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Developing a Watershed-based Plan Evaluation Framework for Socio-ecological Network Analysis in the Upper Pontchartrain Basin

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DEVELOPING A WATERSHED-BASED PLAN EVALUATION FRAMEWORK FOR SOCIO-ECOLOGICAL NETWORK ANALYSIS IN THE UPPER PONTCHARTRAIN BASIN

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ABSTRACT

Louisiana's efforts to create regional watershed planning under the Louisiana Watershed Initiative (LWI) suggest the need to evaluate existing governance systems such as the coordination, development, and implementation of plans. The Network Analysis and Plan Evaluation (NAPE) Framework developed in this study answers initial questions related to the LWI's long-term resilience outcomes from the content analysis and extraction of relational data in plans of LWI Region 7 located in the Upper Pontchartrain Basin. Actor-Plan Coordination Networks reveal the coordination and collaboration of entities, and a Network of Plans presents the integration of planning documents in the Region. Local government organizations were disconnected from those outside of their jurisdiction. Higher government levels bridge gaps through hazard mitigation and transportation plans between local governments that would otherwise not be connected. Centrality measures quantify the relationships between organizations and plans. The organizations with the highest two-mode degree centrality value in the participated network were the Louisiana Department of Transportation (LADOTD), FEMA, the Stephenson Disaster Management Institute (SDMI), FEMA, and GOHSEP. The organizations with the highest betweenness centrality value in the participated network were SDMI, LADOTD, GOHSEP, FEMA, and the Center for Planning Excellence (CPEX). Closeness and eigenvector centrality measures were similar for all organizations. Government and educational institutions were more likely to participate in planning compared to other organization types. Educational institutions had the highest average betweenness centrality value and are a possible candidate to bridge the exchange of information and planning across the Region. ANOVA models resulted in government having a significant two-mode and one-mode degree centrality compared to professional services. Educational institutions

have a significant betweenness value compared to NGOs and professional services. Federal government had a significant two-mode degree centrality value compared to local government.

In conclusion, Region 7 lacks integrated planning and coordination with other jurisdictions in the region and organization types that are not related to government. The results of this study can guide other theoretical frameworks or questions that are explored using the NAPE framework. Overall, the NAPE framework can effectively identify the current organizational capacity and integration of plans in a planning network.

1. INTRODUCTION

Louisiana's efforts to create regional watershed planning under the Louisiana Watershed Initiative (LWI) suggest the need to evaluate existing governance systems such as planning, policies, ordinances, implementation, and collaboration at the watershed level that transcends political boundaries. Regional watershed management is needed to reduce flood risks as activities and projects can affect other jurisdictions downstream of the watershed or floodplain.

The LWI has six strategic areas for long-term resilience outcomes intended to guide the state-wide program (Louisiana Watershed Initiative, 2020). These outcomes include the *capability and capacity* to effectively reduce flood risk and *integrated planning* between jurisdictions in each watershed and the state (Louisiana Watershed Initiative, 2018). Analyzing plans at the regional watershed level can help guide these outcomes by revealing the current coordination and integration of plans and policies between jurisdictions and their capacity to reduce flood risks effectively. This study develops a plan content analysis methodology that can answer questions regarding multi-jurisdictional coordination that can help guide the governance structure of the LWI regions and other regional governance efforts.

Research evaluating the integration of plans and content analysis often involves plan evaluation (PE) methodologies. Several studies evaluate regional planning of ecological factors, such as Brody's plan evaluation framework in *Ecosystem Planning in Florida* (2008), which develops a Plan Evaluation Coding Protocol that scores plans based on their content across several plan evaluation principles. Past studies have also evaluated state and local hazard mitigation plans and scored them based on the extent to which they address natural hazards and climate change (Berke, Smith, & Lyles, Planning for Resiliency: Evaluation of State Hazard Mitigation Plans under the Disaster Mitigation Act, 2012; Brody, Ecosystem Planning in Florida: Solving Regional

Problems through Local Decision-making, 2008). Each principle is made up of sub-principles with related items that are measured on either a binary (0-1) or an ordinal (0-2) scale (Brody, 2008). 0 or 1 indicates the absence or presence of an item, and a 2 on an ordinal scale indicates the item is present and described in great detail. Other plan evaluation frameworks include the Plan Integration for Resilience Scorecard (PIRS) that evaluates the integration of plans in a network or network of plans and their physical and social vulnerability to hazards (Berke, Malecha, Yu, Lee, & Masterson, 2018). Plan Integration for Resilience Scorecards (PIRS) measure the vulnerability of a plan to hazards using a -1 or +1 to indicate policies that increase or decrease their vulnerability (Woodruff, et al., 2021). Scorecards obtain results by summing and averaging the overall score of each plan. The results from these studies can be used to improve future planning efforts by identifying policies and strategies and inconsistencies between other regional plans that increase vulnerability to hazards (Berke, Malecha, Yu, Lee, & Masterson, 2018; Malecha, Woodruff, & Berke, 2021).

However, few plan evaluation research methods have incorporated tools or methodologies to extract relational data and quantify measures of multi-jurisdictional planning and coordination across watersheds from the content analysis of plans (Woodruff, et al., 2021). The scoring of plans based on their content alone does not measure consistency between plans and their effect on hazard mitigation and watershed planning. Relational data can provide a more accurate depiction of the integration of plans and policies in a region, the coordination of stakeholders, and a region's vulnerability to natural hazards. The data can be extracted through content analysis of plans or plan coding using qualitative analysis software such as NVivo (QSR International Pty Ltd., 2018). The study system and network components can be analyzed by the structure and measures of the

network, including descriptive statistics, network visualizations, and statistical approaches (Poplier, 2018).

This study's first objective is to develop a Plan Evaluation Coding Protocol (herein referred to as the Protocol) from the integration of past ecological and hazard mitigation protocols, emphasizing regional watershed-based issues and flood hazards. The study's second objective develops a framework for the extraction of relational data from the Protocol and the process of measuring it using quantitative social-ecological network analysis (SENA) measures. SENA is an interdisciplinary methodology of social network analysis (SNA) that addresses social and transboundary environmental issues (Sayles, et al., 2019; Poplier, 2018). The framework distinguishes social and ecological actors or nodes, such as organizations and natural features, as discrete identities and includes all nodes' relationships while applying qualitative and quantitative approaches (Sayles, 2019). This includes network visualization, such as sociograms, that connect actors by their relationship to other actors and plans in the region (Poplier, 2018). This study's combination of plan evaluation and network analysis methods constitutes the Network Analysis and Plan Evaluation (NAPE) framework.

The third objective of this study applies the NAPE framework to two LWI long-term resilience outcomes. NAPE analyzes and identifies key stakeholders and actor-coordination in plans across Region 7 (herein referred to as the Region) of the LWI. An Actor-Coordination or Actor-Plan Network and Network of Plans is created from the extraction of relational data based on organizations and plans mentioned and participating in several types of plans in the Region. The network is measured using centrality measures, a type of social network analysis, and compared across organization type and administrative or government level. Statistical analysis of

variance (ANOVA) compares the differences between centrality measures and, thus, determines which organizations are more involved in developing and coordinating plans in the Region.

2. NETWORK ANALYSIS AND PLAN EVALUATION FRAMEWORK

This study adopts a network analysis and plan evaluation (NAPE) framework for extracting and analyzing relational data from plan evaluation (PE) and social-ecological network analysis (SENA) methods. Five steps make up the NAPE framework (Figure 1). The NAPE framework can be used to answer questions regarding multiple themes or issues, including multi-jurisdictional watershed governance, socio-ecological fit, and polycentric governance (Brody, Highfield, & Carrasco, 2004; Guerrero, McAllister, Corcoran, & Wilson, 2013; Boamah, 2018).

2.1. Themes of Plan Evaluation

The first part of the framework determines what Plan Evaluation principle, or principles, is appropriate for answering the study question. The themes or principles of the Protocol serve as the basis for the theoretical framing and components of NAPE. Plan evaluation methodologies were developed to measure the quality of plans for issues such as ecosystem and natural resource management, hazard mitigation, and climate adaptation (Brody, 2003; Berke, Smith, & Lyles, 2012; Stevens & Senbel, 2017). These methodologies often involve plan evaluation frameworks that score plans based on the presence or absence of plan components. Past protocols are based on four to six different principles of plan quality (Berke & Godschalk, 2009; Brody, 2008; Lyles, Berke, & Smith, 2014). For example, in hazard mitigation and ecosystem management, plan components include a combination of direction-setting and action-oriented principles (Lyles, Berke, & Smith, 2014; Horney, et al., 2017).

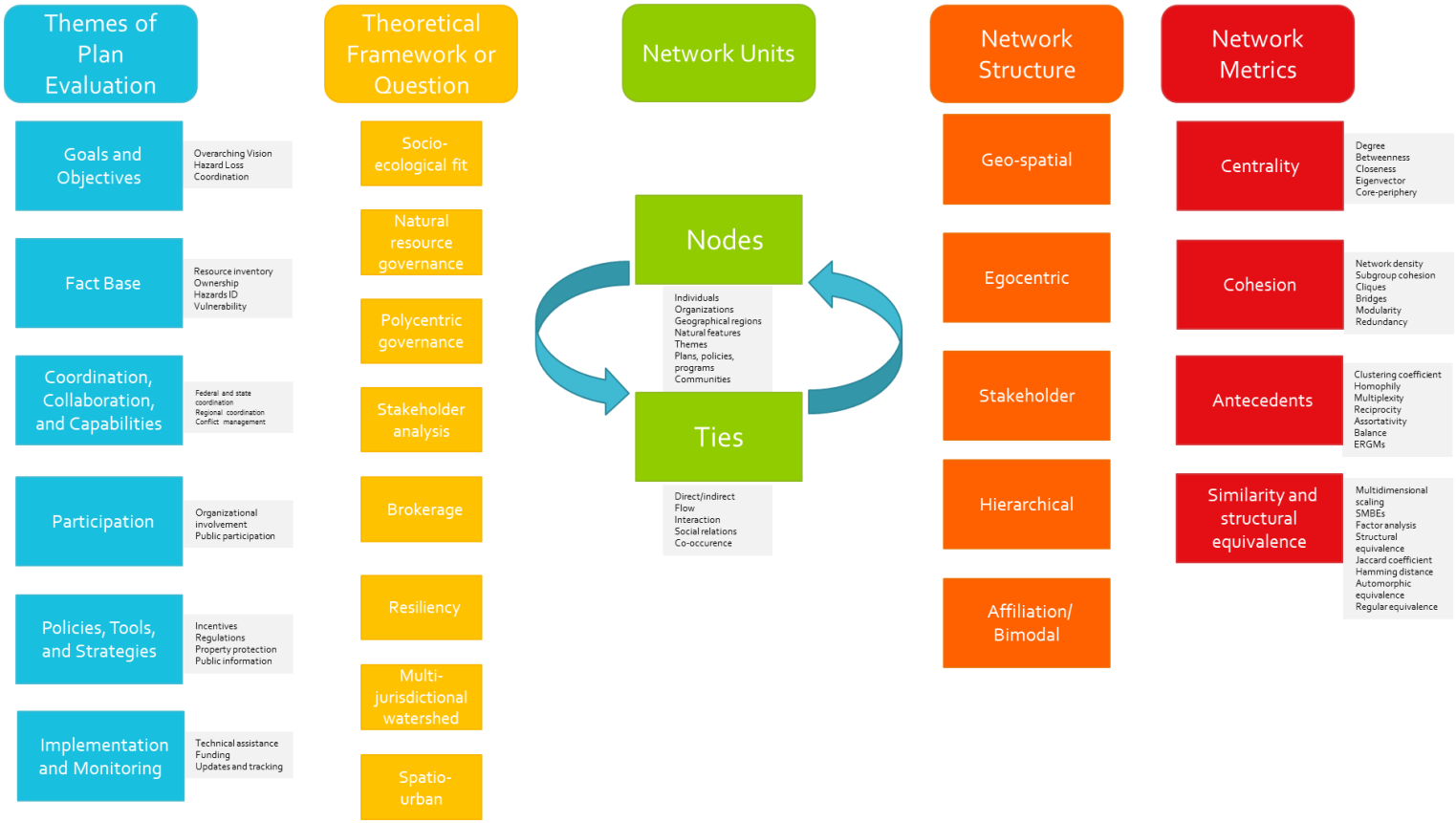

Figure 1. The Network Analysis and Plan Evaluation (NAPE) Framework.

Direction-setting principles include *fact base*, *goals and objectives*, and *policies, tools, and strategies*. Action-oriented principles include *inter-organizational coordination and capabilities, implementation and monitoring*, and *participation* (Lyles, Berke, & Smith, 2014). Early PE uses included only direction-setting principles, with later studies adding action-oriented principles (Brody, 2003). Other studies divide plan quality principles by internal and external dimensions, with *fact base*, *goals*, *policies,* and *implementation* being internal and *coordination* and *participation* being external (Berke, Smith, & Lyles, 2012).

This study includes the following six principles: goals and objectives; fact base; policies, tools, and strategies; coordination, collaboration, and capabilities; implementation and monitoring; and participation (Table 1). The Protocol was adapted from existing literature plan evaluation protocols and frameworks to include watershed and flood-related hazards and multi-jurisdictional elements (Appendix A).

The *goals and objectives* principle outlines a plan's reflected values and future desires (Berke, Smith, & Lyles, 2012). Sub-principles include the overarching vision, coordination, and hazard loss (Berke, Smith, & Lyles, 2012; Lyles, Berke, & Smith, 2014). Creating a network of planning goals in a region can determine if jurisdictions share similar goals that align with each other and do not conflict (Bacău, Grădinaru, & Hersperger, 2020). For example, the consistency of plan goals can be measured using exponential random graph models (ERGMs). ERGMs are logistical regression models that can be used to analyze networks (Hunter, Goodreau, & Handcock, 2008). ERGMs can predict the probability of a tie being in a network while including node and edge variables (Hunter, Goodreau, & Handcock, 2008). The *fact base* principle provides empirical data and background information that serves as the plan's foundation and can identify consistency across jurisdictions (Berke, Smith, & Lyles, 2012; Lyles, Berke, & Smith, 2014).

Table 1. The Plan Evaluation Coding Protocol Principles.

Principle	Sub-Principle
Goals & Objectives	Coordination, hazard loss, overarching vision
Fact Base	Federal and state policies and programs, hazards identification and risk assessment, human ownership and problem identification, resource inventory, and vulnerability assessment
Policies, Tools & Strategies	Incentive tools, preventative land use policies, property protection policies, public information policies, and regulatory tools
Coordination, Collaboration & Capabilities	
Implementation & Monitoring	
Participation	Organizational involvement, public engagement

Note. The *coordination, collaboration, and capabilities,* and *implementation and monitoring* principles do not have sub-principles because their nodes are not distinct enough to be categorized further (Appendix A).

Sub-principles include resource inventory, human ownership, human impacts and problem identification, hazards assessment, vulnerability assessment, and infrastructure (Brody, 2008).The *policies, tools, and strategies princi*ple includes regulatory tools, incentive tools, preventative land-use policies, property protection policies, and public information policies that will be applied to achieve the goals in the plan (Brody, Highfield, & Carrasco, 2004). The *coordination, collaboration, and capabilities* principle involves the collaborative effort and conflict management between local, parish, and regional entities (Berke, Smith, & Lyles, 2012). Actor-coordination networks can reveal those most involved in plan development and which jurisdictions collaborate (Li, et al., 2020). The *implementation and monitoring* principle consists of who is responsible for enforcing and updating the plan and how it will be monitored (Brody, Highfield, & Carrasco, 2004; Lyles, Berke, & Smith, 2014). The *participation* principle identifies organizational involvement and public engagement in the plan's development (Berke, Smith, & Lyles, 2012; Lyles, Berke, & Smith, 2014). The *coordination, collaboration and capabilities; implementation and monitoring;* and *participation* principles can be measured using degree centrality measures, measures related to the position of a node or an actor in a network, and community detection techniques.

2.2. Theoretical Framework or Questions

The second part of the framework identifies the study question and its theme or Plan Evaluation principle. For example, the mission of the LWI is to improve floodplain management and reduce flooding in the state by establishing multi-jurisdictional watershed planning across watershed regions (Louisiana Watershed Initiative, 2018). The LWI's overall efforts would align with the *multi-jurisdictional watershed governance* theme. Any principle of the Protocol can answer questions related to this theme. *Goals and objectives* can identify consistencies between hazard loss and coordination goals. *Coordination, collaboration, and capabilities* can identify if jurisdictions have the resources and tools available to reduce flood risk and increase resiliency in the regions or if the jurisdiction is coordinating planning efforts with federal, state, regional, and other local government bodies.

Other theoretical frameworks that can be examined using NAPE are polycentric governance, a governance system with multiple centers or bodies of decision-making, and socio-ecological fit (Boamah, 2018; Sayles, et al., 2019). *Coordination, collaboration, and capabilities* can identify the interaction of different actors and which levels of government are more involved in the development of plans. In comparison, *implementation and monitoring* identify actors that will be involved in future updates to the plan. When plan objectives do not align with the ecological system it impacts, socio-ecological fit can have implications for natural resource governance and environmental management (Guerrero, McAllister, Corcoran, & Wilson, 2013). *Fact base* and *policies, tools, and strategies* can identify sensitive habitats and whether management policies can reduce human impacts on the environment or if future projects or policies could adversely impact habitats.

2.3.Network Units

The third part of the framework identifies which nodes and ties are to be created from the Plan Evaluation principle. A node or vertex is the basic unit of a network (Borgatti, Everett, & Johnson, 2018). Nodes are discrete entities such as actors, organizations, plans, policies, projects, and natural features. Nodes are either social or ecological in socio-ecological network analysis (SENA), (Sayles, et al., 2019). Social nodes include actors, organizations, individuals, policies, laws, projects, and other non-ecological units. Ecological nodes include individuals or groups of species, ecosystems and habitats, and natural and geographic features. Nodes are connected by ties or edges that constitute relationships between nodes. Relationships can be one-way, symmetrical, or associative (QSR International Pty Ltd., 2018). Examples include direct and indirect mentions, plan participation or coordination, the flow or exchange of information or financial resources, and technical assistance and consulting of plan development. Nodes and the relationships between them form relational data.

Relational data can be extracted from plan content analysis. Reading plans and manual coding is the simplest content analysis method, but extracting and storing data is time-consuming and ineffective. A more practical option is using qualitative analysis software. An example and the program used in this study is NVivo 12, a statistical and qualitative analysis software (QSR International Pty Ltd., 2018). Plans can be uploaded and coded in NVivo, creating relational data that can either be analyzed in the program or extracted into a tabulated form for statistical analysis in other programs such as R or SAS.

2.4.Network Structures

The fourth part of the framework determines the best network layout or structure to graph and visualize the network. Network visualizations are an initial way of understanding and

identifying patterns or gaps in a network according to their ties and node attributes or variables. A sociogram is the direct visualization of the relationships in a network (Borgatti, Everett, & Johnson, 2018). Multiple programs can create sociograms, including NVivo, R, and KUMU (QSR International Pty Ltd., 2018; R Core Team, 2021; Kumu [Relationship mapping software], 2021). A one-mode network has only one node type, while a two-mode or affiliation network has two types of nodes (Borgatti, Everett, & Johnson, 2018). An example of a one-mode network is the Network of Plans that depicts a one-way relationship between plans that reference each other (Figure 2).

Bipartite networks are two-mode networks that only consist of ties between groups, such as plans and organizations (Borgatti, Everett, & Johnson, 2018). The Actor-Plan Coordination Network is an example of a bipartite network that illustrates the relationship between plans and the organizations mentioned or participated in them (Figure 3).

Egocentric sociograms consist of the relationships to the network's ego and its ties or alters (Borgatti, Everett, & Johnson, 2018). Whole networks can be graphed and the ego network extracted, such as East Baton Rouge Parish's direct, or one-step, relationships to other organizations and plans (Figure 4).

Geo-spatial networks are mapped based on the geographic coordinates of the nodes (Kumu [Relationship mapping software], 2021). In an initial study, the LWI Region 7 comprehensive plan goals and objectives were mapped in KUMU based on parish latitude and longitude coordinates (Figure 5).

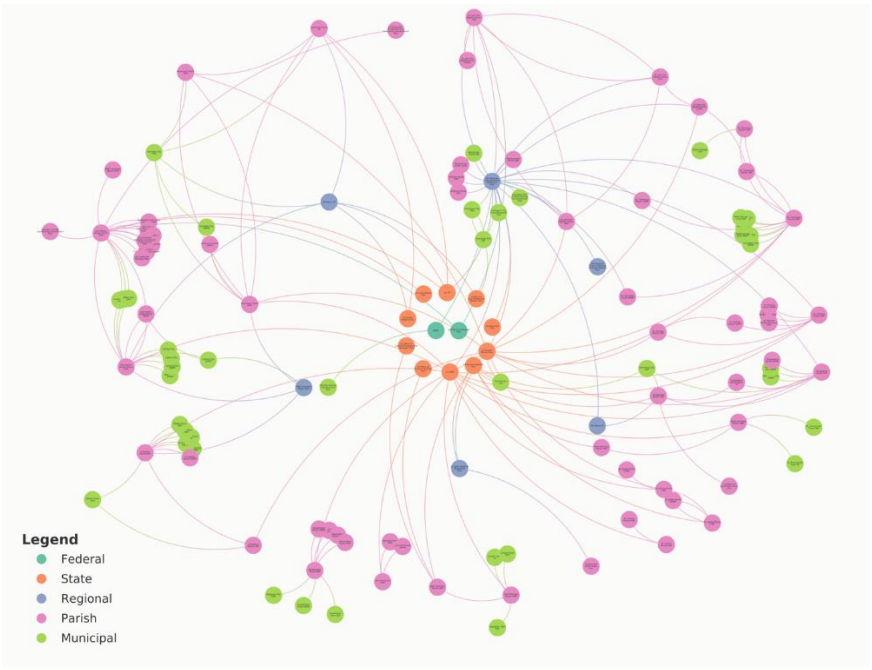

Figure 2. One-mode Network of Plans in LWI Region 7.

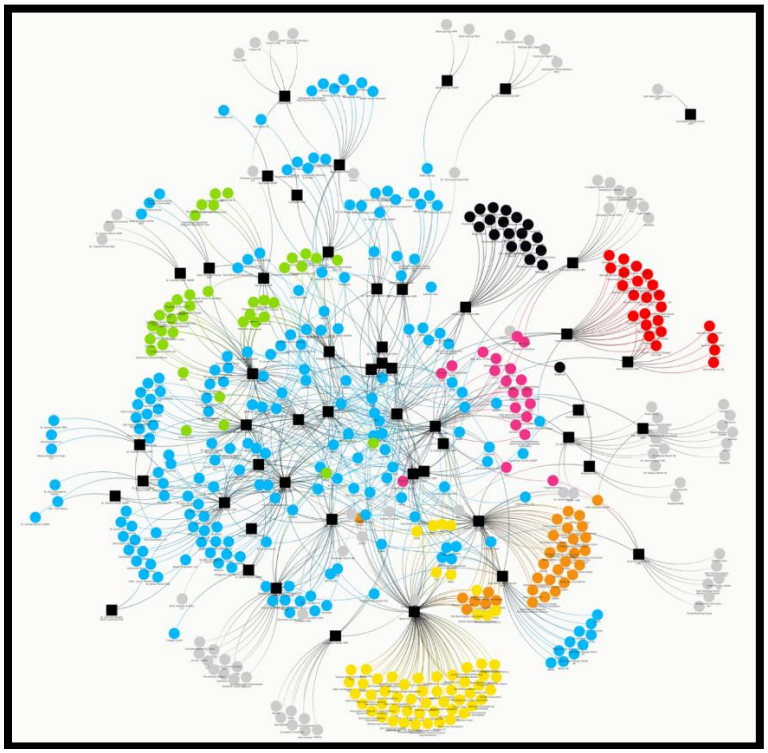

Figure 3. Two-mode Network of Actor-Plan Communities in LWI Region 7.
Note. The community or sub-group the node belongs to is characterized by node color.

