SharePoint relatively little thought had been given to why. Initially it appeared that the programs had good business or functional reasons, but upon further discussion the reasons provided were not found to have sound business or functional rationale. It became apparent that there were misconceptions about what SharePoint is and what it can do. It also became apparent the programs did not have a clear understanding of their role in governing and managing documents in SharePoint.

2.2   Legacy Documents

One of the underlying assumptions of this project was that users would be able/willing to perform the work necessary to associate documents to features. While this might be true for day forward work, it was found to be false for linking legacy documents to features. In the case of the sometimes complex relationships of lands transaction documents to features, the task of linking potentially thousands of legacy documents to features (parcels), would not only be daunting but would be prohibitively expensive.

2.3 Relationship Integrity

Another issue that greatly influenced the direction of this project was the realization that the integrity of the relationships linking documents to features would be entirely left to the users. For some features, likes facilities, this issue would not be too problematic. However, managing the relationships of lands transaction documents with parcels (features) would require users to understand and perform a relatively complex procedure.

2.4 Complexity

An overarching issue that the project team wrestled with is complexity in both the model and the application. The original conceptual model was heavily influenced by an assumed need to handle many-to-many relationships between features and documents. This assumption greatly increased overall complexity because many-to-many relationships must be maintained in its own structure, and must be created, modified, and deleted records by the application. However, during the course of this project, the assumption was found to be more of the exception than the rule.

The project team devised a new conceptual model based on handling only one-to-one and one-to-many relationships between features and documents. This greatly reduced complexity while meeting the needs of most cases.

3   New Conceptual Model

The project team developed a new conceptual model. The focuses on loosely-coupled interoperation between a custom FLEX web mapping application and SharePoint (Figure 1).

Figure 1

The SharePoint web application is launched with a URL string that opens the page that corresponds to the document library and folder path defined by the attributes of

a feature returned through a query to a GIS web service. In essence, a user clicks on a feature in the web mapping application and a SharePoint window opens with a list of documents associated with the selected feature.
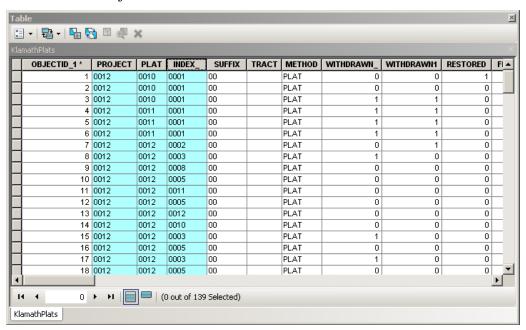
3.1   Feature-to-Document Relationships

In the new conceptual model, feature-to-document relationships address the one-to-one and one-to-many cases. The many-to-many case tends to be an exception in most document collections. In order to arrive at a potentially implementable result to this project, the project team decided that the many-to-many case be tabled.
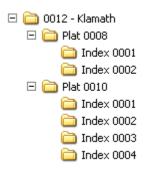
This decision eliminated the need for a separate a database and matrix table in which to build and maintain the many-to-many relationships. It also eliminated the need to build a custom web service to handle linking transactions.

The new conceptual model requires that features have attributes that correspond to the organizational structure of an associated document collection. In the prototype the lands transaction documents are organized in folders by project, plat, and index.

The figure below shows the attribute table of the geospatial data set of land parcels for the Klamath Project.

The values in the highlighted fields are the "keys" for linking geospatial features to documents stored in the folder structure shown below.

```
  ☐ 📁 0012 - Klamath
     ☐ 📁 Plat 0008
          📁 Index 0001
          📁 Index 0002
     ☐ 📁 Plat 0010
          📁 Index 0001
          📁 Index 0002
          📁 Index 0003
          📁 Index 0004
```

The values in the attribute table of the geospatial data correspond to the numbers in the folder names. Note that names do not need to match exactly as long as clear pattern is followed (e.g., Plat ### and Index ####).

4   Prototype

The project team developed the components needed to implement a prototype using a lands transaction document collection for the Klamath Project in MP Region. The prototype is hosted on a GIS Server and a SharePoint instance maintained by Reclamation GIS (BORGIS).

http://ibr1pnrapgis002/LandsDocuments/

The prototype will be available for demonstration as long as the S&T office desires.
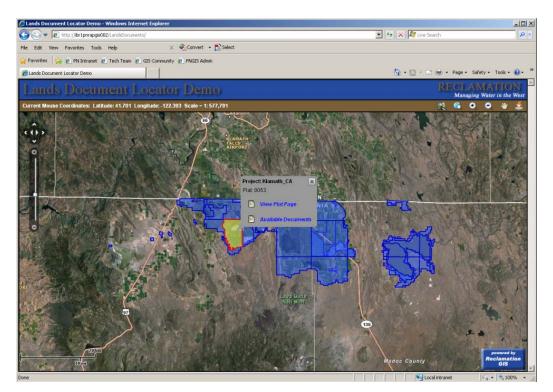
4.1   Documents & Features

The project team selected a collection of lands transaction documents for Klamath Project in MP Region to use in the prototype. The document collection is organized in an established hierarchical file structure – Project, Plat page, Index. In addition, MP Region maintains a GIS data set of land parcel features that have attributes that contain Project, Plat, and Index values.

The project team discussed the potential for translating the folders names to metadata field values in a SharePoint document library. Metadata fields allow content to be displayed using one or two levels of "group by". However, common filenames are used for key documents separated by folders. This precluded using metadata fields, which requires document filenames to be unique. The document collection was bulk loading into a SharePoint document library with folders.
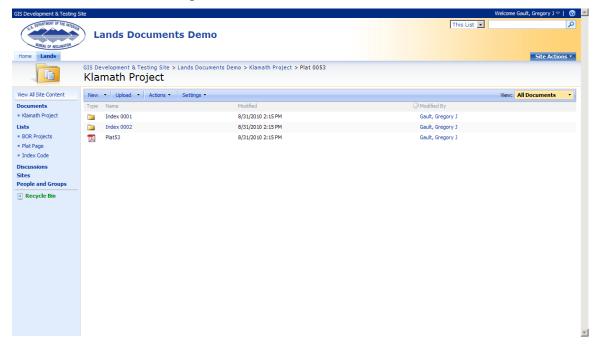
4.2   FLEX Web Mapping Application

A prototype FLEX web mapping application was developed using a mash-up of internal (features) and external web services (base maps). The prototype application demonstrates basic document access functionality.

Clicking on a parcel generates a popup in which the user can choose a hyperlink "View Plat Page" or "Available Documents".

The first choice opens the SharePoint document library page that corresponds to the Plat page. The Plat page contains a scanned image of the plat and the folders of Indexes associated with the plat.

The second choice opens the SharePoint document library page that corresponds to the Index (folder) associated with the parcel.

The breadcrumb feature of SharePoint displays the current location in the document library. The user can navigate up the structure by clicking a breadcrumb item.

5   Research Results

The results of this research and development project are somewhat different than originally proposed due to the issues described in Section 3. Nonetheless, the research resulted in the development of a working prototype that will likely be implemented with some refinements by programs in one or more Regions.

In addition, the project prepared a report "Recommendations, Best Practices, and Guidelines for Linking Documents in SharePoint". This report compiles and organizes the many lessons learned by the project team in a form that hopefully will be useful to Reclamation programs as they tackle using SharePoint.

The resulting model for handling linking documents to features is far simpler and more easily implementable that the original concepts.