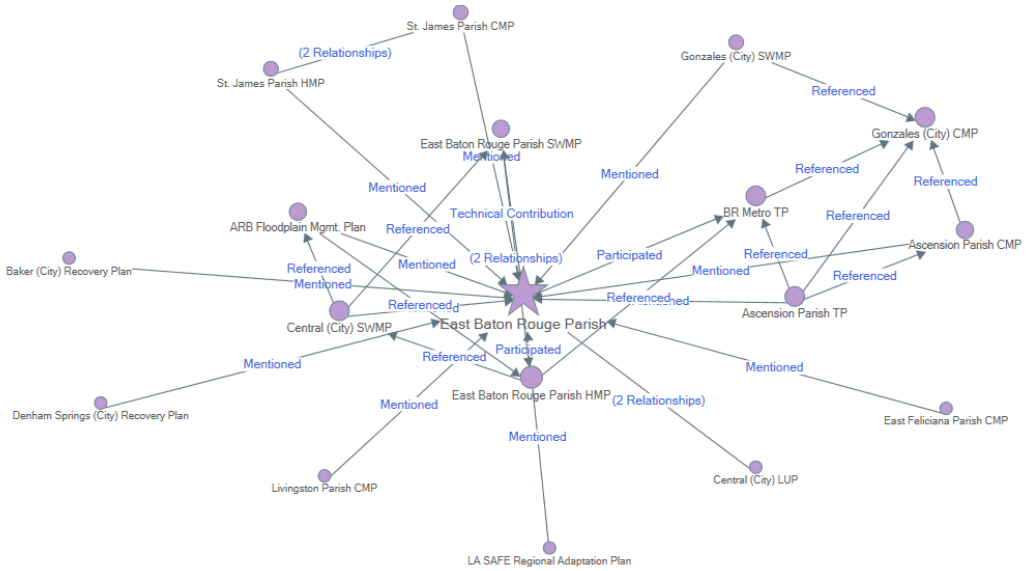

Figure 4. East Baton Rouge Parish Egocentric Network.

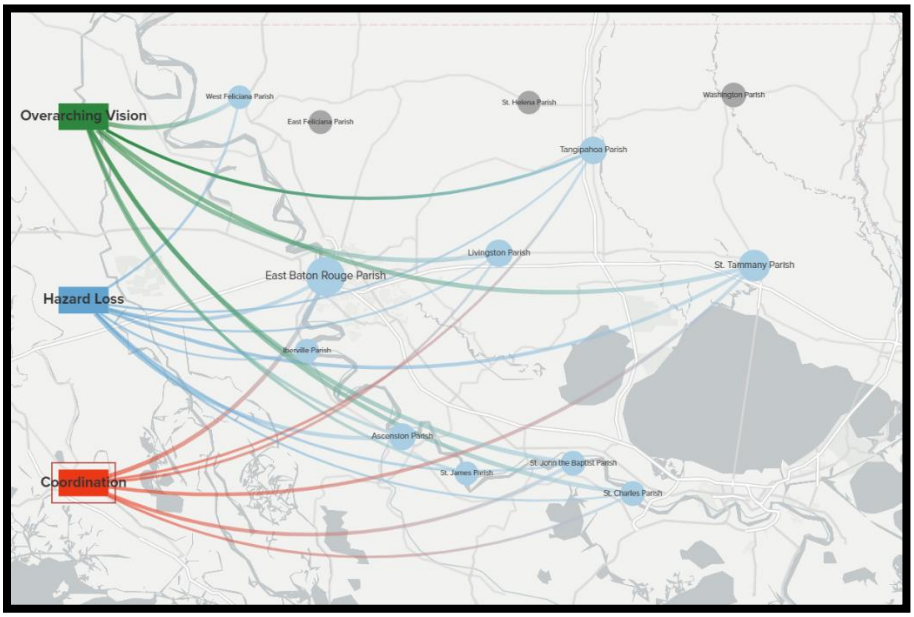

Figure 5. Goals and Objectives Network of Comprehensive Plans in LWI Region 7.
Note: St. Helena and Washington Parish do not have comprehensive plans. East Feliciana Parish does not have goals that are listed in the Protocol.

Networks can also have more than one relationship type. Multiplex networks have multiple types of relations. Each network corresponds to a different relationship type, creating separate layers in a multiplex network (Magnani, Rossi, & Vega, 2021).

2.5.Network Measures

The fifth part of the framework identifies measures to analyze the network quantitatively. Network measures used in SNA literature can be divided into five categories: centrality and prestige, basic network demographics, cohesion, antecedents, and similarity and structural equivalence (Poplier, 2018). Degree and betweenness centrality measures can quantify the interaction of actors in the network (Ingold, 2011). Degree centrality measures the number of ties each node has (Borgatti, Everett, & Johnson, 2018). Actors with a high degree of centrality have more significant ties and are thus more involved and known to other actors in the network (Ernston, Sörlin, & Elmqvist, 2008). Betweenness centrality measures the number of ties an actor has between two actors that are not connected themselves or the number of shortest paths each node is on (Ingold, 2011; Dong, et al., 2020). Thus, actors with high betweenness centrality can control or increase the flow of information between actors and organizations that would otherwise not be connected (Long, Cunningham, & Braithwaite, 2013). In other words, those actors, known as brokers or boundary spanners, bridge relationships and close gaps in governance and knowledge (Long, Cunningham, & Braithwaite, 2013). Closeness centrality measures the distance between two nodes as the shortest path between them (Freeman, 1978). Closeness is the reciprocal of farness, the average distance from the node to all other nodes. This metric is not well-suited for directed networks (Borgatti, Everett, & Johnson, 2018). Eigenvector centrality measures the number of ties each node has, but it also considers the degree of those nodes it is tied to (Borgatti, Everett, & Johnson, 2018). In other words, the node will have a higher value if it is linked to nodes with a high degree of centrality compared to a low degree centrality value.

Community detection techniques can reveal subgroups of actors in the network. These subgroups consist of actors that share multiple ties (Borgatti, Everett, & Johnson, 2018). Cliques

are subgroups where every actor is adjacent (Borgatti, Everett, & Johnson, 2018). Subgroups can be further identified using the community detection technique, Speaker-listener Label Propagation Algorithm (SLPA) that identifies community clusters or overlapping actors in the network. (Xie, Szymanski, & Liu, 2013).

Lastly, whole networks can be analyzed using cohesion and reciprocity measures (Borgatti, Everett, & Johnson, 2018). Density is a measure of cohesion equal to the proportion of ties present in the network to possible ties (Borgatti, Everett, & Johnson, 2018). Reciprocity measures how often a tie is matched or the proportion of reciprocated ties to the total number of ties (Borgatti, Everett, & Johnson, 2018).

The study presents an example of the NAPE framework by analyzing plans in Region 7 of the LWI based on the *coordination, collaboration, and capabilities,* and *participation* principle to answer questions related to multi-jurisdictional watershed governance.

3. CONTEXT FOR DEMONSTRATING NAPE APPLICATION

The historical August 2016 floods in Louisiana caused widespread physical, economic, and emotional devastation across the central and southern parts of the state. The total cost amounted to over $8 billion in commercial, residential, and public damage (Terrell, 2016). In addition, this disaster exposed gaps in watershed governance and flood risk reduction, prompting Governor Edwards to direct state agencies towards creating the LWI (Louisiana Watershed Initiative, 2020). The LWI separates Louisiana's watersheds into eight regions (Louisiana Watershed Initiative, 2020). Each region has a Regional Steering Committee (RSC) that must create its temporary governance structure based on planning and development, project implementation, data and modeling, outreach and engagement, and creating a representative body (Louisiana Watershed Initiative, 2018). Evaluating plans can identify which organization types and levels of government are more involved in the planning development and process and the key stakeholders and boundary-spanners in a region. These stakeholders may be better equipped to coordinate and collaborate and share knowledge and data across jurisdictions in the region.

The plans in this study consisted of those produced by parishes and their corresponding municipalities within the boundaries of the Louisiana Watershed Initiative (LWI) Region 7 watershed (Figure 6). LWI Region 7 (the Region) includes the following parishes: Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, St. Charles, St. Helena, St. James, St. John the Baptist, St. Tammany, Tangipahoa, Washington, and West Feliciana. This area is located north of Lake Pontchartrain in the HUC 08-Lower Mississippi Region and Lower Mississippi-Lake Maurepas sub-region (USGS, 2020). Washington Parish is partially located in the HUC 03-South Atlantic-Gulf region and Pearl sub-region (USGS, 2020).

Plans collected included parish, municipal, and regional plans in LWI Region 7 published between 2000 and 2020. Regional plans were limited to those that included two or more parishes in the Region, such as the New Orleans Metro Transportation Plan and the LA SAFE Regional Adaptation Plan. Seven types of plans were included: Comprehensive Master Plans (CMPs); Hazard Mitigation Plans (HMPs); Coastal Zone Management Plans (CZMPs); Stormwater Management or Master Plans (SWMPs); Recovery, Resiliency, or Adaptation Plans (herein collectively referred to as Recovery plans); Transportation Plans (TPs); and Economic Development Plans (EDPs).

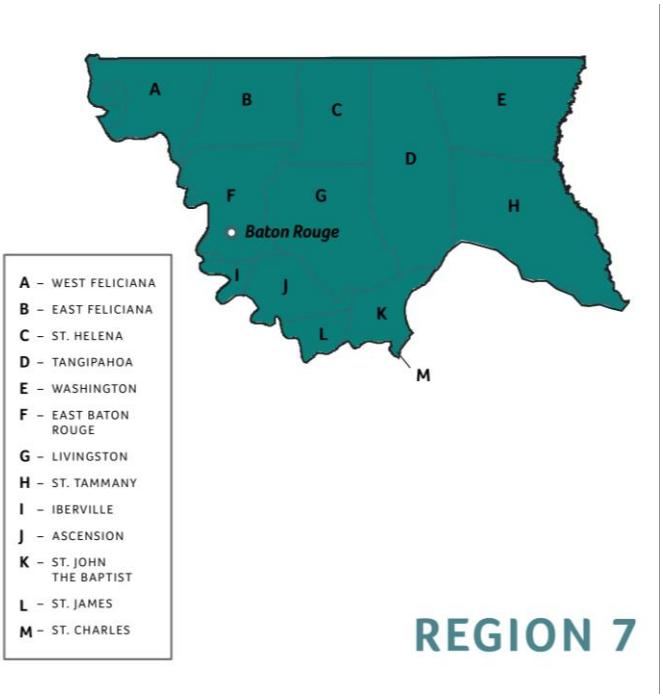

Figure 6. LWI Region 7 Boundaries.
Source: (Louisiana Watershed Initiative, 2020).

Comprehensive master plans must describe the future goals and objectives and define the parish's vision and contain three or more of the following themes or elements: economic development, transportation, housing, infrastructure, recreation, and environment. All but two parishes in the Region have a comprehensive master plan (Figure 7). Hazard mitigation plans

must be approved by GOHSEP and FEMA and include all natural hazards. Stormwater management plans must be comprehensive for reducing the effects of surface water run-off and not a stormwater manual or MS4 permit for stormwater management compliance and regulations. Overall, the Region had 68 plans collected. The government-level plans included 53 parish, 19 municipal, and 6 regional. The plan types included 23 CMPs, 17 HMPs, 11 SWMPs, 8 TPs, 5 CZMPs, 3 Recovery, and 1 EDP.

Figure 7. Status of Comprehensive Plans in Louisiana Parishes.
Source: (Douthat, 2020).

Documents were collected by visiting official parish and municipal websites and contacting their planning and zoning departments. Local HMP's were available on the Stephenson Disaster Management Institute's (SDMI) *Hazard Mitigation Plans* website (LSU SDMI, 2021). Local

CZMP's were available on the Louisiana Department of Natural Resources (LDNR) Office of Coastal Management website (LDNR, 2021).

4. IMPLEMENTING NAPE

The methods in this study establish a means of extracting and analyzing relational data based on PE and SNA methods and the NAPE framework (Figure 8). Relational data is based on ties or relationships between nodes that make up a network. Nodes are not limited to social and ecological nodes and can be any discrete unit or concept. The sub-principles and nodes of PE can themselves be nodes and have connections to each other by their relationships to plans. Plan content can be extracted and analyzed as relational data to answer theoretical questions based on geographic scales of governance.

NVivo 12 was used as the primary data extraction software (QSR International Pty Ltd., 2018). The software provides an effective means of content analysis, extracting, organizing, and storing qualitative and relational data, and exporting relational data in a suitable format for statistical analysis in other software. Another advantage of NVivo is the ability to create nodes and relationships from plans and store the plan's reference as text. References make it possible to review relationships and their explicit mention in plans. References can also be extracted as summaries and reports for reading. The steps below define the NVivo process used in this study.

First, the Protocol was imported into NVivo as nodes and sub-nodes. The plans were also imported into NVivo and classified based on plan type and jurisdiction, and a *case node* was created for each plan (Figure 9). Case nodes or cases are nodes in NVivo representing discrete units (QSR International Pty Ltd., 2018). In this study, cases include organizations and plans.

Second, the plans were coded by reading each document and identifying organizations mentioned in the plans. A case was created for each organization and classified based on organization type. Organization types include government, educational institution, NGO, professional service, and private business. The reference to each organization was coded to its

corresponding case node. Coding will create a reference to the text in the plan that is the node's source. A directed relationship was created between organizations and plans or plans and plans (Table 2; Figure 10). In order to make sure all relationships in the plans were accounted for, a second coder repeated the coding process.

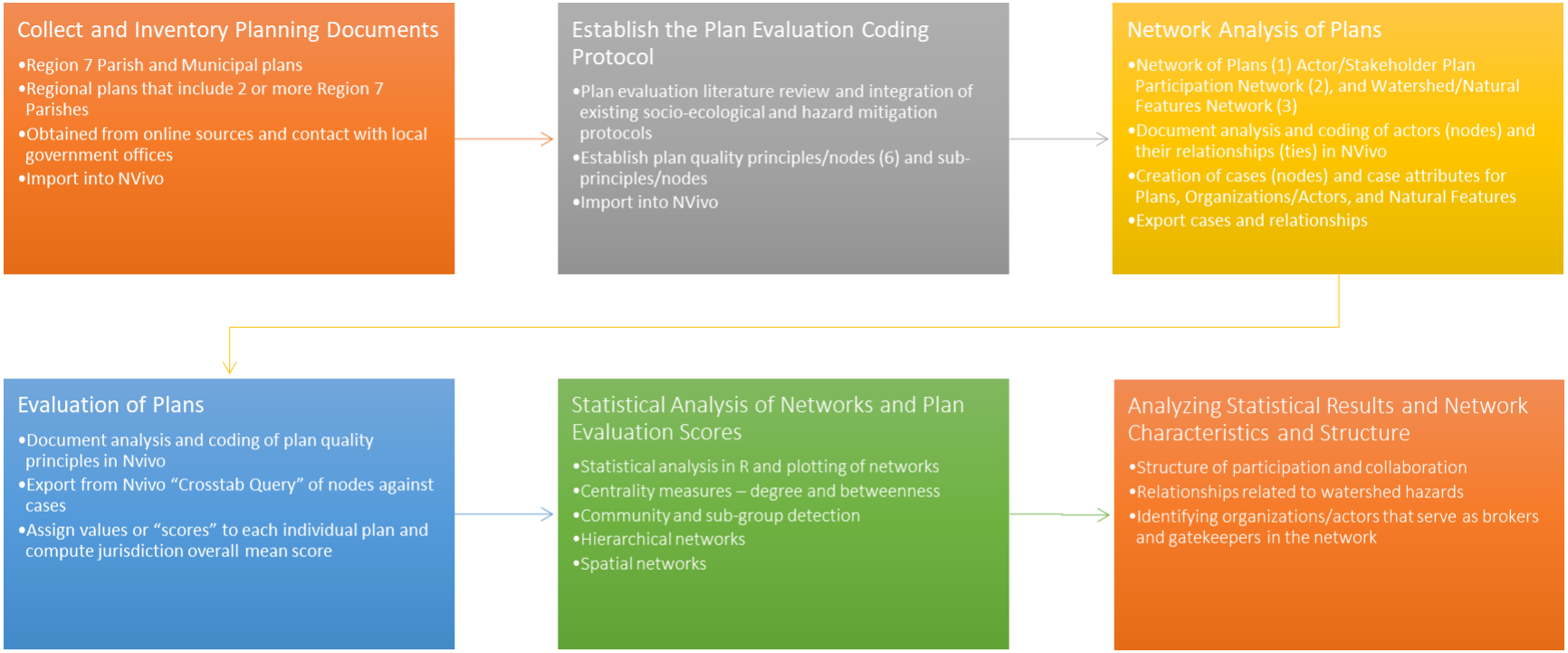

Figure 8. Study Methods.

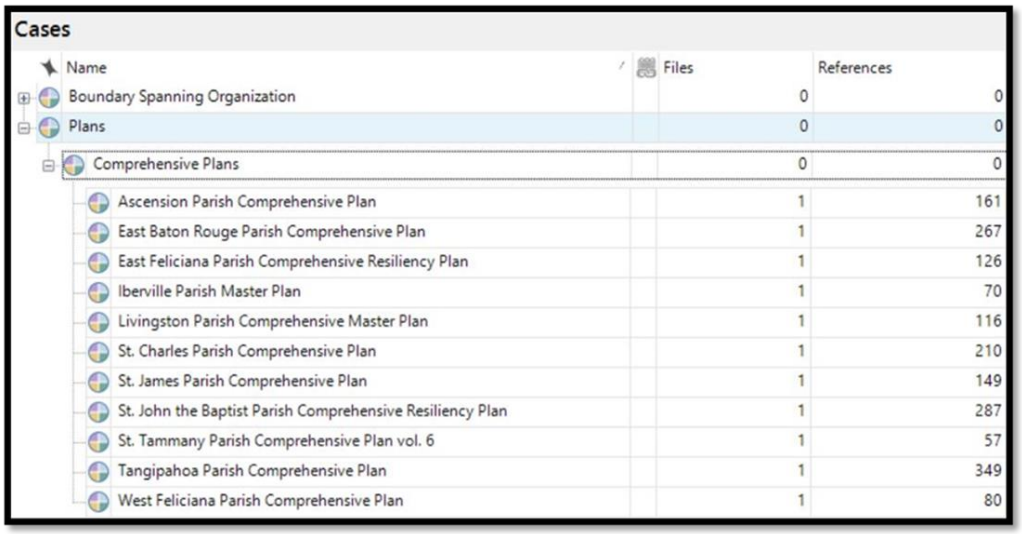

Figure 9. Comprehensive Plans as Case Nodes in NVivo 12.

Table 2. Relationship Types.

Network Type	Relationship
Actor-Plan	Participated, sponsored, authored, technical assistance, mentioned, cited
Plan-Plan	Text reference, table reference

Relationships were also flagged to determine whether the organization in the relationship was directly involved in plan development or related to a watershed-based or flood hazard issue. Flagging the relationships added a tie variable to each relationship. The first variable, *Participated*, indicated whether an organization explicitly participated in the plan development. Participants include authors or co-authors, sponsors or funders, technical assistance, or contributors to developing the plan or a section.

Relationships

From Name	Type	To Name	From Fol	To Fold	Direction
Organization\State\Pontchartrain Levee District	Participated	Plan\Stormwater Management\St. James Parish SWMP	Cases	Cases	→
Organization\State\Pontchartrain Levee District	Participated	Plan\Hazard Mitigation\East Baton Rouge Parish HMP	Cases	Cases	→
Organization\State\LSUPD	Participated	Plan\Hazard Mitigation\East Baton Rouge Parish HMP	Cases	Cases	→
Organization\State\Southern Police Department	Participated	Plan\Hazard Mitigation\East Baton Rouge Parish HMP	Cases	Cases	→
Organization\State\LaDNR - OCM	Participated	Plan\Coastal Zone Management\St. John the Baptist Parish CZMP	Cases	Cases	→
Organization\State\LaDNR - OCM	Participated	Plan\Coastal Zone Management\St. James Parish CZMP	Cases	Cases	→
Organization\State\LaDAF	Participated	Plan\Hazard Mitigation\St. John the Baptist Parish HMP	Cases	Cases	→
Organization\State\LaDEQ	Participated	Plan\Hazard Mitigation\St. John the Baptist Parish HMP	Cases	Cases	→
Organization\State\LaDEQ	Participated	Plan\Stormwater Management\St. Tammany Parish SWMP	Cases	Cases	→
Organization\State\LaDEQ	Participated	Plan\Stormwater Management\St. Charles Parish SWMP	Cases	Cases	→
Organization\State\LaDPS	Participated	Plan\Hazard Mitigation\St. John the Baptist Parish HMP	Cases	Cases	→
Organization\State\LaHHS	Participated	Plan\Hazard Mitigation\St. John the Baptist Parish HMP	Cases	Cases	→
Organization\State\LaDOH - OPH	Participated	Plan\Hazard Mitigation\St. Helena Parish HMP	Cases	Cases	→
Organization\State\LTC	Participated	Plan\Hazard Mitigation\St. Helena Parish HMP	Cases	Cases	→
Organization\Parish\Ascension Parish\Ascension Parish Government	Participated	Plan\Hazard Mitigation\Ascension Parish HMP	Cases	Cases	→
Organization\Parish\Ascension Parish\Ascension Parish School Board	Participated	Plan\Hazard Mitigation\Ascension Parish HMP	Cases	Cases	→
Organization\Parish\Ascension Parish\Ascension Parish Sheriff's Office	Participated	Plan\Hazard Mitigation\Ascension Parish HMP	Cases	Cases	→
Organization\Parish\East Baton Rouge Parish\East Baton Rouge Parish MOHSEP	Participated	Plan\Hazard Mitigation\East Baton Rouge Parish HMP	Cases	Cases	→
Organization\Parish\East Baton Rouge Parish\East Baton Rouge Parish Sheriff's Of	Participated	Plan\Hazard Mitigation\East Baton Rouge Parish HMP	Cases	Cases	→
Organization\Parish\East Baton Rouge Parish\East Baton Rouge Parish School Syst	Participated	Plan\Hazard Mitigation\East Baton Rouge Parish HMP	Cases	Cases	→
Organization\Parish\East Feliciana Parish\East Feliciana Parish OEP	Participated	Plan\Hazard Mitigation\East Feliciana Parish HMP	Cases	Cases	→
Organization\Parish\East Feliciana Parish\East Feliciana Parish Police Jury	Participated	Plan\Hazard Mitigation\East Feliciana Parish HMP	Cases	Cases	→

Figure 10. Participated Relationships Created in NVivo from Region 7 Plans.

The second variable, *Watershed*, indicated whether an organization and its relationship to the plan are related to or assumed to be watershed-based issues. Watershed-based issues include those related to flood risk and hazards, vulnerability to hazards, watershed-level policies and project implementation, equitable actions and policies to increase resiliency to hazards, response to hazards, and climate change. Organizations included but their relationship did not explicitly mention a watershed issue were agencies or entities that govern or address watersheds or are included in a hazard mitigation, stormwater management, coastal zone management, or recovery plan.

Third, case node attributes or variables were assigned to each node. Node attributes consisted of geographic, demographic, socio-economic, and capacity data (Table 3). Each jurisdiction's geographical coordinates in latitude and longitude were obtained online (Latitude and Longitude Finder, 2021). The reference coordinate system is the World Geodetic System (WGS84). Demographic and socio-economic data were obtained from the American Community Survey's 2019 census estimates and the 2010 U.S. Census Bureau (U.S. Census Bureau, 2019; Social Explorer, 2020). Local jurisdictional capacity was measured on a scale of 0-4 to indicate

the presence of a certified planner, certified floodplain manager, professional engineer, or landscape architect on staff. Capacity data was obtained by contacting government offices.

Table 3. Node Attributes and Variables.

Case Type	Numeric Attributes	Categorical Attributes
Organization	GEOID/FIPS code, total population, population density, land area (sq mi), median household income (USD), capacity	Organization type, government level, parish, municipality, NGO type, NPO, professional services type, urban area, urban cluster, population urban and rural (%), land area urban and rural (% sq mi), geographic coordinates (lat long)
Plan	GEOID/FIPS code, total population, population density, land area (sq mi), median household income (USD), capacity	Plan type, government level, parish, municipality, plan year, federal plan, state plan, regional plan, geographic coordinates (lat long)

Fourth, the relational network was exported as Excel spreadsheets and separated into the *Actor-Plan Coordination Network* and the *Network of Plans*. Each spreadsheet has two sheets – *nodes* and *ties*. The nodes sheet contains each case in the network and its node attributes or variables. The ties sheet contains each relationship and any tie or *edge* attributes, such as whether or not the relationship is based on a watershed issue. The Actor-Plan Coordination Network is a two-mode network with several relationship types. It can be categorized by whether the organization participated in the plan development process or was only mentioned in the plan. The Network of Plans is a one-mode network with only two relationship types – direct or indirect reference (Bacău, Grădinaru, & Hersperger, 2020). A direct reference is where the plan is explicitly mentioned in the text of the document. An indirect reference is where the plan is only mentioned in a table or similar format.

Next, the R software was used for social network analysis (R Core Team, 2021). Separate *nodes* and *ties* data frames were created from each network spreadsheet. Three additional networks were created from the Actor-Plan Coordination Network from organizations that participated in plan development, were related to plans through watershed-based issues, and both. The R *igraph* package was then used to graph and measure the networks (Csardi & Nepusz, 2006). They were each converted into a one-mode network using the simple count of overlaps method that creates relationships between actors that had relationships to the same plan (Murphy & Knapp, 2018). The one-mode network was created as a graph for statistical analysis of actors. Degree centrality measures were then calculated for each organization and added as a node variable.

A one-way analysis of variance (ANOVA) model with an effects parameterization was run for the effect of the categorical predictors *organization type* and *government level* on degree centrality and betweenness centrality. The ANOVA model was chosen to identify if there are any differences in values between different organization types using the model formula:

$$yi = \alpha + \beta j \times xi + \epsilon i.$$

Organization type has five levels or groups – educational institution, government, NGO, professional service, and private business. *Government level* has five levels – federal, state, regional, parish, and municipal. Tukey's Honest Significant Differences (HSD) multiple comparisons of means test was then run to quantify differences between groups.

5. RESULTS

The overall hypothesis of the study asks whether the NAPE framework can be used to evaluate multi-jurisdictional watershed-based planning issues effectively. In order to answer questions related to multi-jurisdictional watershed governance, two of the strategic areas listed in the LWI's long-term resilience outcomes, *capability and capacity,* and *integrated planning*, served as the basis for establishing what theme of plan evaluation will be followed. First, *coordination, collaboration, and capabilities* evaluates federal, state, regional, and local coordination in the Region (Figure 11). A plan that has greater coordination on different levels of government can achieve more excellent capability and capacity to address flood risks. Capacity includes access to additional staff, support, data, and financial resources. This study addresses the current capability and capacity of the Region by assessing which levels of government are most involved in planning.

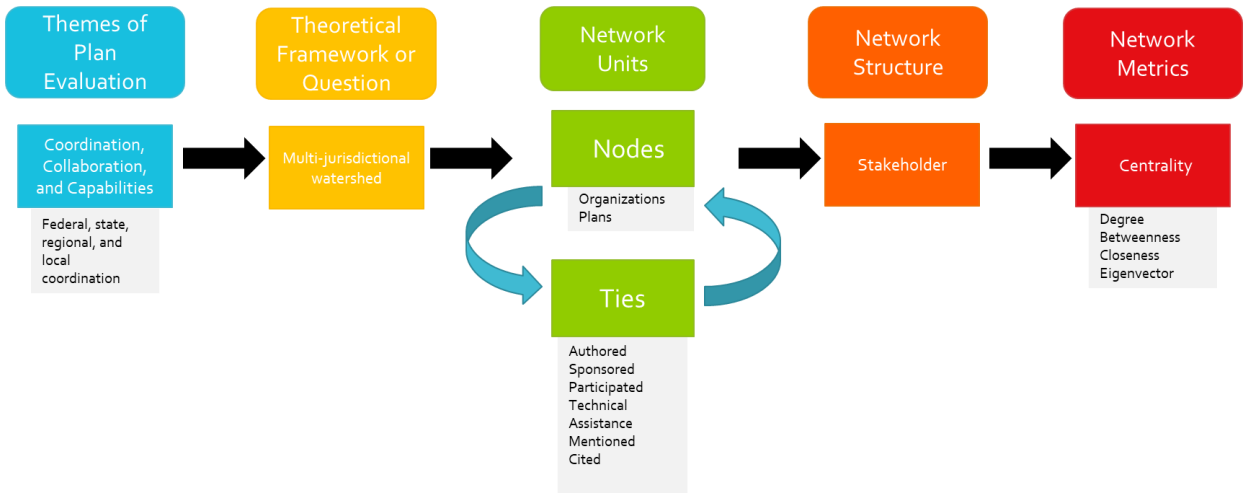

Figure 11. Using NAPE to Evaluate Multi-jurisdictional Watershed Governance under the Coordination, Collaboration, and Capabilities Principle.

Second, *participation* evaluates the organizational involvement in the Region (Figure 12). Each LWI Region must create its temporary governance structure to support regional watershed-based floodplain management (Louisiana Watershed Initiative, 2018). Regional planning efforts

can be best achieved by including various organizations and individuals to understand better the impacts of flooding and access more diverse information. This study addresses the current capability and capacity of the Region by also assessing which organization types are most involved in planning.

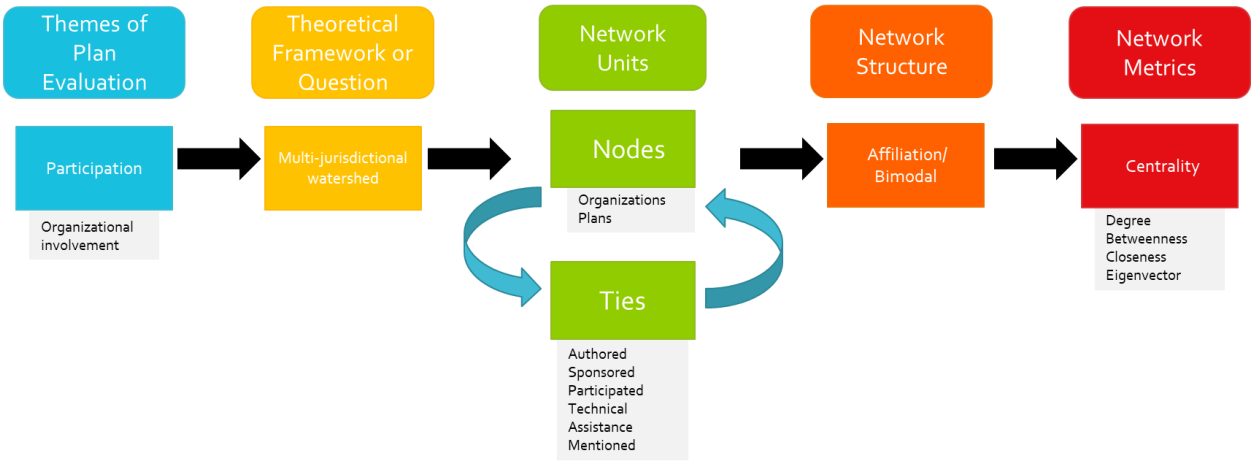

Figure 12. Using NAPE to Evaluate Multi-jurisdictional Watershed Governance under the Participation Principle.

5.1. Network Units

The Actor-Plan Network included relationships between plans and government, educational institutions, NGOs, professional services, and private businesses; relationships between plans and organizations that address watershed-based and flood hazard issues, policies, and programs. Over 300 government organizations were identified in the Actor-Plan Network, followed by 138 non-governmental organizations (NGOs) (Figure 13). Professional services, private businesses, and educational institutions had 65, 30, and 27 identified organizations. Government organizations consisted of 170 parish, 119 municipal, 35 state, 34 federal, and 15 regional. There were 110 main offices within the government organizations, 34 planning and development, 25 environmental, 25 public works, 20 public safety, 15 economic development, and 15 transportation departments. NGOs consisted of 42 philanthropic and charity, 21 community-

based, 15 environmental, 11 economic development, 9 religious and faith-based, 8 advocacy, 6 professional, 6 healthcare and public health, 4 public policy, 3 trade organizations, 2 educational organizations, and 1 service organization. Professional service consisted of 30 planning and development, 17 engineering, 7 environmental, and 6 architecture consultants. Only one consultant was identified for law, landscape, and marketing each.

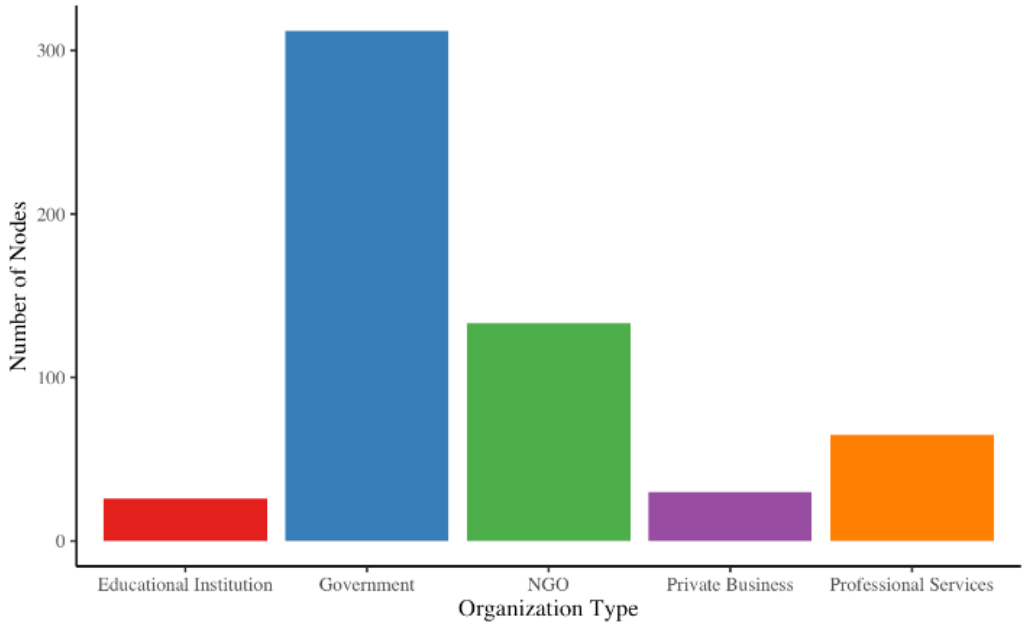

Figure 13. Count of Actor Nodes by Organization Type in the Actor-Plan Network.

The number of ties identified in the Actor-Plan Network was 1295, but only 589 of those ties participated in planning and development. Seven hundred eighty of the total number of ties were related to watershed issues. Most ties were between Parish organizations and parish plans, with the second greatest number being between NGOs and Parish plans, followed by municipalities and parish plans. Most local government organization ties between parishes and municipalities were with plans within the same jurisdiction with over 200 ties and about 100 ties outside of the plan jurisdiction (Figure 14).

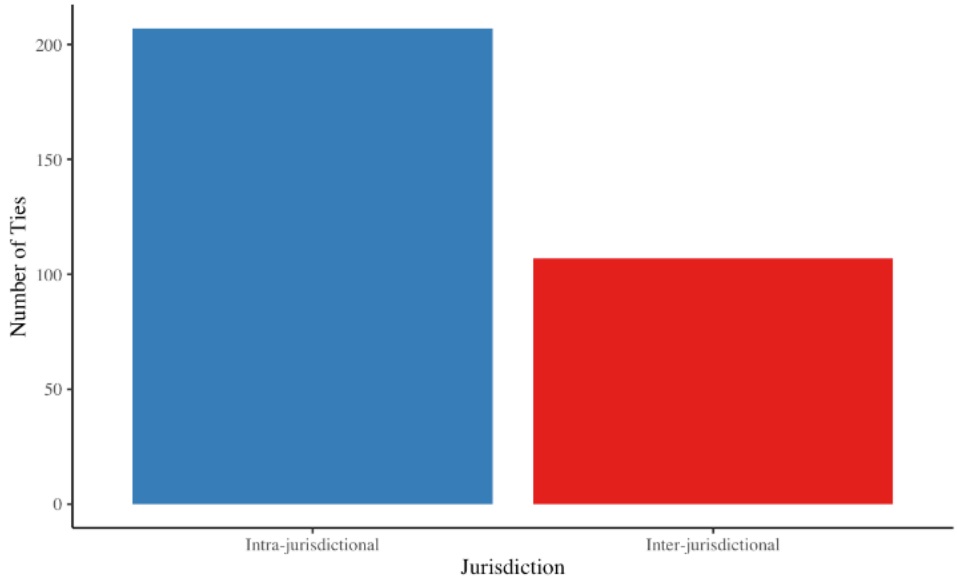

Figure 14. Count of Local Government Actor-Plan Ties by Jurisdiction.

The majority of ties in the Actor-Plan Network were between parish organizations and plans in the same jurisdiction, followed by parish organization and plan ties in different jurisdictions (Figure 15). There are fewer ties between municipal organizations and their plans than parish organizations and municipal plans in a different parish or extra-Parish. However, parish plans that were analyzed and parish organizations that were identified in the network far outnumber municipal plans and organizations.

The number of ties in the Network of Plans was 182. One hundred twenty-three of these ties were direct text references, and 131 ties were related to watershed issues. The coded plans reference 48 CMPs, 34 HMPs, 24 SWMPs, 19 CZMPs, 23 TPs, 10 EDPs, 9 recovery plans, and 15 uncategorized (other) plans altogether. Other plans include small area plans for communities within parishes or municipalities. The majority of ties were between parish plans followed by municipal and parish plans. All but one local government level tie between parishes and municipalities was within the same jurisdiction (Figure 16).

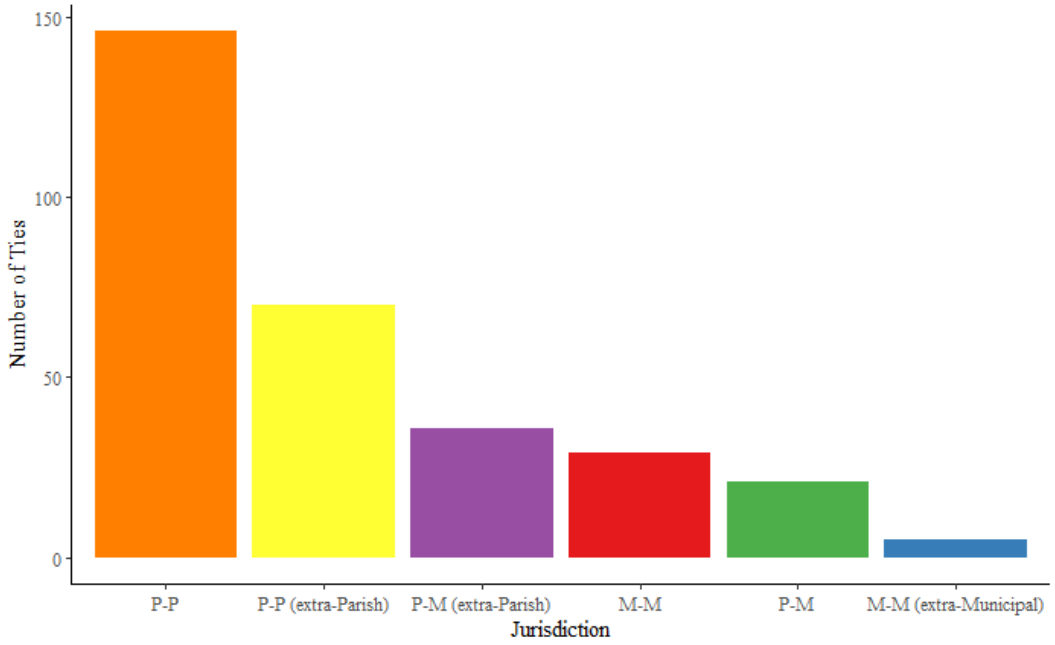

Figure 15. Count of Local Government Actor-Plan Ties by Jurisdiction and Parish or Municipality.
Note. P and M refer to Parish and Municipal. Extra-parish refers to parishes in different jurisdictions. Extra-municipal refers to different municipalities in the same parish. There were no ties between organizations and plans in different parishes and municipalities.

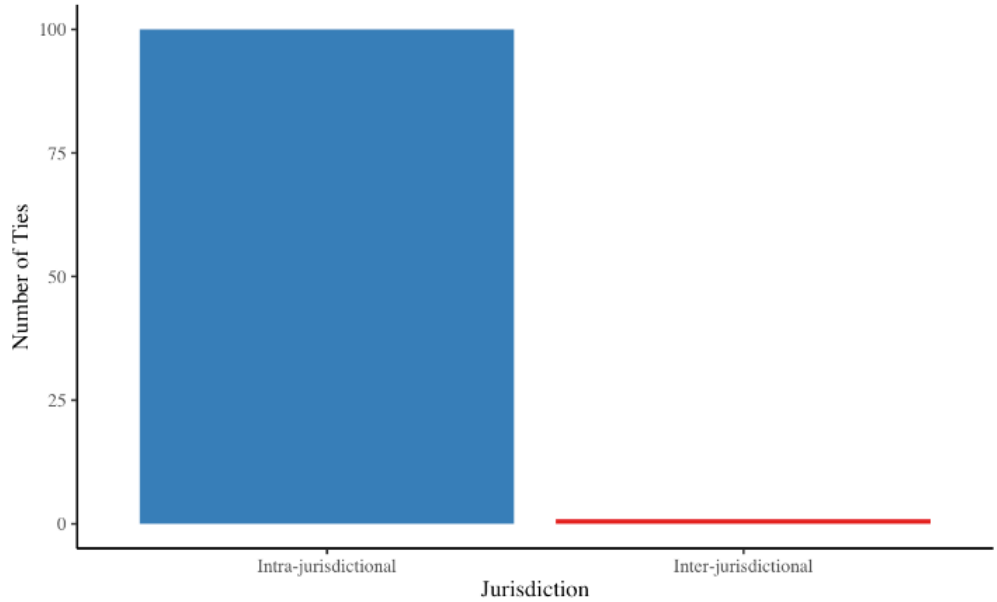

Figure 16. Count of Local Government Plan-Plan Ties by Jurisdiction.

The majority of Plan Network ties were between plans in the same parish (Figure 17). Ties between parish plans outnumber those between parishes and municipalities and municipal plans

within the same municipality. There were no ties between municipal plans that are in a different municipality.

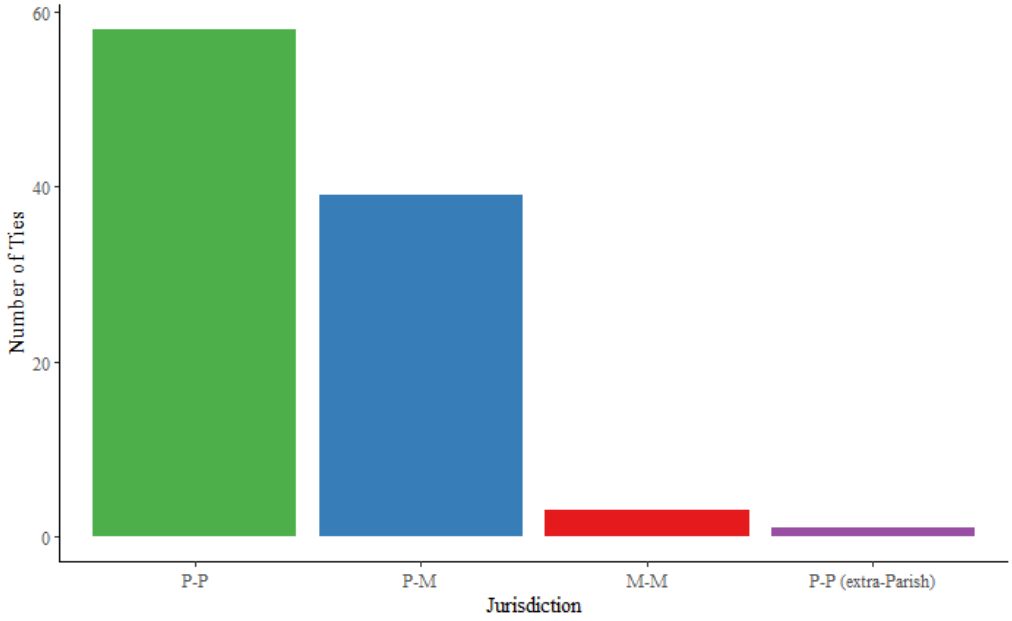

Figure 17. Count of Local Government Plan-Plan Ties by Jurisdiction and Parish and Municipality.

Additionally, 112 Region 7 jurisdictional plans were identified in the Plan Network whose documents were not found through the study's collection process. The parishes' hazard mitigation plan mainly identified these plans in a Planning and Regulatory Capability Assessment table. The existing plans were reviewed once more to determine if the unavailable plan was a section or element of one of these plans. A total of 21 plans were identified as a section or element in an analyzed plan. An additional nine were stated as being in development. The existing plan in the network replaced those plans that were a section in an existing plan. All other unavailable plans were listed as an indirect reference. An additional node variable was created to identify whether a plan was available or not.

5.2.Network Structure

The Actor-Plan Coordination Network revealed a densely connected network between organizations and plans (Figure 18). Federal, state, and regional entities are connected in the center of the network. Municipalities are mostly found at the outermost edges of the network. Parishes are spread throughout the entirety of the network. Organization types that are not government are also more likely on the network's edge. Organizations closer to the center of the network may have more influence on the network, such as exchanging information and financial resources.

Removing the higher administrative levels (federal, state, and regional) from the network shows a disconnect between parishes and municipalities in different jurisdictions and gaps in the network (Figure 19). Local government parishes and municipalities are only connected by those in the same jurisdiction except for some parishes within the same metro area. Examples include the Baton Rouge metro area, which connects East Baton Rouge and Ascension Parish, and the New Orleans metro area, which connects Orleans, St. Charles, St. John the Baptist, St. Bernard, St. Tammany Parish, and Tangipahoa Parish. Some jurisdictions in the same metro area, such as East Baton Rouge and Ascension Parish, are connected locally. However, not all parishes in the same metro area or served by the same Metropolitan Planning Organization (MPO) are connected. Thus, the Region is poorly connected on a watershed level and needs greater collaboration between jurisdictions not in the same parish.

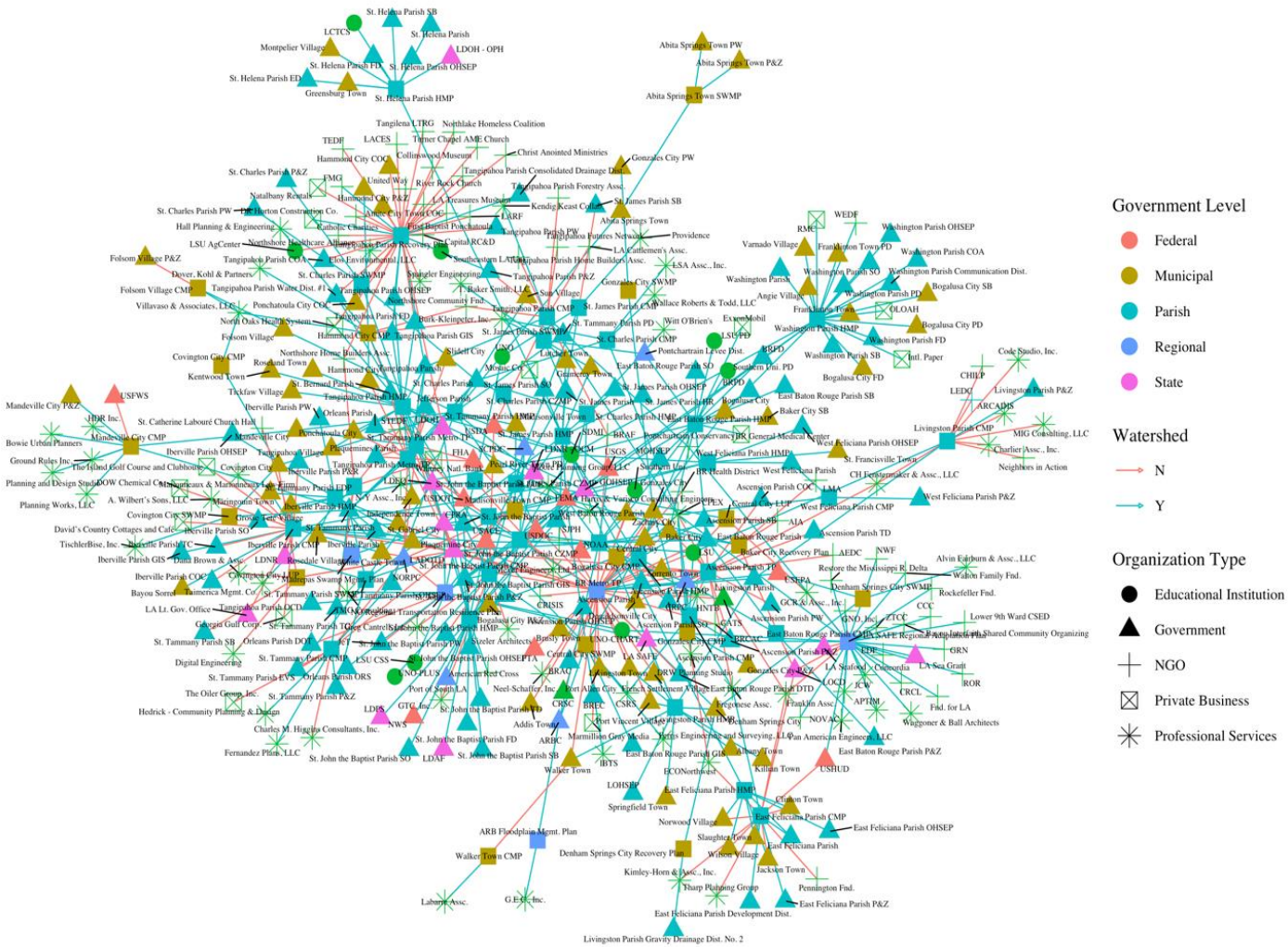

Figure 18. The Actor-Plan Coordination Network.

Note. The network does not include only mentioned organizations (i.e., did not explicitly participate) in a plan.

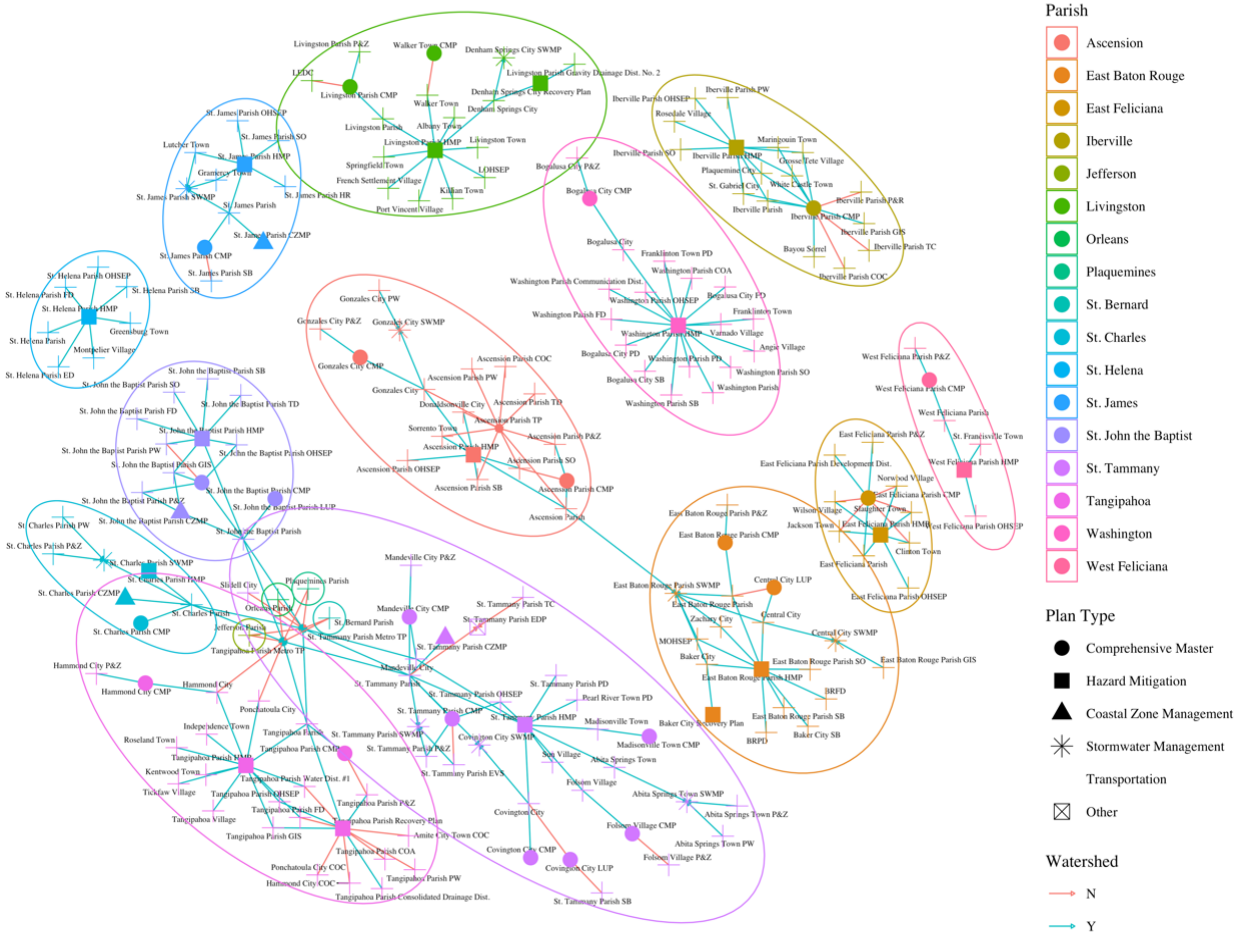

Figure 19. Actor-Plan Coordination Network at the Local Government Level.

Note. The network does not include organizations only mentioned in a plan that did not participate.

The Network of Plans revealed the Region 7 plans' numerous references and ties to state and regional plans. (Figure 20). Parish and municipal plans are more likely to reference federal, state, and regional plans than local government plans in different parishes or jurisdictions. References were also made to plans outside of Region 7, including the parishes of Jefferson, Plaquemines, and Orleans. However, these references were primarily made in transportation compared to other types of plans.

Filtering hazard mitigation and transportation plans from the Plan Network revealed an even more significant gap in regional planning (Figure 21). Removing these plan types that are a primary effort between federal and state organizations and local jurisdictions shows a disconnect between local jurisdictional planning. Additionally, state plans are absent from the filtered Plan Network.

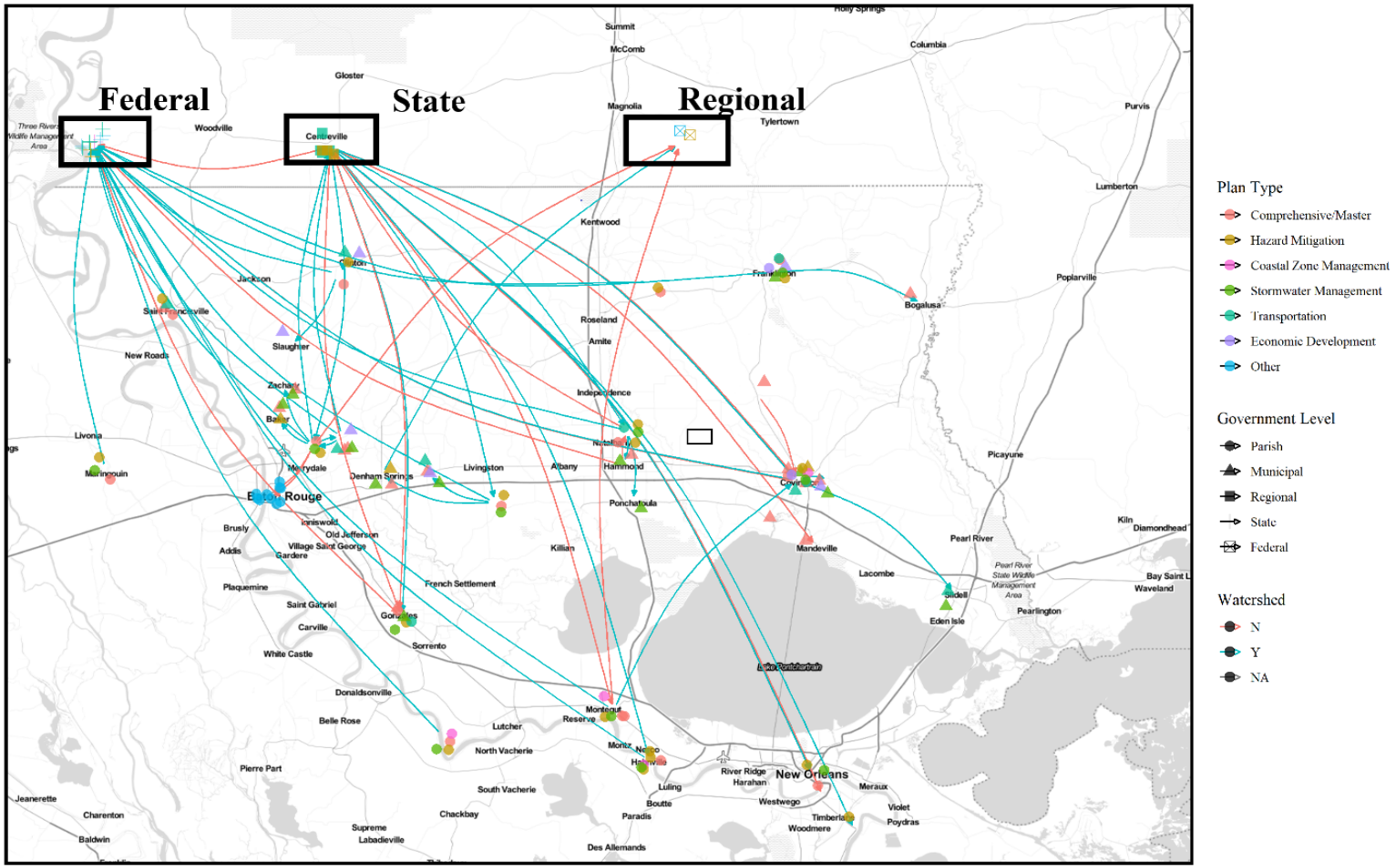

Figure 20. Geo-spatial Network of Plans in LWI Region 7.

Note. State, regional, and federal plans were placed in western Mississippi from east to west, respectively.

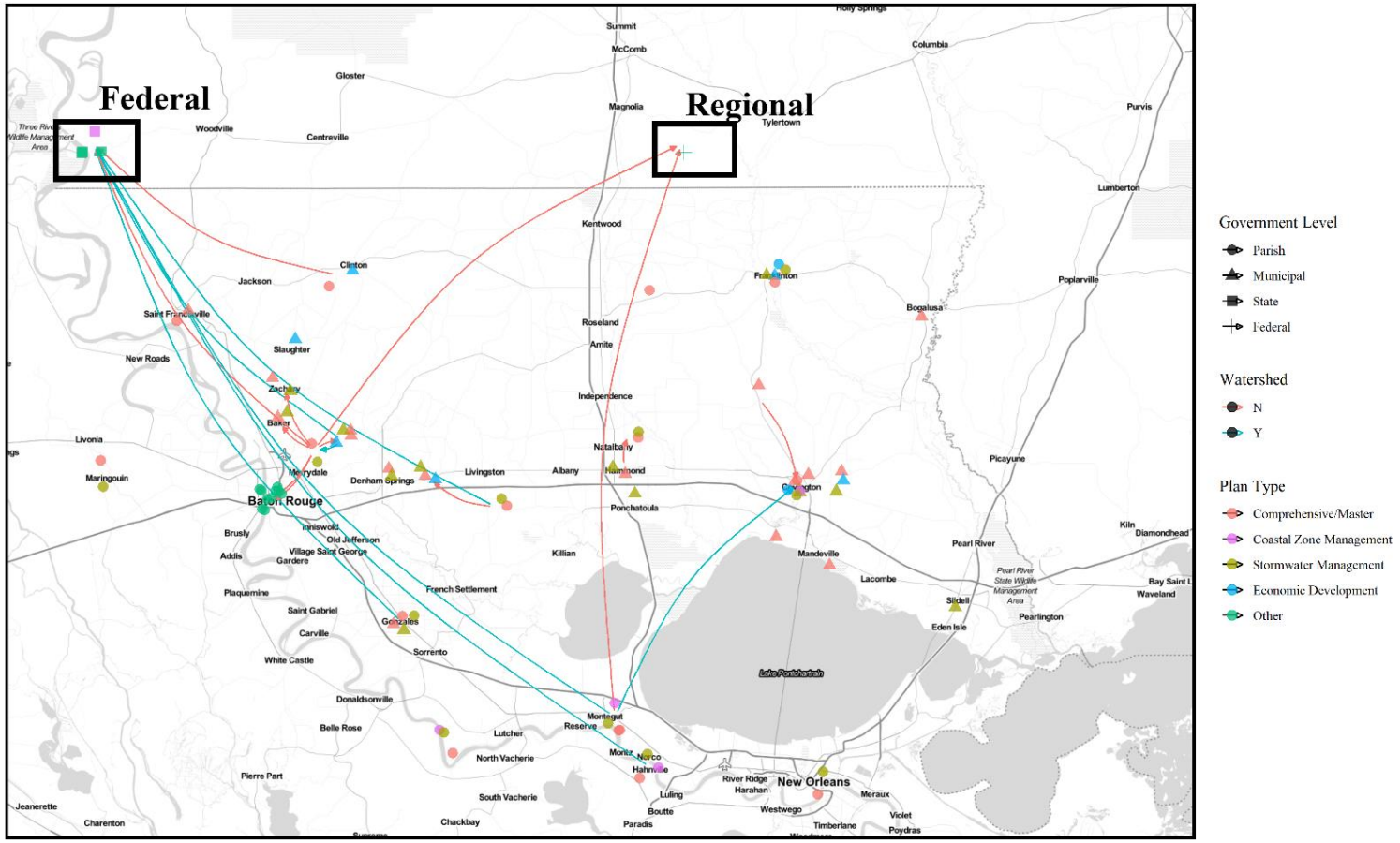

Figure 21. Geo-spatial Network of Plans in LWI Region 7 Excluding Hazard Mitigation and Transportation Plan.

5.3. Centrality Measures by Organization Type

Centrality measures can determine an organization's level of involvement in the Region and are influenced by an organization's position in the network (Borgatti, Everett, & Johnson, 2018). All organizations that were identified in the Actor-Plan Coordination Network were measured, and centrality measures were compared by organization type and government level (Appendix C). The organizations with the highest two-mode degree centrality value in the participated network were the Louisiana Department of Transportation (LADOTD), FEMA, the Stephenson Disaster Management Institute (SDMI), United States Army Corps of Engineers (USACE), and the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP). The organizations with the highest betweenness centrality value in the participated network were SDMI, LADOTD, GOHSEP, FEMA, and the Center for Planning Excellence (CPEX). Closeness and eigenvector centrality measures were similar for all organizations.

Government had the greatest average two-mode degree centrality value followed closely by educational institutions (Table 5). However, educational institutions had a higher average one-mode degree centrality value. Two-mode degree centrality indicates that government had an average greater number of ties to plans than other organizations, and the average number of ties a government entity had to a plan was three. One-mode degree centrality indicates that educational institutions had a greater average number of ties to organizations with the same plan, and the average number of ties was 111. Thus, government and educational institutions were more likely to be involved or mentioned in planning documents than other organizations.

Educational institutions had the greatest average betweenness and eigenvector centrality. Its average betweenness value of 759 means that, on average, an educational institution falls along the shortest path between two other nodes that many times (Table 5). Organizations with a high

betweenness centrality value are more likely to share information between two nodes that would otherwise not be connected (Borgatti, Everett, & Johnson, 2018). Eigenvector centrality is a variation of degree centrality in which more weight is given to nodes that are connected to other nodes with a high degree of centrality (Borgatti, Everett, & Johnson, 2018). Thus, educational institutions are more likely to bridge gaps between organizations or jurisdictions and are better connected to network nodes than other organization types.

Table 5. Average Centrality Measures by Organization Type in the Actor-Plan Coordination Network.

Organization Type	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Educational Institution	2.6923	111.3077	759.5952	0.0009	0.1429
Government	3.0066	91.1016	404.0914	0.0009	0.1385
NGO	1.2571	78.8071	59.3630	0.0009	0.0771
Private Business	1.0667	65.9333	39.3833	0.0009	0.0668
Professional Services	1.5385	45.2769	86.6481	0.0008	0.0599

A plot of two-mode degree centrality by organization type shows possible differences between the groups (Figure 22). From ANOVA results, higher F-statistic values indicate higher means variability between groups or the between-group variance is much larger than the within-group variance. An ANOVA model of the effect of organization type on two-mode degree centrality was used to test the following hypothesis:

H_0: The mean two-mode degree centrality values of organization types are equal.

H_A: The mean two-mode degree centrality values of organization types are not equal.

The ANOVA model of the effect of organization type on two-mode degree centrality had an F-statistic value of 73.94 and a significant p-value of less than 0.05. Therefore, we can assume that at least one of the groups differs from another. The output from the Tukey HSD test resulted in no-confidence interval overlaps of 0 between pairwise comparisons. Based on a p-value less

than 0.05, three pairwise comparison groups differ from government – NGO, professional services, and private business.

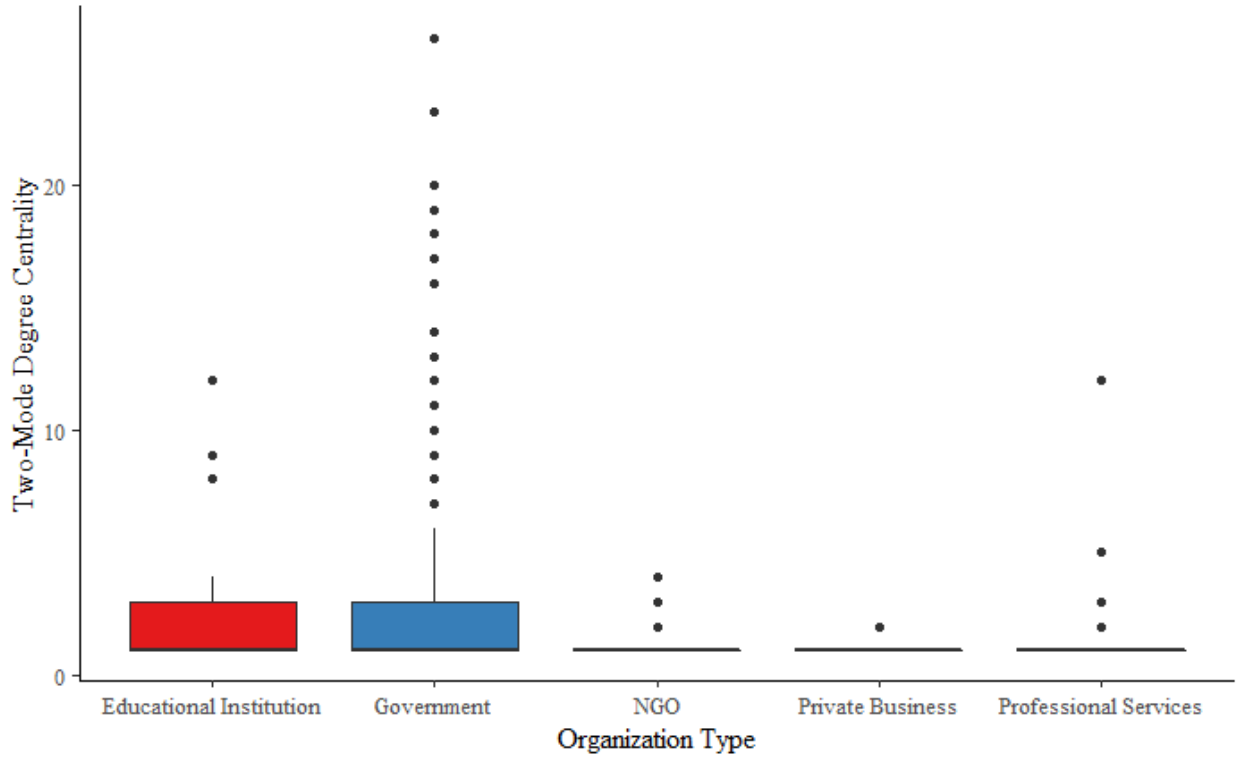

Figure 22. Two-mode Degree Centrality by Organization Type in the Actor-Plan Coordination Network.

Government had the greatest overall one-mode degree centrality value or the highest number of ties in every Actor-Coordination Network compared to other organizations (Figure 23). NGOs followed with the second greatest overall value in every network, even though they did not have the second greatest average value (Table 5). NGO's have more ties in the network compared to educational institutions, but there were significantly more NGOs identified than educational institutions.

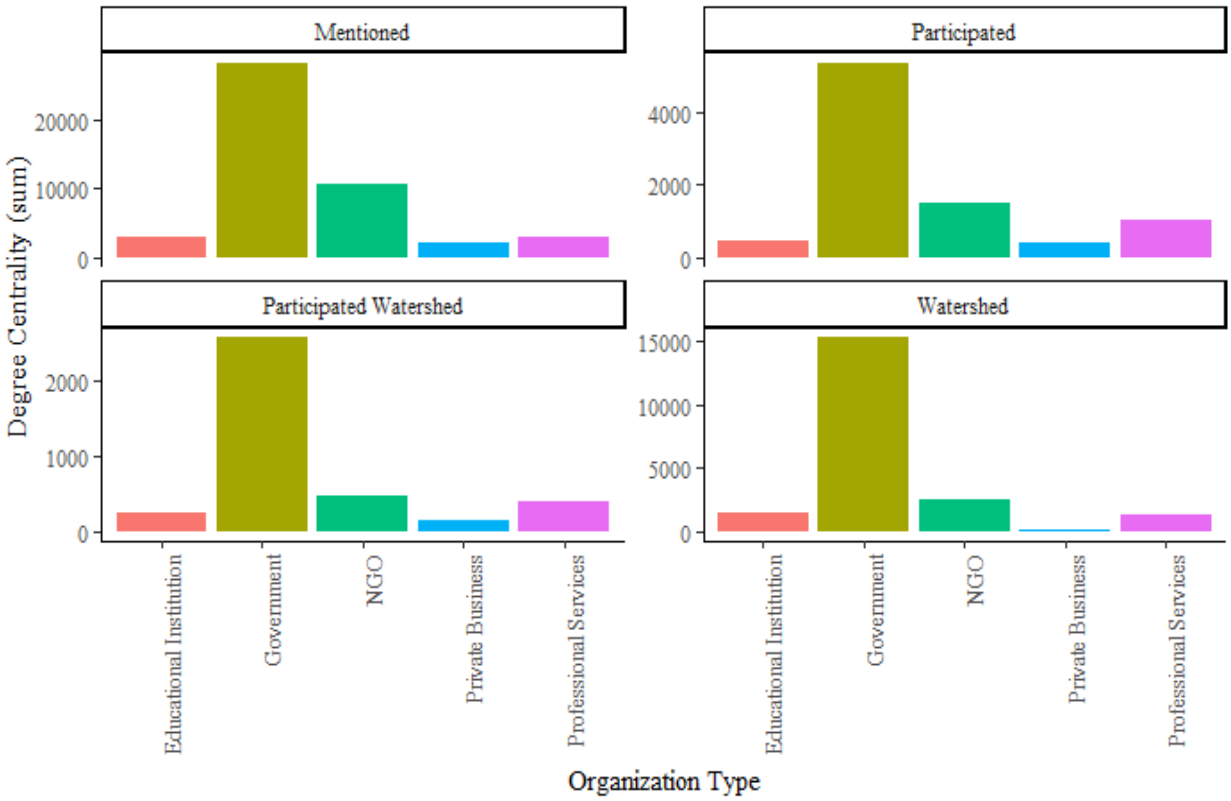

Figure 23. Sum of One-mode Degree Centrality Measures by Organization Type in the Two-mode Actor Coordination Networks.

A plot of one-mode degree centrality by organization type shows possible differences between the groups (Figure 24). An ANOVA model of the effect of organization type on one-mode degree centrality was used to test the following hypothesis:

H_0: The mean one-mode degree centrality values of organization types are equal.

H_A: The mean one-mode degree centrality values of organization types are not equal.

The ANOVA model of the effect of organization type on one-mode degree centrality had an F-statistic value of 118.6 and a significant p-value of less than 0.05. Therefore, we can assume that at least one of the groups differs from another. The output from the Tukey HSD test resulted in no-confidence interval overlaps of 0 between pairwise comparisons. Based on a p-value less than 0.05, government and professional services differ from one another. Therefore, government

has significant two-mode and one-mode degree centrality values compared to professional services.

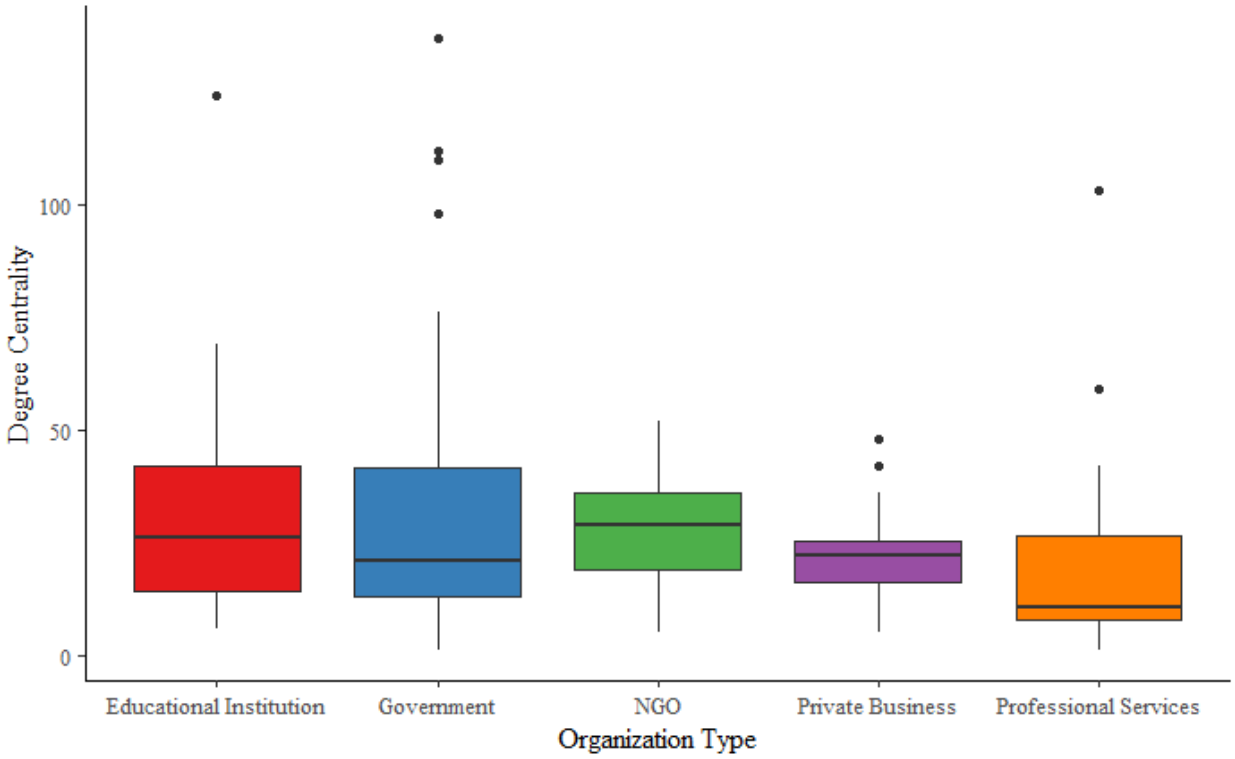

Figure 24. One-mode Degree Centrality by Organization Type.

A plot of betweenness centrality by organization type shows possible differences between the groups (Figure 25). An ANOVA model of the effect of organization type on betweenness centrality was used to test the following hypothesis:

H_0: The mean betweenness centrality values of organization types are equal.

H_A: The mean betweenness centrality values of organization types are not equal.

The ANOVA model of the effect of organization type on betweenness centrality had an F-statistic value of 8.95 and a significant p-value of less than 0.05. Therefore, we can assume that at least one of the groups differs from another. The output from the Tukey HSD test resulted in no-confidence interval overlaps of 0 between pairwise comparisons. Based on a p-value less than 0.05, educational institution differs from NGO and professional services.

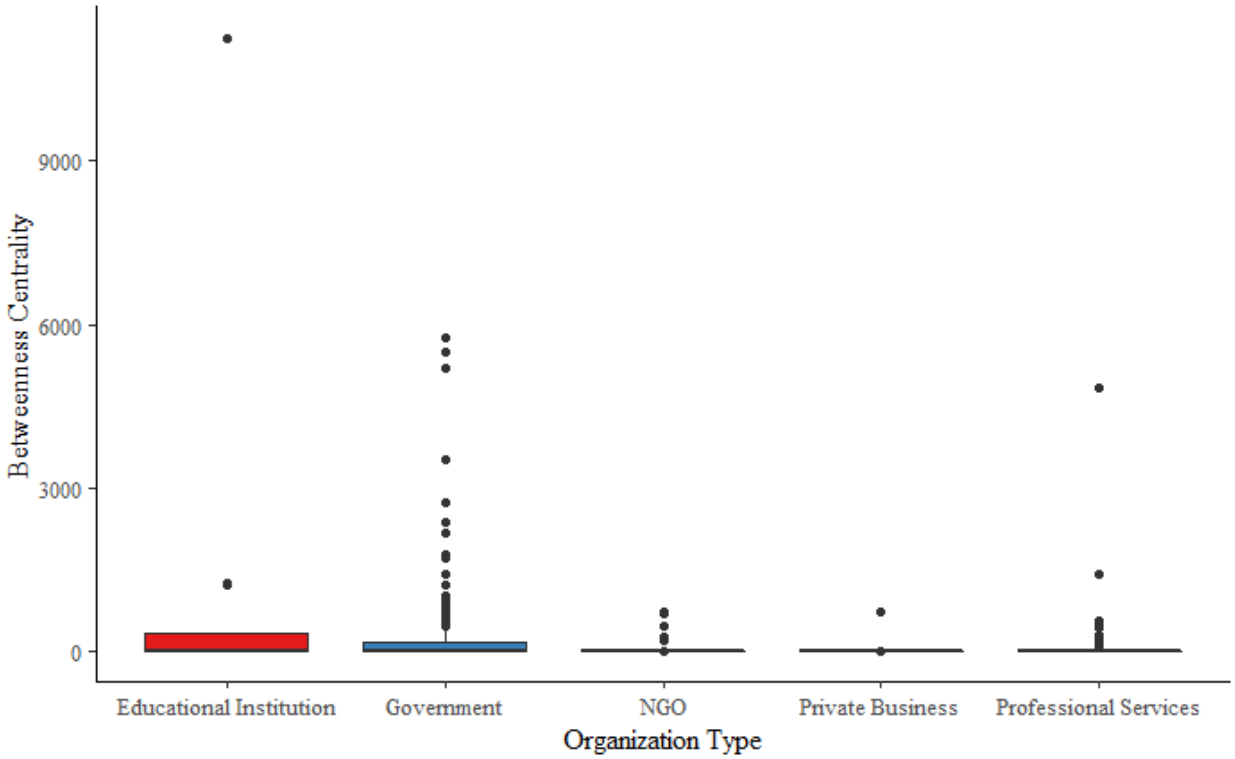

Figure 25. Betweenness Centrality by Organization Type in the Actor-Plan Coordination Network.

5.4. Centrality Measures by Government Level

Federal government had the greatest average degree centrality measures overall (Table 6). Regional and state government follows second or third in all other centrality measures. We can conclude that the federal government was mentioned more often in plans than other government levels, but this does not necessarily mean that they had a greater level of participation. Scientific data, maps, and figures obtained from federal documents and websites were often cited in plans, especially hazard mitigation plans.

Table 6. Average Centrality Measures by Government Level in the Actor-Plan Coordination Network.

Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Federal	5.1429	172.9714	1139.7898	0.0010	0.2776
Municipal	2.2857	73.1327	218.0829	0.0008	0.1018
Parish	2.5391	68.2109	238.5800	0.0008	0.1039
State	4.2647	134.7353	809.2840	0.0009	0.2110
Regional	5.1429	133.4286	514.9056	0.0009	0.2305

Planning departments had the greatest average degree and eigenvector centrality, and public safety departments had the greatest average betweenness centrality (Figure 26). Closeness centrality values among organization types have slight variance due to the disconnect between organizations in the two-mode network.

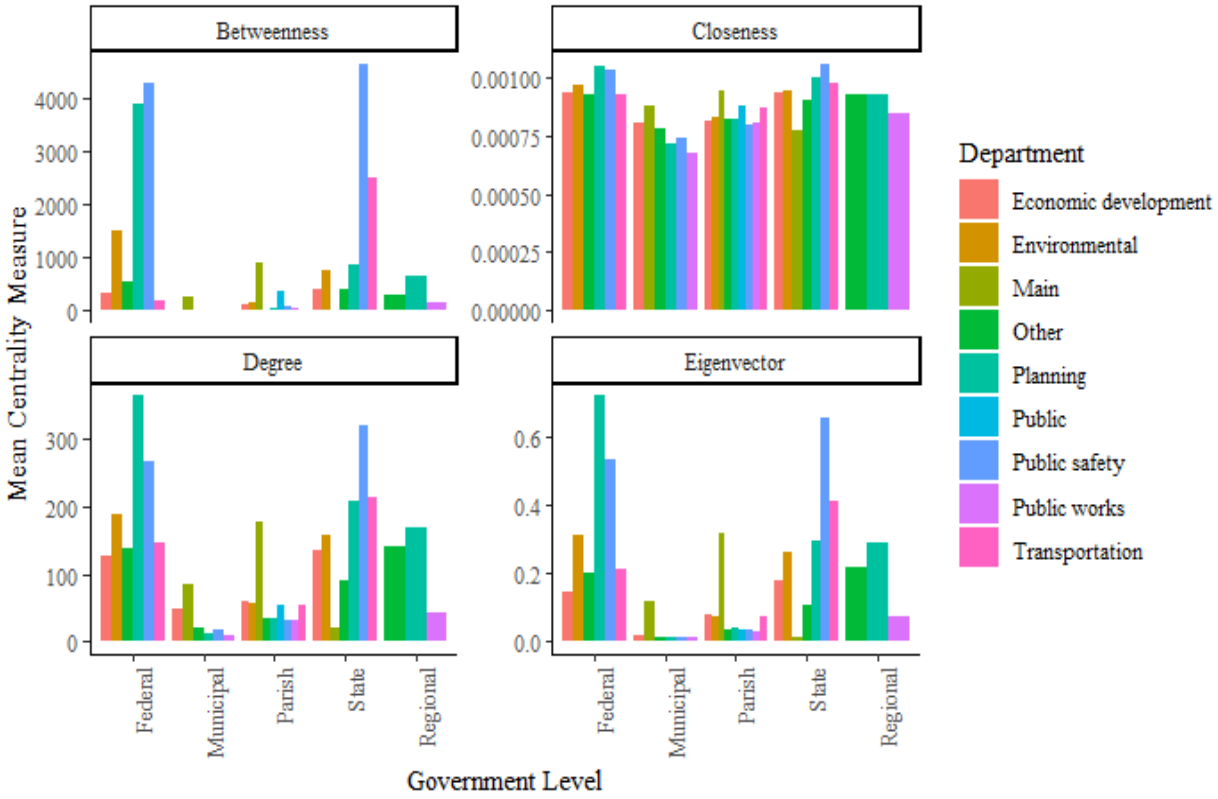

Figure 26. Mean Degree Centrality Measures by Government Level and Department in the Actor-Plan Coordination Network.

A plot of two-mode degree centrality by government level shows possible differences between the groups (Figure 27). An ANOVA model of the effect of government level on two-mode degree centrality was used to test the following hypothesis:

H0: The mean two-mode degree centrality values of government level are equal.

HA: The mean two-mode degree centrality values of government level are not equal.

The ANOVA model of the effect of organization type on two-mode degree centrality had an F-statistic value of 41.84 and a significant p-value of less than 0.05. Therefore, we can assume that at least one of the groups differs from another. The output from the Tukey HSD test resulted in no-confidence interval overlaps of 0 between pairwise comparisons. Based on a p-value less than 0.05, federal differs from parish and municipal organizations.

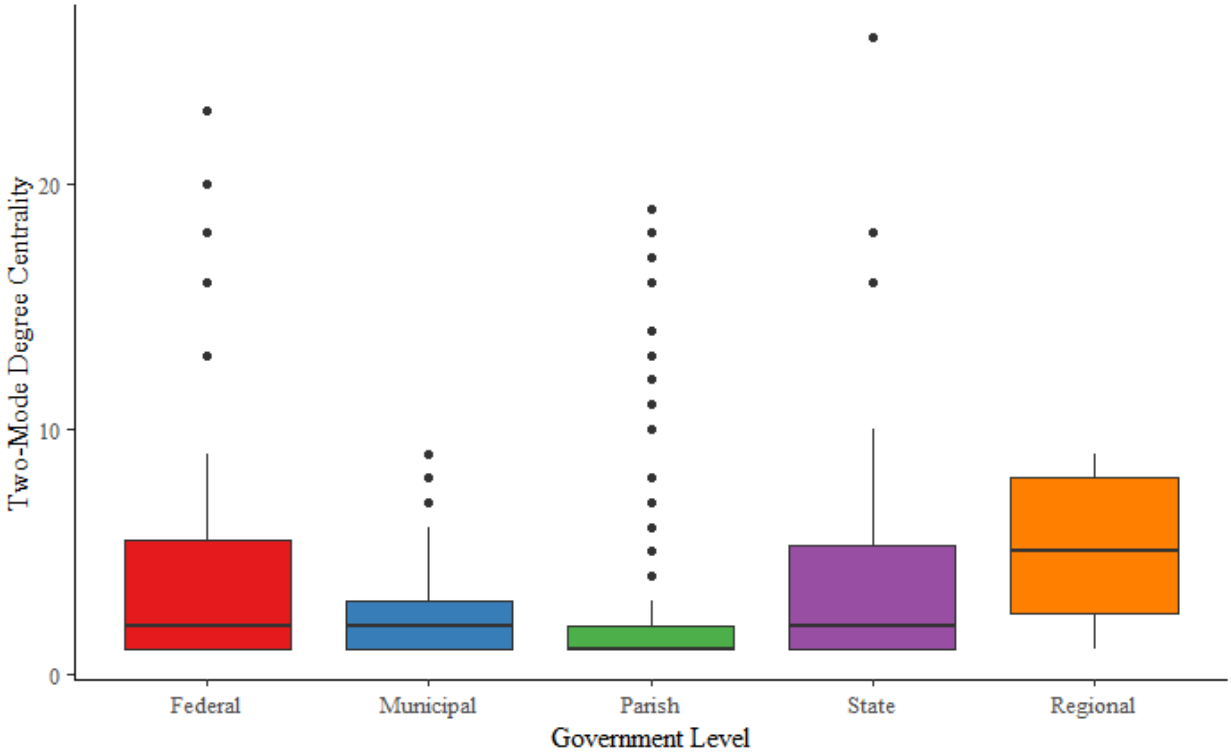

Figure 27. Two-mode Degree Centrality by Government Level in the Actor-Plan Coordination Network.

A plot of one-mode degree centrality by government level shows possible differences between the groups (Figure 28). An ANOVA model of the effect of government level on one-mode degree centrality was used to test the following hypothesis:

H0: The mean one-mode degree centrality values of government level are equal.

HA: The mean one-mode degree centrality values of government level are not equal.

The ANOVA model of the effect of organization type on two-mode degree centrality had an F-statistic value of 67.08 and a significant p-value of less than 0.05. Therefore, we can assume that at least one of the groups differs from another. The output from the Tukey HSD test resulted in no-confidence interval overlaps of 0 between pairwise comparisons. Based on a p-value less than 0.05, state and parish organizations differ from one another.

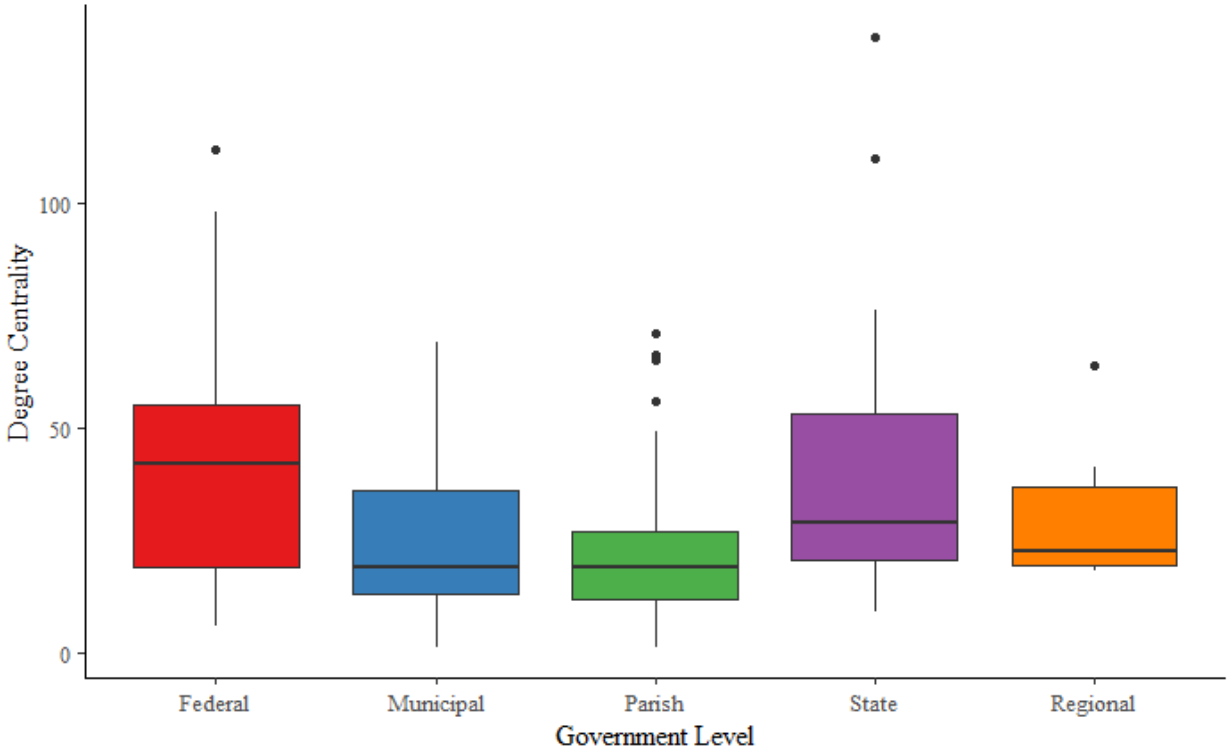

Figure 28. One-mode Degree Centrality by Government Level in the Actor-Plan Coordination Network.

A plot of betweenness centrality by government level shows possible differences between the groups (Figure 29). An ANOVA model of the effect of government level on betweenness centrality was used to test the following hypothesis:

H0: The mean betweenness centrality values of government level are equal.

HA: The mean betweenness centrality values of government level are not equal.

The ANOVA model of the effect of government level on betweenness centrality had an F-statistic value of 13 and a significant p-value that is less than 0.05. Therefore, we can assume that at least one of the groups differs from another. The output from the Tukey HSD test resulted in no-confidence interval overlaps of 0 between pairwise comparisons. Based on a p-value less than 0.05, state differs from parish and municipal organizations.

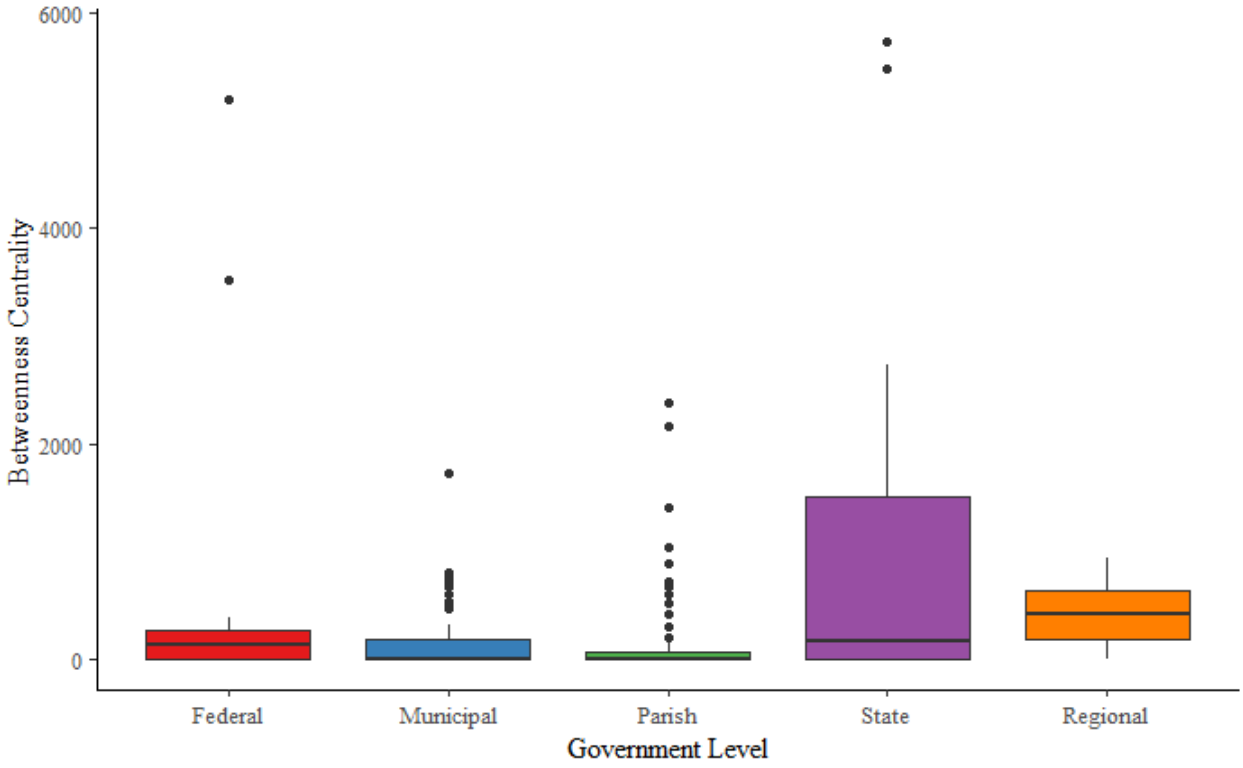

Figure 29. Betweenness Centrality by Government Level in the Actor-Plan Coordination Network.

In addition to government organizations, the LWI identified water management entities in each LWI Region that are stakeholders and authorities in the state's watershed management. Entities include districts with statutory powers such as gravity drainage, levee, and planning districts (Figure 30). The Actor-Plan Network identified which of these districts were mentioned or involved in Region 7 plans.

REGION 7 WATER MANAGEMENT ENTITIES

In addition to the parishes and municipalities in Region 7, the table below contains a comprehensive list of the 40 other local and regional entities with water management functions.

Region 7 entities with water management authority

Coastal zone management

- St. Tammany Parish Coastal Zone Management Program
- St. James Parish Coastal Zone Management Program

Gravity Drainage Districts

- Ascension Parish, East Ascension Gravity Drainage District No. 1
- Livingston Parish, Gravity Drainage District No. 1
- Livingston Parish, Gravity Drainage District No. 2
- Livingston Parish, Gravity Drainage District No. 5
- Livingston Parish, Gravity Drainage District No. 6
- Livingston Parish, Gravity Drainage District No. 7
- St. Charles Parish, Gravity Drainage District No. 2
- St. Tammany Parish, Gravity Drainage District No. 3
- St. Tammany Parish, Gravity Drainage District No. 4
- St. Tammany Parish, Gravity Drainage District No. 5
- St. Tammany Parish, Gravity Drainage District No. 5, Sub-Drainage District No. 1
- St. Tammany Parish, Gravity Drainage District No. 5, Sub-Drainage District No. 2
- St. Tammany Parish, Gravity Drainage District No. 5, Sub-Drainage District No. 3
- St. Tammany Parish, Gravity Drainage District No. 5, Sub-Drainage District No. 4
- St. Tammany Parish, Gravity Drainage District No. 5, Sub-Drainage District No. 5
- St. Tammany Parish, Gravity Drainage District No. 6
- Tangipahoa Parish, Gravity Drainage District No. 4
- Tangipahoa Parish, Gravity Drainage District No. 5
- Tangipahoa Parish, Consolidated Gravity Drainage District No. 1

Levee districts

- Atchafalaya Basin Levee District
- Lafourche Basin Levee District
- Pontchartrain Levee District
- Southeast Louisiana Flood Protection Authority-East
- Tangipahoa Levee District
- St. Tammany Levee, Drainage and Conservation District

Planning and development districts

- District 1: New Orleans Regional Planning Commission
- District 2: Capital Region Planning Commission
- District 3: South Central Planning & Development Commission

Recreation and water conservation districts

- Amite River Basin Commission, Amite River Basin Drainage and Water Conservation District
- Capital Area Ground Water Conservation Commission
- Greater Baton Rouge Water Conservation District

Soil and water conservation districts

- Crescent Soil and Water Conservation District
- Lower Delta Soil and Water Conservation District
- New River Soil and Water Conservation District
- Bogue Chitto-Pearl River Soil and Water Conservation District
- Capital Soil and Water Conservation District
- Feliciana Soil and Water Conservation District
- Tangipahoa-St. Helena Soil and Water Conservation District

Navigation and waterway special district

- Mississippi River Deepening Project

Figure 30. LWI Region 7 Water Management Entities.

Note. This figure is a composite of a table covering multiple pages in "Regional Watershed Management" a briefing book for LWI regional steering committees that describes roles and authorities of key watershed management bodies chartered under Louisiana law. Water management entities are the region's organizational stakeholders with statutory powers (Louisiana Watershed Initiative, 2020).

However, only 23 of the nearly 40 entities listed in the guidebook were identified in the network (Table 7). The districts had low centrality values overall and rarely participated in a plan. Planning and Development districts were most involved compared to other types, followed by Levee districts. Gravity Drainage districts play an important role in localized project development and development permitting, yet our sample of 64 plans only documents their participation formally in one planning process, the *Tangipahoa Parish Recovery Plan* (2017), which also led to more unified drainage permitting in the parish. Comprehensive plans for Ascension Parish,

Livingston Parish, and St. Tammany Parish (3 out of 11) mention local drainage districts, and one hazard mitigation plan out of 13 mentions them.

The Pontchartrain Levee District was the only levee district to participate in a plan. Its plan participation included the East Baton Rouge Parish Hazard Mitigation Plan and the St. James Parish Stormwater Management Plan. The St. Tammany Levee District was mentioned in the St. Tammany Parish Comprehensive, Hazard Mitigation, and Coastal Zone Management Plan (Table 7).

Besides the levee districts, there is only one body in Region 7 that could be classified as having a multi-jurisdictional watershed management mandate, the Amite River Basin Commission. They authored the Amite River Basin Floodplain Management Plan, and provided technical assistance to the Central City and East Baton Rouge Parish Stormwater Plans. Besides the La Safe Regional Adaption Plan, where they are mentioned, no other documents from jurisdictions within the Amite River Basin mention them. The ARBC Floodplain Management Plan mentions Hazard Mitigation Plans from Ascension Parish, EBR Parish, and Livingston Parish, but no other planning documents. However, they do make reference to the majority of jurisdictions within their watershed area, as well as several state agencies on the Watershed Council, and important federal partners such as and FEMA, EPA, USACE, and USGS. Notably, the ARBC plan does not mention gravity drainage districts in Ascension or Livingston Parish, following the trend for these bodies to appear sparsely in official planning documents in our sample.

Table 7. LWI Region 7 Water Management Entities and their Centrality Measures.

Node	District Type	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Washington Parish Communication Dist.	Communication	1.00	25.00	0.26	0.00	0.02
East Feliciana Parish Development Dist.	Economic Development	1.00	19.00	2.86	0.00	0.02
Livingston Parish Gravity Drainage Dist. No. 2	Gravity Drainage	2.00	73.00	240.85	0.00	0.08
Tangipahoa Parish Consolidated Drainage Dist.	Gravity Drainage	2.00	55.00	352.77	0.00	0.03
East Ascension Consolidated Gravity Drainage Dist.	Gravity Drainage	1.00	37.00	16.48	0.00	0.05
West Ascension Consolidated Gravity Drainage Dist.	Gravity Drainage	1.00	37.00	16.48	0.00	0.05
Livingston Parish Gravity Drainage Dist. No. 1	Gravity Drainage	1.00	23.00	2.18	0.00	0.02
Livingston Parish Gravity Drainage Dist. No. 5	Gravity Drainage	1.00	23.00	2.18	0.00	0.02
Livingston Parish Gravity Drainage Dist. No. 6	Gravity Drainage	1.00	23.00	2.18	0.00	0.02
Livingston Parish Gravity Drainage Dist. No. 7	Gravity Drainage	1.00	23.00	2.18	0.00	0.02
St. Tammany Parish, Gravity Drainage District No. 3	Gravity Drainage	1.00	13.00	5.20	0.00	0.01
St. Tammany Parish, Gravity Drainage District No. 4	Gravity Drainage	1.00	13.00	5.20	0.00	0.01
St. Tammany Parish, Gravity Drainage District No. 5	Gravity Drainage	1.00	13.00	5.20	0.00	0.01
Tangipahoa Parish Gravity Drainage Dist. No. 4	Gravity Drainage	1.00	38.00	0.84	0.00	0.01
Tangipahoa Parish Gravity Drainage Dist. No. 5	Gravity Drainage	1.00	38.00	0.84	0.00	0.01
Pontchartrain Levee Dist.	Levee	5.00	54.00	283.86	0.00	0.11
STLDCD	Levee	3.00	31.00	325.61	0.00	0.04
Lafourche Basin Levee Dist.	Levee	1.00	32.00	9.02	0.00	0.04
CRPC	Planning and Development	9.00	312.00	1930.65	0.00	0.54
SCPDC	Planning and Development	7.00	170.00	377.07	0.00	0.28
NORPC	Planning and Development	9.00	116.00	862.51	0.00	0.25
ARBC	Soil and Water Conservation	4.00	135.00	115.92	0.00	0.27
Tangipahoa Parish Water Dist. #1	Water	2.00	55.00	352.77	0.00	0.03

6. CONCLUSIONS AND DISCUSSION

Following the NAPE framework to evaluate the content of plans in LWI Region 7 can reveal the current level of multi-jurisdiction coordination and collaboration in the Region that can be used to guide future watershed governance structures. The NAPE framework effectively-identified planning issues in the Region by showing a lack of planning efforts between local jurisdictions. The Actor-Plan Coordination Network shows a densely connected region of organizations and plans that includes organizations and jurisdictions outside the Region. However, the Actor-Plan Coordination Network's structure suggests the need for much greater coordination between jurisdictions outside of their parish. In addition, local plans are unlikely to reference plans in other jurisdictions. Federal, state, and regional organizations are also more likely to participate in the coordination and development of plans than other local government organizations. In conclusion, Region 7 lacks integrated planning and coordination with other jurisdictions in the region and organization types that are not related to government.

The Region would benefit from a governance structure that increases organizational and public participation in the planning process and the integration of planning and coordination with other jurisdictions in the Region. Educational institutions are a possible candidate to bridge the exchange of information and planning across the Region because of their high betweenness centrality scores. SDMI, an educational institution, had one of the highest degree centrality values in the network and connected all but two of the HMPs in the Region to one another. A possible solution to the Region's disconnectedness is to propose a similar entity that participates in regional planning or a watershed-governance plan requiring all jurisdictions' participation. The network is already well-connected by watershed-based issues as identified by the network visualizations.

Overall, NAPE can prove helpful by answering initial questions to help guide the efforts of the LWI and determine its overall capacity for regional watershed governance. Relational data from the planning documents can identify what organizations and plans are connected in the Region. However, the NAPE framework is subjective and limited to the content included in plans. Planning documents are not likely to present the complete network of coordination in a Region, but plans can give valuable insight into current capacity and understanding the structure of networks. Interviews and surveys can be used in conjunction with NAPE to fill gaps and review the accuracy of relational data. The NAPE process is also time-consuming, but NVivo increases the efficiency of plan content analysis compared to other qualitative analysis methods.

Additionally, plan evaluation requires a team to review the reliability of each planning coder. Discrepancies can arise in what content should and should not be coded and which node content may fall into, but NVivo makes the coding process easily traceable. A study's network measures must also be applied appropriately. Finally, not all network measures are suited or meant to analyze all types of networks. The results from network measures can also be interpreted in numerous ways.

Further NAPE studies can go beyond organizational involvement by analyzing the consistency of the plans regarding their goals and objectives, policies and strategies, and available data. Inconsistences identified in plans can determine if regions are more vulnerable to natural hazards. The NAPE framework can also answer questions related to the other LWI strategic areas for long-term resilience outcomes and planning efforts. Furthermore, the NAPE framework can prove valuable for other planning efforts besides the LWI. Metropolitan planning organizations, planning and development departments, planning consultants and professionals, and administrative governments can utilize NAPE for various planning efforts on different scales.

Spatial plan evaluations can examine land-use policies in different areas of a jurisdiction that may conflict with each other or increase vulnerability to natural hazards (Malecha, Woodruff, & Berke, 2021). The evaluation can help guide the integration of policies and coordination in a region to reduce flood risks. Longitudinal or temporal plan evaluations explore how a plan network changes over time (Woodruff, et al., 2021). NAPE can be used to compare how a network of plans or actor-coordination changes over time or after significant events such as declared natural disasters. These evaluations can be applied at different administrative scales, and the NAPE process can be effectively used as a first step in improving planning efforts across regions and over time.

APPENDIX A. THE PLAN EVALUATION CODING PROTOCOL

Table 8. The Plan Evaluation Coding Protocol for Multi-jurisdictional Watershed Governance.

Principle	Sub-principle	Node
Goals and objectives	Coordination	Increase mitigation information availability
Goals and objectives	Coordination	Increase local coordination
Goals and objectives	Coordination	Increase regional coordination
Goals and objectives	Hazard loss	Improve stormwater management and drainage
Goals and objectives	Hazard loss	Protect public safety
Goals and objectives	Hazard loss	Reduce damage to property
Goals and objectives	Hazard loss	Reduce economic loss
Goals and objectives	Hazard loss	Reduce impacts on environment and natural areas
Goals and objectives	Hazard loss	Reduce social inequities
Goals and objectives	Overarching vision	Increase resiliency to natural hazards
Goals and objectives	Overarching vision	Promote sustainable development
Fact base	Federal and state policies and programs	FEMA flood mitigation assistance program identified
Fact base	Federal and state policies and programs	FEMA hazard mitigation assistance program identified
Fact base	Federal and state policies and programs	FEMA hazard mitigation grant program identified
Fact base	Federal and state policies and programs	FEMA pre-hazard mitigation program identified
Fact base	Federal and state policies and programs	FEMA public assistance program identified
Fact base	Federal and state policies and programs	Community development block grant program identified
Fact base	Federal and state policies and programs	National Flood Insurance Program participation
Fact base	Federal and state policies and programs	Community Rating System participation
Fact base	Federal and state policies and programs	Certified floodplain manager identified
Fact base	Hazards identification and risk assessment	Factors used in prioritizing hazards
Fact base	Hazards identification and risk assessment	Classification system for prioritizing hazards
Fact base	Hazards identification and risk assessment	Location and boundaries of hazardous areas for coastal storms
Fact base	Hazards identification and risk assessment	Magnitude and severity of coastal storms

(table cont'd.)

Principle	Sub-principle	Node
Fact base	Hazards identification and risk assessment	Likelihood and frequency of flood events
Fact base	Hazards identification and risk assessment	Location and boundaries of hazardous areas for flood hazards
Fact base	Hazards identification and risk assessment	Location and boundaries of Special Flood Hazard Areas (SFHA)
Fact base	Hazards identification and risk assessment	Separate characteristics of flood hazards
Fact base	Hazards identification and risk assessment	Information of previous flood events
Fact base	Hazards identification and risk assessment	Likelihood of coastal storms
Fact base	Hazards identification and risk assessment	Separate characteristics of coastal storms
Fact base	Hazards identification and risk assessment	Information of previous coastal storms
Fact base	Hazards identification and risk assessment	Climate change impacts
Fact base	Hazards identification and risk assessment	Coastal erosion impacts
Fact base	Hazards identification and risk assessment	Repetitive loss properties/structures
Fact base	Hazards identification and risk assessment	Repetitive loss properties/structures loss estimates
Fact base	Human ownership and problem identification	Public ownership patterns for floodplain mapped
	Human ownership and problem identification	Private ownership patterns for floodplain mapped
Fact base	Human ownership and problem identification	Management status identified for floodplain
Fact base	Human ownership and problem identification	Watershed network mapped
Fact base	Human ownership and problem identification	Rate of wetlands development

(table cont'd.)

Principle	Sub-principle	Node
Fact base	Human ownership and problem identification	Nutrient loading
Fact base	Human ownership and problem identification	Water pollution
Fact base	Resource inventory	Watershed boundaries/edges mapped
Fact base	Resource inventory	Watershed boundaries/edges described
Fact base	Resource inventory	Floodplain boundaries/edges mapped
Fact base	Resource inventory	Floodplain boundaries/edges described
Fact base	Resource inventory	Wetlands and riparian habitat mapped
Fact base	Resource inventory	Wetlands and riparian habitat described
Fact base	Resource inventory	Water resources mapped
Fact base	Resource inventory	Water resources described
Fact base	Resource inventory	Natural vegetation cover mapped
Fact base	Resource inventory	Climate described
Fact base	Resource inventory	Surface hydrology described
Fact base	Resource inventory	Subsurface hydrology described
Fact base	Vulnerability assessment	Vulnerable populations exposed to hazards identified
Fact base	Vulnerability assessment	State facilities exposed to hazards identified
Fact base	Vulnerability assessment	Critical facilities exposed to hazards identified
Fact base	Vulnerability assessment	Danger of hazardous facilities or hazardous materials identified
Fact base	Vulnerability assessment	Environmental impacts of a disaster described
Policies tools and strategies	Incentive tools	Density bonuses in exchange for wetland and riparian habitat protection
Policies tools and strategies	Incentive tools	Clustering away from wetland and riparian habitat
Policies tools and strategies	Incentive tools	Transfer of Development Rights away from wetland and riparian habitat
Policies tools and strategies	Incentive tools	Preferential tax treatments to protect wetland and riparian habitat
Policies tools and strategies	Incentive tools	Mitigation banking
Policies tools and strategies	Incentive tools	Tax abatement
Policies tools and strategies	Incentive tools	Land acquisition/buyout programs

(table cont'd.)

Principle	Sub-principle	Node
Policies tools and strategies	Preventative land use policies	Density of land use
Policies tools and strategies	Preventative land use policies	Density transfer provision
Policies tools and strategies	Preventative land use policies	Hazards included in land suitability analysis
Policies tools and strategies	Preventative land use policies	Setbacks or buffer zones
Policies tools and strategies	Preventative land use policies	Permitted land use
Policies tools and strategies	Preventative land use policies	Permit for floodplain development
Policies tools and strategies	Preventative land use policies	Floodplain regulation ordinance
Policies tools and strategies	Preventative land use policies	Subdivision ordinance
Policies tools and strategies	Preventative land use policies	Zoning ordinance
Policies tools and strategies	Preventative land use policies	Development moratorium
Policies tools and strategies	Preventative land use policies	Natural hazard specific ordinance
Policies tools and strategies	Property protection policies	Elevation of structures
Policies tools and strategies	Property protection policies	Building standards
Policies tools and strategies	Property protection policies	Freeboard requirement
Policies tools and strategies	Property protection policies	Adjust public infrastructure
Policies tools and strategies	Property protection policies	Retrofit existing public facilities
Policies tools and strategies	Property protection policies	Post-disaster capital improvements adjustments
Policies tools and strategies	Property protection policies	Building design change/considerations for flooding
Policies tools and strategies	Property protection policies	Stormwater and drainage controls
Policies tools and strategies	Property protection policies	Retrofitting of private structures
Policies tools and strategies	Property protection policies	Flood control structures
Policies tools and strategies	Public information policies	Encourage insurance purchase

(table cont'd.)

Principle	Sub-principle	Node
Policies tools and strategies	Public information policies	Post signs indicating hazardous areas
Policies tools and strategies	Public information policies	Tech assistance for developers\public
Policies tools and strategies	Public information policies	Voluntary real estate hazard disclosure
Policies tools and strategies	Public information policies	Mandatory real estate hazard disclosure
Policies tools and strategies	Public information policies	Special study\impact fees assessment
Policies tools and strategies	Public information policies	Site public facilities
Policies tools and strategies	Public information policies	Land use change identified
Policies tools and strategies	Public information policies	Emergency response capability
Policies tools and strategies	Public information policies	Emergency shelter identified
Policies tools and strategies	Public information policies	Evacuation route identified
Policies tools and strategies	Public information policies	Emergency plans identified
Policies tools and strategies	Regulatory tools	Restrictions on native vegetation removal
Policies tools and strategies	Regulatory tools	Controls on construction activities to protect wetland and riparian habitat
Policies tools and strategies	Regulatory tools	Conservation zones or overlay districts to protect wetland and riparian habitat
Policies tools and strategies	Regulatory tools	Creation of protected areas
Policies tools and strategies	Regulatory tools	Urban growth boundaries that do not include wetland and riparian habitat
Policies tools and strategies	Regulatory tools	Targeted growth areas away from wetland and riparian habitat
Policies tools and strategies	Regulatory tools	Capital Improvements Programming to protect wetland and riparian habitat
Policies tools and strategies	Regulatory tools	Site plan review to protect wetland and riparian habitat
Policies tools and strategies	Regulatory tools	Wetland and riparian habitat restoration actions
Policies tools and strategies	Regulatory tools	Actions to protect wetland and riparian habitat crossing into other jurisdictions

(table cont'd.)

Principle	Sub-principle	Node
Coordination, capabilities, and collaboration		Coordination with federal organizations
Coordination, capabilities, and collaboration		Coordination with state organizations
Coordination, capabilities, and collaboration		Coordination within county/parish
Coordination, capabilities, and collaboration		Coordination with local governments within watershed
Coordination, capabilities, and collaboration		Coordination with organizations to protect wetland and riparian habitat
Coordination, capabilities, and collaboration		Coordination with private sector
Coordination, capabilities, and collaboration		Links between science and policy organizations
Coordination, capabilities, and collaboration		Joint database production specified
Coordination, capabilities, and collaboration		Position of the local jurisdiction within the watershed specified
Coordination, capabilities, and collaboration		Integration with other plans/policies in the region specified
Coordination, capabilities, and collaboration		Conflict management processes outlined

(table cont'd.)

Principle	Sub-principle	Node
Coordination, capabilities, and collaboration		Commitment of financial resources specified
Implementation and monitoring		Clear designation of responsibility for implementation specified
Implementation and monitoring		Provision of technical assistance identified
Implementation and monitoring		Identification of costs or funding for implementation outlined
Implementation and monitoring		Clear timetable for implementation outlined
Implementation and monitoring		Regular updates and plan assessment specified
Implementation and monitoring		Enforcement of ordinances specified
Implementation and monitoring		Identification of obstacles faced in implementation
Implementation and monitoring		Monitoring specified for plan effectiveness
Implementation and monitoring		Monitoring specified for policy response to new scientific information
Implementation and monitoring		Tracking losses post-disaster events
Implementation and monitoring		Tracking use of post-disaster funds
Implementation and monitoring		Public involvement in updates/monitoring
Implementation and monitoring		Identifies parties to be involved in future updates/monitoring
Implementation and monitoring		Documents process to develop and update plan
Participation	Organizational involvement	Identifies organizations and individuals involved in plan development
Participation	Organizational involvement	Identifies why organizations and individuals were involved
Participation	Organizational involvement	Identifies which agencies and organizations provide data incorporated in plan
Participation	Organizational involvement	Identifies which agencies and organizations provide technical assistance in plan preparation

(table cont'd.)

Principle	Sub-principle	Node
Participation	Public engagement	Local citizens groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.
Participation	Public engagement	Natural disaster or safety related school program
Participation	Public engagement	Ongoing public education or information program
Participation	Public engagement	Public/private partnership initiatives addressing disaster-related issues
Participation	Public engagement	Citizen advisory committee
Participation	Public engagement	Information distribution (newsletter or brochures)
Participation	Public engagement	Open meetings/workshops
Participation	Public engagement	Public notice
Participation	Public engagement	Targeted outreach (focus groups, surveys, or questionnaires)
Participation	Public engagement	Website

APPENDIX B. PROTOCOL FOR EXTRACTING RELATIONAL DATA

1. Data Coding and Analysis of Documents in NVivo
    i. Project Preparation
        1. A project is created in **NVivo** titled "Parish Assessment."
        2. The documents collected are uploaded into NVivo. File classification is based on Parish/Municipality and type of planning document.
        3. Each document that is filed in NVivo will be coded in alphabetical order by Parish, followed by their municipalities in alphabetical order.
    ii. Plan Content Coding
        1. Identify text or data in the document that corresponds to a node in the *Plan Evaluation Coding Protocol* that was created in NVivo as a hierarchy of nodes.
        2. Code a sentence/paragraph/table/image/graph to the corresponding node listed in the *Plan Evaluation Protocol*. This will create a source to the reference of the node.
        3. Identify actors in the document and create a case node for each. Cases include social and ecological actors. (Note: The term "case" and "case node" can be used interchangeably.)
        4. Assign a **case attribute** to each case node.
2. Text Search Query in NVivo

i. A text search query in NVivo finds all occurrences of a word, phrase, or concept in selected files that results in a coding summary of references. Words and phrases can be searched individually or combined using Boolean operators such as “OR”, “AND”, and “NOT”. To specify the proximity of words from one another, use the tilde “~” followed by the number of words from each other (e.g., “hazard flood”~10).

ii. The results of the query can be created as a new code or case or merged into an existing code or case. This is especially useful for evaluation of plans using the Protocol. Words or phrases from each sub-principle in the Protocol can be searched for and merged to the corresponding code.

iii. Plan Content Coding

    1. Choose node (sub-principle) from the Protocol that will be used in the text search query.
    2. For our process, each individual will choose one sub-principle at a time to work on independently. We will discuss those sub-principle results before continuing onto another (see step 4).
    3. Document trial-and-error process of determining the appropriate search criteria for the query.
    4. The process will be documented in a shared work log between each individual.
    5. Save the results to Query Results in NVivo. The query results will be named after the corresponding node.

6. Each individual will save their own results from the same query that corresponds to each node. For example, Individual 1 saves their results as "[node name] 1", and Individual 2 saves their results as "[node name] 2".
7. Compare and discuss results with lab members to determine if and whose search criteria and results are acceptable.
8. Once a search criteria is agreed upon, code references from the new code to the existing Protocol node.
9. Not all references that are included in the query results will be coded. Lab members will agree upon which references to code.

iv. Advantages and Limitations

1. Overall, the text search query process was less time-consuming than coding each document individually. The preliminary results took an average of 30 minutes to decide on what was the most appropriate search criteria for the *floodplain boundaries mapped* node. Previously, we analyzed the *Ascension Parish Comprehensive Master Plan* but did not complete the process because it went over 3-4 hours. However, there is a risk of not coding all references with the query process. A possible solution is still being discussed, but this process can be a more efficient alternative to the individual document analyzation.

APPENDIX C. ACTOR LIST WITH CENTRALITY MEASURES

Table 9. Organization Centrality Measures in the Actor-Plan Coordination Network.

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
LCTCS	Educational Institution	NA	1.00	69.00	667.39	0.00	0.06
LSU	Educational Institution	NA	1.00	207.00	938.61	0.00	0.41
LSU CSS	Educational Institution	NA	1.00	134.00	505.93	0.00	0.16
LSU PD	Educational Institution	NA	3.00	16.00	1.12	0.00	0.02
SDMI	Educational Institution	NA	8.00	169.00	5286.51	0.00	0.24
Southern Uni. PD	Educational Institution	NA	9.00	16.00	1.12	0.00	0.02
UNO	Educational Institution	NA	3.00	49.00	32.70	0.00	0.07
UNO-CHART	Educational Institution	NA	1.00	149.00	236.01	0.00	0.21
UNO-PLUS	Educational Institution	NA	1.00	115.00	288.74	0.00	0.12
Flanders Marine Inst.	Educational Institution	NA	1.00	115.00	25.31	0.00	0.13
Fletcher Technical CC	Educational Institution	NA	1.00	115.00	25.31	0.00	0.13
LSU AgCenter	Educational Institution	NA	1.00	375.00	9312.84	0.00	0.52
LSU G&A	Educational Institution	NA	1.00	115.00	25.31	0.00	0.13
LSU Landscape Architecture	Educational Institution	NA	1.00	82.00	9.40	0.00	0.06
Nicholls State Uni.	Educational Institution	NA	1.00	130.00	157.27	0.00	0.15
Northshore Technical CC	Educational Institution	NA	1.00	115.00	25.31	0.00	0.13
Southern Uni.	Educational Institution	NA	1.00	199.00	579.09	0.00	0.30
Tulane Uni. Water Inst.	Educational Institution	NA	1.00	115.00	25.31	0.00	0.13
ULL	Educational Institution	NA	1.00	115.00	25.31	0.00	0.13
Southeastern LA Uni.	Educational Institution	NA	18.00	105.00	1351.06	0.00	0.10
BRCC	Educational Institution	NA	1.00	47.00	17.49	0.00	0.07

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
LSU PBRC	Educational Institution	NA	1.00	47.00	17.49	0.00	0.07
River Parishes CC	Educational Institution	NA	1.00	22.00	10.77	0.00	0.03
TAMU-TTI	Educational Institution	NA	1.00	134.00	162.56	0.00	0.22
UNO Pontchartrain Inst.	Educational Institution	NA	2.00	57.00	12.09	0.00	0.06
UNOTI	Educational Institution	NA	1.00	82.00	9.40	0.00	0.06
FEMA	Government	Federal	1.00	424.00	8184.38	0.00	0.91
NOAA	Government	Federal	1.00	296.00	4517.60	0.00	0.53
NWS	Government	Federal	2.00	50.00	62.69	0.00	0.10
USACE	Government	Federal	1.00	389.00	5116.40	0.00	0.88
USDOC	Government	Federal	1.00	221.00	1012.20	0.00	0.28
USEPA	Government	Federal	12.00	263.00	2520.53	0.00	0.55
USGS	Government	Federal	4.00	332.00	4582.30	0.00	0.71
USHUD	Government	Federal	4.00	341.00	2651.37	0.00	0.57
LA Sea Grant	Government	Federal	1.00	145.00	189.22	0.00	0.19
CB	Government	Federal	1.00	334.00	3897.60	0.00	0.71
EIA	Government	Federal	1.00	115.00	25.31	0.00	0.13
SA	Government	Federal	2.00	62.00	207.86	0.00	0.07
NMFS	Government	Federal	1.00	107.00	24.65	0.00	0.12
NWRC	Government	Federal	2.00	115.00	25.31	0.00	0.13
USCG	Government	Federal	1.00	107.00	24.65	0.00	0.12
USDA	Government	Federal	2.00	201.00	1360.84	0.00	0.33
USDHS	Government	Federal	2.00	109.00	334.52	0.00	0.16
USDOI	Government	Federal	1.00	155.00	301.19	0.00	0.18
USDOJ	Government	Federal	1.00	123.00	58.75	0.00	0.18
USDOT	Government	Federal	1.00	216.00	485.59	0.00	0.39
USEDA	Government	Federal	1.00	155.00	301.19	0.00	0.18
USFWS	Government	Federal	2.00	223.00	1761.56	0.00	0.33

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
USNPS	Government	Federal	2.00	228.00	991.12	0.00	0.30
USNRCS	Government	Federal	4.00	124.00	74.23	0.00	0.18
FHA	Government	Federal	1.00	135.00	73.65	0.00	0.24
FTA	Government	Federal	1.00	156.00	250.88	0.00	0.24
CDC	Government	Federal	1.00	107.00	24.65	0.00	0.12
DRA	Government	Federal	1.00	57.00	12.09	0.00	0.06
MARAD	Government	Federal	1.00	107.00	24.65	0.00	0.12
NHTSA	Government	Federal	1.00	107.00	24.65	0.00	0.12
USED	Government	Federal	1.00	107.00	24.65	0.00	0.12
USHHS	Government	Federal	1.00	199.00	586.17	0.00	0.24
USNRC	Government	Federal	1.00	44.00	16.99	0.00	0.06
USSBA	Government	Federal	1.00	82.00	9.40	0.00	0.06
USVA	Government	Federal	1.00	118.00	133.79	0.00	0.12
Abita Springs Town	Government	Municipal	1.00	18.00	1128.25	0.00	0.02
Abita Springs Town P&Z	Government	Municipal	3.00	2.00	0.00	0.00	0.00
Abita Springs Town PW	Government	Municipal	1.00	2.00	0.00	0.00	0.00
Albany Town	Government	Municipal	1.00	31.00	72.96	0.00	0.03
Angie Village	Government	Municipal	3.00	25.00	0.26	0.00	0.02
Baker City	Government	Municipal	1.00	298.00	1345.84	0.00	0.53
Baker City SB	Government	Municipal	3.00	16.00	1.12	0.00	0.02
Bayou Sorrel	Government	Municipal	2.00	22.00	1.67	0.00	0.01
Bogalusa City	Government	Municipal	1.00	27.00	103.80	0.00	0.02
Bogalusa City FD	Government	Municipal	18.00	25.00	0.26	0.00	0.02
Bogalusa City P&Z	Government	Municipal	1.00	2.00	0.00	0.00	0.00
Bogalusa City PD	Government	Municipal	1.00	25.00	0.26	0.00	0.02
Bogalusa City SB	Government	Municipal	1.00	25.00	0.26	0.00	0.02
Central City	Government	Municipal	23.00	282.00	1302.57	0.00	0.54

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Clinton Town	Government	Municipal	4.00	50.00	174.00	0.00	0.08
Covington City	Government	Municipal	4.00	46.00	452.24	0.00	0.08
Denham Springs City	Government	Municipal	1.00	236.00	1113.91	0.00	0.38
Donaldsonville City	Government	Municipal	2.00	237.00	982.94	0.00	0.37
Folsom Village	Government	Municipal	1.00	20.00	795.25	0.00	0.02
Franklinton Town	Government	Municipal	1.00	25.00	0.26	0.00	0.02
Franklinton Town PD	Government	Municipal	13.00	25.00	0.26	0.00	0.02
French Settlement Village	Government	Municipal	1.00	217.00	970.95	0.00	0.33
Gonzales City	Government	Municipal	2.00	158.00	523.35	0.00	0.33
Gonzales City P&Z	Government	Municipal	20.00	22.00	10.77	0.00	0.03
Gonzales City PW	Government	Municipal	1.00	9.00	0.47	0.00	0.02
Gramercy Town	Government	Municipal	8.00	53.00	191.25	0.00	0.08
Greensburg Town	Government	Municipal	3.00	9.00	0.07	0.00	0.00
Grosse Tete Village	Government	Municipal	4.00	27.00	87.31	0.00	0.02
Hammond City	Government	Municipal	2.00	161.00	1144.66	0.00	0.24
Hammond City P&Z	Government	Municipal	2.00	20.00	6.29	0.00	0.03
Independence Town	Government	Municipal	6.00	46.00	31.34	0.00	0.06
Jackson Town	Government	Municipal	1.00	21.00	22.48	0.00	0.02
Kentwood Town	Government	Municipal	2.00	46.00	31.34	0.00	0.06
Killian Town	Government	Municipal	13.00	10.00	0.58	0.00	0.01
Livingston Town	Government	Municipal	5.00	111.00	149.93	0.00	0.13
Lutcher Town	Government	Municipal	16.00	66.00	196.85	0.00	0.11
Madisonville Town	Government	Municipal	3.00	126.00	383.50	0.00	0.15
Mandeville City	Government	Municipal	9.00	142.00	1449.44	0.00	0.22
Mandeville City P&Z	Government	Municipal	4.00	8.00	0.11	0.00	0.00
Maringouin Town	Government	Municipal	1.00	27.00	87.31	0.00	0.02
Montpelier Village	Government	Municipal	2.00	9.00	0.07	0.00	0.00
Norwood Village	Government	Municipal	1.00	21.00	22.48	0.00	0.02

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Pearl River Town PD	Government	Municipal	2.00	16.00	2.25	0.00	0.02
Plaquemine City	Government	Municipal	2.00	129.00	1011.24	0.00	0.13
Ponchatoula City	Government	Municipal	1.00	62.00	312.99	0.00	0.09
Port Vincent Village	Government	Municipal	1.00	202.00	447.82	0.00	0.31
Rosedale Village	Government	Municipal	1.00	10.00	1.06	0.00	0.00
Roseland Town	Government	Municipal	2.00	46.00	31.34	0.00	0.06
Slaughter Town	Government	Municipal	1.00	21.00	22.48	0.00	0.02
Sorrento Town	Government	Municipal	1.00	147.00	288.87	0.00	0.27
Springfield Town	Government	Municipal	1.00	10.00	0.58	0.00	0.01
St. Francisville Town	Government	Municipal	8.00	28.00	127.26	0.00	0.04
St. Gabriel City	Government	Municipal	1.00	142.00	1117.80	0.00	0.17
Sun Village	Government	Municipal	1.00	16.00	2.25	0.00	0.02
Tangipahoa Village	Government	Municipal	1.00	46.00	31.34	0.00	0.06
Tickfaw Village	Government	Municipal	1.00	46.00	31.34	0.00	0.06
Varnado Village	Government	Municipal	2.00	25.00	0.26	0.00	0.02
Walker Town	Government	Municipal	1.00	125.00	239.69	0.00	0.20
White Castle Town	Government	Municipal	1.00	129.00	1011.24	0.00	0.13
Wilson Village	Government	Municipal	1.00	21.00	22.48	0.00	0.02
Zachary City	Government	Municipal	1.00	299.00	1353.52	0.00	0.55
Belle Chasse CDP	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Buras CDP	Government	Municipal	2.00	115.00	25.31	0.00	0.13
Convent CDP	Government	Municipal	2.00	48.00	31.39	0.00	0.06
Edgard CDP	Government	Municipal	2.00	32.00	9.02	0.00	0.04
Garyville CDP	Government	Municipal	1.00	49.00	25.72	0.00	0.08
Golden Meadow Town	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Gonzales City FD	Government	Municipal	1.00	9.00	0.47	0.00	0.02
Grand Isle Town	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Hammond City PW	Government	Municipal	2.00	20.00	6.29	0.00	0.03

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Hester CDP	Government	Municipal	1.00	63.00	73.75	0.00	0.10
Houma City	Government	Municipal	4.00	208.00	556.80	0.00	0.27
Jean Lafitte Town	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Killona CDP	Government	Municipal	1.00	44.00	16.99	0.00	0.06
LaPlace CDP	Government	Municipal	1.00	62.00	97.28	0.00	0.10
Lemannville CDP	Government	Municipal	1.00	37.00	16.48	0.00	0.05
Maurepas	Government	Municipal	1.00	50.00	61.24	0.00	0.08
Meraux CDP	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Metairie CDP	Government	Municipal	2.00	141.00	195.86	0.00	0.18
Morgan City City	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Paulina CDP	Government	Municipal	1.00	63.00	73.75	0.00	0.10
Prairieville CDP	Government	Municipal	1.00	48.00	23.84	0.00	0.09
Raceland CDP	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Reserve CDP	Government	Municipal	1.00	44.00	16.99	0.00	0.06
Slidell City	Government	Municipal	1.00	199.00	322.99	0.00	0.31
Thibodaux City	Government	Municipal	2.00	208.00	556.80	0.00	0.27
Vacherie CDP	Government	Municipal	1.00	63.00	73.75	0.00	0.10
Venice CDP	Government	Municipal	1.00	115.00	25.31	0.00	0.13
Addis Town	Government	Municipal	1.00	107.00	24.65	0.00	0.12
Brusly Town	Government	Municipal	3.00	107.00	24.65	0.00	0.12
Folsom Village P&Z	Government	Municipal	7.00	4.00	0.00	0.00	0.00
Port Allen City	Government	Municipal	1.00	123.00	58.75	0.00	0.18
Amite City Town	Government	Municipal	1.00	35.00	7.87	0.00	0.03
Burnside	Government	Municipal	1.00	22.00	10.77	0.00	0.03
Folsom Village PD	Government	Municipal	1.00	4.00	0.00	0.00	0.00
Folsom Village PW	Government	Municipal	3.00	4.00	0.00	0.00	0.00
Hammond City Industrial Board	Government	Municipal	2.00	35.00	7.87	0.00	0.03
Manchac	Government	Municipal	1.00	35.00	7.87	0.00	0.03

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
CATS	Government	NA	1.00	148.00	216.63	0.00	0.27
RPTA	Government	NA	16.00	64.00	83.59	0.00	0.09
CRSC	Government	NA	1.00	107.00	24.65	0.00	0.12
Ascension Parish	Government	Parish	1.00	281.00	1343.85	0.00	0.71
Ascension Parish OHSEP	Government	Parish	3.00	7.00	0.99	0.00	0.01
Ascension Parish P&Z	Government	Parish	1.00	48.00	23.84	0.00	0.09
Ascension Parish SB	Government	Parish	1.00	30.00	48.38	0.00	0.05
Ascension Parish SO	Government	Parish	2.00	50.00	53.78	0.00	0.10
East Baton Rouge Parish	Government	Parish	5.00	389.00	4353.76	0.00	0.86
BRFD	Government	Parish	1.00	16.00	1.12	0.00	0.02
BRPD	Government	Parish	1.00	16.00	1.12	0.00	0.02
East Baton Rouge Parish GIS	Government	Parish	1.00	29.00	9.42	0.00	0.05
East Baton Rouge Parish P&Z	Government	Parish	1.00	47.00	17.49	0.00	0.07
East Baton Rouge Parish SB	Government	Parish	3.00	16.00	1.12	0.00	0.02
East Baton Rouge Parish SO	Government	Parish	3.00	16.00	1.12	0.00	0.02
MOHSEP	Government	Parish	2.00	98.00	315.22	0.00	0.11
East Feliciana Parish	Government	Parish	2.00	200.00	840.88	0.00	0.33
East Feliciana Parish Development Dist.	Government	Parish	1.00	19.00	2.86	0.00	0.02
East Feliciana Parish OHSEP	Government	Parish	2.00	7.00	1.19	0.00	0.00
East Feliciana Parish P&Z	Government	Parish	1.00	19.00	2.86	0.00	0.02

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Iberville Parish	Government	Parish	1.00	231.00	1698.87	0.00	0.38
Iberville Parish GIS	Government	Parish	2.00	22.00	1.67	0.00	0.01
Iberville Parish OHSEP	Government	Parish	1.00	10.00	1.06	0.00	0.00
Iberville Parish PW	Government	Parish	2.00	10.00	1.06	0.00	0.00
Iberville Parish SO	Government	Parish	4.00	10.00	1.06	0.00	0.00
Livingston Parish	Government	Parish	3.00	288.00	1888.19	0.00	0.60
Livingston Parish Gravity Drainage Dist. No. 2	Government	Parish	1.00	73.00	240.85	0.00	0.08
Livingston Parish P&Z	Government	Parish	6.00	23.00	2.18	0.00	0.02
LOHSEP	Government	Parish	1.00	64.00	96.41	0.00	0.07
Orleans Parish ORS	Government	Parish	2.00	24.00	7.06	0.00	0.03
St. Charles Parish	Government	Parish	2.00	207.00	1252.97	0.00	0.46
St. Charles Parish P&Z	Government	Parish	1.00	4.00	0.05	0.00	0.00
St. Charles Parish PW	Government	Parish	2.00	4.00	0.05	0.00	0.00
St. Helena Parish	Government	Parish	1.00	195.00	1532.70	0.00	0.31
St. Helena Parish ED	Government	Parish	1.00	9.00	0.07	0.00	0.00
St. Helena Parish FD	Government	Parish	2.00	9.00	0.07	0.00	0.00
St. Helena Parish OHSEP	Government	Parish	3.00	9.00	0.07	0.00	0.00
St. Helena Parish SB	Government	Parish	1.00	9.00	0.07	0.00	0.00
St. James Parish	Government	Parish	3.00	196.00	711.82	0.00	0.42
St. James Parish HR	Government	Parish	3.00	27.00	8.84	0.00	0.04
St. James Parish OHSEP	Government	Parish	1.00	27.00	8.84	0.00	0.04
St. James Parish SO	Government	Parish	2.00	27.00	8.84	0.00	0.04

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
St. John the Baptist Parish	Government	Parish	4.00	208.00	648.58	0.00	0.51
St. John the Baptist Parish GIS	Government	Parish	2.00	58.00	51.92	0.00	0.10
St. John the Baptist Parish FD	Government	Parish	1.00	25.00	7.86	0.00	0.04
St. John the Baptist Parish OHSEP	Government	Parish	1.00	56.00	49.37	0.00	0.09
St. John the Baptist Parish P&Z	Government	Parish	1.00	59.00	64.62	0.00	0.10
St. John the Baptist Parish PW	Government	Parish	2.00	56.00	49.37	0.00	0.09
St. John the Baptist Parish SB	Government	Parish	2.00	25.00	7.86	0.00	0.04
St. John the Baptist Parish SO	Government	Parish	5.00	25.00	7.86	0.00	0.04
St. John the Baptist Parish TD	Government	Parish	5.00	25.00	7.86	0.00	0.04
St. Tammany Parish	Government	Parish	1.00	192.00	4454.01	0.00	0.39
St. Tammany Parish EVS	Government	Parish	3.00	17.00	37.11	0.00	0.02
St. Tammany Parish OHSEP	Government	Parish	4.00	27.00	262.27	0.00	0.02
St. Tammany Parish P&Z	Government	Parish	1.00	17.00	37.11	0.00	0.02
St. Tammany Parish PD	Government	Parish	2.00	16.00	2.25	0.00	0.02
Tangipahoa Parish (table cont’d.)	Government	Parish	3.00	158.00	1661.22	0.00	0.33

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Tangipahoa Parish Consolidated Drainage Dist.	Government	Parish	2.00	55.00	352.77	0.00	0.03
Tangipahoa Parish FD	Government	Parish	3.00	55.00	352.77	0.00	0.03
Tangipahoa Parish GIS	Government	Parish	1.00	55.00	352.77	0.00	0.03
Tangipahoa Parish OCD	Government	Parish	1.00	24.00	7.06	0.00	0.03
Tangipahoa Parish OHSEP	Government	Parish	4.00	55.00	352.77	0.00	0.03
Tangipahoa Parish P&Z	Government	Parish	3.00	68.00	298.10	0.00	0.04
Tangipahoa Parish Water Dist. #1	Government	Parish	2.00	55.00	352.77	0.00	0.03
Washington Parish	Government	Parish	9.00	48.00	512.33	0.00	0.05
Washington Parish COA	Government	Parish	1.00	25.00	0.26	0.00	0.02
Washington Parish Communication Dist.	Government	Parish	2.00	25.00	0.26	0.00	0.02
Washington Parish FD	Government	Parish	1.00	25.00	0.26	0.00	0.02
Washington Parish OHSEP	Government	Parish	2.00	25.00	0.26	0.00	0.02
Washington Parish PD	Government	Parish	1.00	25.00	0.26	0.00	0.02
Washington Parish SB	Government	Parish	1.00	25.00	0.26	0.00	0.02
Washington Parish SO	Government	Parish	1.00	25.00	0.26	0.00	0.02

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
West Feliciana Parish	Government	Parish	3.00	127.00	262.76	0.00	0.20
West Feliciana Parish OHSEP	Government	Parish	1.00	8.00	0.66	0.00	0.02
West Feliciana Parish P&Z	Government	Parish	2.00	3.00	0.16	0.00	0.00
Ascension Parish P&R	Government	Parish	2.00	37.00	16.48	0.00	0.05
Ascension Parish TC	Government	Parish	1.00	37.00	16.48	0.00	0.05
East Ascension Consolidated Gravity Drainage Dist.	Government	Parish	1.00	37.00	16.48	0.00	0.05
West Ascension Consolidated Gravity Drainage Dist.	Government	Parish	2.00	37.00	16.48	0.00	0.05
Assumption Parish	Government	Parish	1.00	136.00	186.81	0.00	0.18
Avoyelles Parish	Government	Parish	2.00	115.00	25.31	0.00	0.13
Concordia Parish	Government	Parish	3.00	115.00	25.31	0.00	0.13
Build BR	Government	Parish	1.00	82.00	9.40	0.00	0.06
East Baton Rouge Parish DTD	Government	Parish	1.00	123.00	58.75	0.00	0.18
East Baton Rouge Parish DOD	Government	Parish	1.00	47.00	17.49	0.00	0.07
Iberia Parish	Government	Parish	3.00	115.00	25.31	0.00	0.13
Jefferson Parish	Government	Parish	1.00	164.00	372.38	0.00	0.33
Lafayette Parish	Government	Parish	1.00	115.00	25.31	0.00	0.13
Lafourche Parish	Government	Parish	19.00	136.00	186.81	0.00	0.18
Livingston Parish Gravity Drainage Dist. No. 1	Government	Parish	4.00	23.00	2.18	0.00	0.02

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Livingston Parish Gravity Drainage Dist. No. 5	Government	Parish	1.00	23.00	2.18	0.00	0.02
Livingston Parish Gravity Drainage Dist. No. 6	Government	Parish	1.00	23.00	2.18	0.00	0.02
Livingston Parish Gravity Drainage Dist. No. 7	Government	Parish	1.00	23.00	2.18	0.00	0.02
Orleans Parish	Government	Parish	1.00	308.00	2213.16	0.00	0.74
Plaquemines Parish	Government	Parish	1.00	137.00	146.96	0.00	0.24
Pointe Coupee Parish	Government	Parish	4.00	206.00	331.25	0.00	0.31
St. Bernard Parish	Government	Parish	2.00	156.00	370.02	0.00	0.30
St. John the Baptist Parish HA	Government	Parish	1.00	44.00	16.99	0.00	0.06
St. Landry Parish	Government	Parish	1.00	115.00	25.31	0.00	0.13
St. Martin Parish	Government	Parish	1.00	115.00	25.31	0.00	0.13
St. Mary Parish	Government	Parish	1.00	115.00	25.31	0.00	0.13
STLDCD	Government	Parish	1.00	31.00	325.61	0.00	0.04
St. Tammany Parish, Gravity Drainage District No. 3	Government	Parish	3.00	13.00	5.20	0.00	0.01
St. Tammany Parish, Gravity Drainage District No. 4	Government	Parish	6.00	13.00	5.20	0.00	0.01
St. Tammany Parish, Gravity Drainage District No. 5	Government	Parish	1.00	13.00	5.20	0.00	0.01

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Tangipahoa Parish Gravity Drainage Dist. No. 4	Government	Parish	1.00	38.00	0.84	0.00	0.01
Tangipahoa Parish Gravity Drainage Dist. No. 5	Government	Parish	1.00	38.00	0.84	0.00	0.01
Terrebonne Parish	Government	Parish	1.00	136.00	186.81	0.00	0.18
West Baton Rouge Parish	Government	Parish	6.00	224.00	486.88	0.00	0.41
Ascension Parish PW	Government	Parish	1.00	28.00	17.84	0.00	0.04
Ascension Parish TD	Government	Parish	1.00	28.00	17.84	0.00	0.04
BREC	Government	Parish	11.00	185.00	431.83	0.00	0.27
Iberville Parish P&R	Government	Parish	1.00	22.00	1.67	0.00	0.01
Iberville Parish TC	Government	Parish	1.00	22.00	1.67	0.00	0.01
JeT	Government	Parish	2.00	24.00	7.06	0.00	0.03
Orleans Parish DOT	Government	Parish	1.00	24.00	7.06	0.00	0.03
St. James Parish SB	Government	Parish	2.00	28.00	7.60	0.00	0.03
St. Tammany Parish SB	Government	Parish	1.00	14.00	5.91	0.00	0.02
St. Tammany Parish TC	Government	Parish	1.00	5.00	0.17	0.00	0.00
Tangipahoa Parish COA	Government	Parish	2.00	38.00	0.84	0.00	0.01
Tangipahoa Parish PW	Government	Parish	1.00	38.00	0.84	0.00	0.01
ACOA	Government	Parish	6.00	107.00	24.65	0.00	0.12
EBRPLS	Government	Parish	3.00	47.00	17.49	0.00	0.07
EBRPSS	Government	Parish	1.00	47.00	17.49	0.00	0.07
Iberville Parish COA	Government	Parish	2.00	107.00	24.65	0.00	0.12
LCOA	Government	Parish	6.00	107.00	24.65	0.00	0.12

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
LA Swift	Government	Parish	3.00	107.00	24.65	0.00	0.12
St. James Parish ED	Government	Parish	1.00	28.00	7.60	0.00	0.03
Tangipahoa Parish SB	Government	Parish	1.00	35.00	7.87	0.00	0.03
Tangipahoa Parish TC	Government	Parish	7.00	35.00	7.87	0.00	0.03
WBRCOA	Government	Parish	3.00	107.00	24.65	0.00	0.12
ARBC	Government	Regional	1.00	135.00	115.92	0.00	0.27
CRPC	Government	Regional	1.00	312.00	1930.65	0.00	0.54
Pontchartrain Levee Dist.	Government	Regional	1.00	54.00	283.86	0.00	0.11
SCPDC	Government	Regional	1.00	170.00	377.07	0.00	0.28
Acadiana Watershed Commission	Government	Regional	1.00	115.00	25.31	0.00	0.13
Lafourche Basin Levee Dist.	Government	Regional	1.00	32.00	9.02	0.00	0.04
NORPC	Government	Regional	1.00	116.00	862.51	0.00	0.25
CPRA	Government	State	1.00	173.00	918.93	0.00	0.37
GOHSEP	Government	State	1.00	321.00	4623.01	0.00	0.66
LA SAFE	Government	State	1.00	127.00	135.69	0.00	0.16
LADOTD	Government	State	1.00	423.00	7450.18	0.00	1.00
LDAF	Government	State	1.00	76.00	116.87	0.00	0.10
LDEQ	Government	State	1.00	251.00	2266.39	0.00	0.60
LDNR	Government	State	1.00	185.00	1631.93	0.00	0.27
LDNR - OCM	Government	State	1.00	138.00	252.17	0.00	0.17
LDOH	Government	State	1.00	181.00	3700.56	0.00	0.22
LDOH - OPH	Government	State	1.00	81.00	897.51	0.00	0.09
LDPS	Government	State	1.00	25.00	7.86	0.00	0.04
Port of South LA	Government	State	1.00	169.00	513.85	0.00	0.29

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Atchafalaya Trace Commission	Government	State	1.00	115.00	25.31	0.00	0.13
LATax	Government	State	1.00	32.00	9.02	0.00	0.04
LAWorks	Government	State	1.00	48.00	31.39	0.00	0.06
LDCRT	Government	State	1.00	190.00	588.36	0.00	0.24
LDOA	Government	State	8.00	29.00	9.42	0.00	0.05
LDOE	Government	State	1.00	126.00	171.27	0.00	0.17
LDWF	Government	State	1.00	186.00	1208.73	0.00	0.33
LED	Government	State	3.00	137.00	397.46	0.00	0.18
LOCD	Government	State	1.00	293.00	1555.88	0.00	0.43
LOSCO	Government	State	12.00	32.00	11.58	0.00	0.06
LRA	Government	State	1.00	132.00	247.79	0.00	0.18
LSRRA	Government	State	2.00	115.00	25.31	0.00	0.13
LWI Council on Watershed Mgmt.	Government	State	1.00	146.00	283.72	0.00	0.23
Port of Greater BR	Government	State	1.00	134.00	162.56	0.00	0.22
Port of NO	Government	State	2.00	119.00	150.48	0.00	0.15
LA Lt. Gov. Office	Government	State	1.00	22.00	1.67	0.00	0.01
LA Seafood	Government	State	1.00	115.00	25.31	0.00	0.13
LDOR	Government	State	5.00	107.00	24.65	0.00	0.12
LHC	Government	State	7.00	57.00	12.09	0.00	0.06
LHSC	Government	State	3.00	107.00	24.65	0.00	0.12
LSP	Government	State	2.00	107.00	24.65	0.00	0.12
Restore LA	Government	State	6.00	82.00	9.40	0.00	0.06
American Red Cross	NGO	NA	1.00	25.00	7.86	0.00	0.04
Bayou Interfaith Shared Community Organizing	NGO	NA	1.00	115.00	25.31	0.00	0.13
Capital RC&D (table cont'd.)	NGO	NA	1.00	38.00	0.84	0.00	0.01

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
CCC	NGO	NA	9.00	115.00	25.31	0.00	0.13
CRCL	NGO	NA	3.00	115.00	25.31	0.00	0.13
EDF	NGO	NA	2.00	115.00	25.31	0.00	0.13
FMG	NGO	NA	6.00	38.00	0.84	0.00	0.01
Fnd. for LA	NGO	NA	7.00	183.00	597.67	0.00	0.19
GNO, Inc.	NGO	NA	6.00	121.00	67.41	0.00	0.15
GRN	NGO	NA	1.00	115.00	25.31	0.00	0.13
Lower 9th Ward CSED	NGO	NA	2.00	115.00	25.31	0.00	0.13
NOVAC	NGO	NA	1.00	115.00	25.31	0.00	0.13
NWF	NGO	NA	1.00	115.00	25.31	0.00	0.13
Pontchartrain Conservancy	NGO	NA	1.00	166.00	159.47	0.00	0.25
Restore the Mississippi R. Delta	NGO	NA	1.00	115.00	25.31	0.00	0.13
Rockefeller Fnd.	NGO	NA	1.00	115.00	25.31	0.00	0.13
ROR	NGO	NA	5.00	115.00	25.31	0.00	0.13
SJPH	NGO	NA	2.00	27.00	8.84	0.00	0.04
STEDF	NGO	NA	1.00	20.00	307.26	0.00	0.02
Walton Family Fnd.	NGO	NA	8.00	115.00	25.31	0.00	0.13
WEDF	NGO	NA	1.00	25.00	0.26	0.00	0.02
ZTCC	NGO	NA	1.00	115.00	25.31	0.00	0.13
AASHTO	NGO	NA	1.00	107.00	24.65	0.00	0.12
American Assc. of Port Authorities	NGO	NA	2.00	115.00	25.31	0.00	0.13
APA	NGO	NA	1.00	199.00	798.40	0.00	0.24
Keep St. Tammany Beautiful	NGO	NA	1.00	7.00	5.48	0.00	0.01
Living Cities	NGO	NA	1.00	82.00	9.40	0.00	0.06

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
MBECA	NGO	NA	1.00	37.00	16.48	0.00	0.05
Natl. Assc. of Realtors	NGO	NA	1.00	37.00	16.48	0.00	0.05
NOGS	NGO	NA	1.00	115.00	25.31	0.00	0.13
NRPA	NGO	NA	1.00	72.00	148.86	0.00	0.11
RWJF	NGO	NA	1.00	277.00	1109.88	0.00	0.36
BRAC	NGO	NA	1.00	199.00	579.09	0.00	0.30
Amite City Town COC	NGO	NA	5.00	38.00	0.84	0.00	0.01
Hammond City COC	NGO	NA	13.00	38.00	0.84	0.00	0.01
Ponchatoula City COC	NGO	NA	1.00	38.00	0.84	0.00	0.01
AEDC	NGO	NA	5.00	40.00	26.43	0.00	0.07
AIA	NGO	NA	1.00	86.00	43.27	0.00	0.08
BR Health District	NGO	NA	1.00	107.00	24.65	0.00	0.12
BRAF	NGO	NA	1.00	182.00	698.90	0.00	0.27
BRCAC	NGO	NA	1.00	107.00	24.65	0.00	0.12
Catholic Charities	NGO	NA	10.00	38.00	0.84	0.00	0.01
CHILP	NGO	NA	1.00	23.00	2.18	0.00	0.02
Christ Anointed Ministries	NGO	NA	1.00	38.00	0.84	0.00	0.01
Collinswood Museum	NGO	NA	1.00	38.00	0.84	0.00	0.01
CRISIS	NGO	NA	1.00	135.00	177.65	0.00	0.22
First Baptist Ponchatoula	NGO	NA	14.00	38.00	0.84	0.00	0.01
LA Cattlemen's Assc.	NGO	NA	3.00	35.00	7.87	0.00	0.03
LA Treasures Museum	NGO	NA	1.00	38.00	0.84	0.00	0.01
LACES	NGO	NA	1.00	38.00	0.84	0.00	0.01

(table cont’d.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
LARF	NGO	NA	2.00	38.00	0.84	0.00	0.01
LMA	NGO	NA	3.00	82.00	9.40	0.00	0.06
Neighbors in Action	NGO	NA	2.00	23.00	2.18	0.00	0.02
Northlake Homeless Coalition	NGO	NA	1.00	38.00	0.84	0.00	0.01
Northshore Community Fnd.	NGO	NA	1.00	48.00	110.37	0.00	0.06
Northshore Healthcare Alliance	NGO	NA	1.00	38.00	0.84	0.00	0.01
Northshore Home Builders Assc.	NGO	NA	1.00	43.00	385.15	0.00	0.01
Pennington Fnd.	NGO	NA	1.00	97.00	298.01	0.00	0.08
River Rock Church	NGO	NA	1.00	38.00	0.84	0.00	0.01
St. Catherine Labouré Church Hall	NGO	NA	17.00	22.00	1.67	0.00	0.01
Tangilena LTRG	NGO	NA	2.00	38.00	0.84	0.00	0.01
Tangipahoa Futures Network	NGO	NA	2.00	35.00	7.87	0.00	0.03
Tangipahoa Parish Forestry Assc.	NGO	NA	2.00	35.00	7.87	0.00	0.03
Tangipahoa Parish Home Builders Assc.	NGO	NA	1.00	35.00	7.87	0.00	0.03
TEDF	NGO	NA	1.00	68.00	298.10	0.00	0.04
Turner Chapel AME Church	NGO	NA	1.00	38.00	0.84	0.00	0.01
United Way	NGO	NA	3.00	38.00	0.84	0.00	0.01
Ascension Parish COC	NGO	NA	1.00	40.00	26.43	0.00	0.07
Iberville Parish COC	NGO	NA	2.00	22.00	1.67	0.00	0.01
LEDC	NGO	NA	2.00	23.00	2.18	0.00	0.02

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Baker City COC	NGO	NA	1.00	82.00	9.40	0.00	0.06
Aetna Fnd.	NGO	NA	1.00	57.00	12.09	0.00	0.06
Albertsons Companies Fnd.	NGO	NA	1.00	57.00	12.09	0.00	0.06
Arbor Day Fnd.	NGO	NA	1.00	57.00	12.09	0.00	0.06
Arts Council of Greater BR	NGO	NA	1.00	116.00	216.15	0.00	0.13
ASCE	NGO	NA	1.00	24.00	7.06	0.00	0.03
Assc. of Zoos & Aquariums	NGO	NA	12.00	82.00	9.40	0.00	0.06
Babcock Fnd.	NGO	NA	2.00	82.00	9.40	0.00	0.06
BCBS of LA Fnd.	NGO	NA	1.00	57.00	12.09	0.00	0.06
Boo Grigsby Fnd.	NGO	NA	1.00	118.00	133.79	0.00	0.12
Booth-Bricker Fund	NGO	NA	1.00	57.00	12.09	0.00	0.06
BR Advocates for Safe Streets	NGO	NA	2.00	107.00	24.65	0.00	0.12
BR Bicycle Club	NGO	NA	2.00	107.00	24.65	0.00	0.12
BREC Fnd.	NGO	NA	2.00	82.00	9.40	0.00	0.06
Brookings Inst.	NGO	NA	1.00	107.00	24.65	0.00	0.12
Cisco Fnd.	NGO	NA	1.00	82.00	9.40	0.00	0.06
CNT	NGO	NA	3.00	107.00	24.65	0.00	0.12
Coca Cola Fnd.	NGO	NA	3.00	82.00	9.40	0.00	0.06
Democracy Collaborative	NGO	NA	1.00	82.00	9.40	0.00	0.06
Dreyfus Fnd.	NGO	NA	2.00	82.00	9.40	0.00	0.06
DSCEJ	NGO	NA	1.00	82.00	9.40	0.00	0.06
ExxonMobil Fnd.	NGO	NA	1.00	82.00	9.40	0.00	0.06
FedEx Cares	NGO	NA	1.00	82.00	9.40	0.00	0.06

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Fnd. for the Mid-South	NGO	NA	1.00	118.00	133.79	0.00	0.12
Franciscan PACE	NGO	NA	1.00	107.00	24.65	0.00	0.12
Fuller Center for Housing	NGO	NA	1.00	57.00	12.09	0.00	0.06
GCHP	NGO	NA	1.00	82.00	9.40	0.00	0.06
GCTFS	NGO	NA	5.00	107.00	24.65	0.00	0.12
Greater King David Baptist Church	NGO	NA	1.00	107.00	24.65	0.00	0.12
Habitat for Humanity	NGO	NA	1.00	57.00	12.09	0.00	0.06
Helis Fnd.	NGO	NA	1.00	82.00	9.40	0.00	0.06
HousingNOLA	NGO	NA	3.00	57.00	12.09	0.00	0.06
ICISF	NGO	NA	1.00	57.00	12.09	0.00	0.06
IEDC	NGO	NA	1.00	82.00	9.40	0.00	0.06
J.M. Kaplan Fund	NGO	NA	1.00	82.00	9.40	0.00	0.06
Joyce Fnd.	NGO	NA	3.00	57.00	12.09	0.00	0.06
JPMorgan Chase Fnd.	NGO	NA	1.00	82.00	9.40	0.00	0.06
Kresge Fnd.	NGO	NA	2.00	82.00	9.40	0.00	0.06
LISC	NGO	NA	1.00	82.00	9.40	0.00	0.06
Livingston Activity Center	NGO	NA	1.00	107.00	24.65	0.00	0.12
MAZON	NGO	NA	1.00	57.00	12.09	0.00	0.06
McIlhenny Fnd.	NGO	NA	1.00	82.00	9.40	0.00	0.06
MDRC	NGO	NA	1.00	28.00	7.60	0.00	0.03
Natl. Garden Clubs Inc.	NGO	NA	1.00	82.00	9.40	0.00	0.06
Needmor Fund	NGO	NA	1.00	82.00	9.40	0.00	0.06
NEEF	NGO	NA	1.00	82.00	9.40	0.00	0.06

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
NeighborWorks America	NGO	NA	1.00	82.00	9.40	0.00	0.06
NewCorp, Inc.	NGO	NA	1.00	82.00	9.40	0.00	0.06
NSRSC	NGO	NA	1.00	20.00	0.03	0.00	0.06
Orton Family Fnd.	NGO	NA	1.00	57.00	12.09	0.00	0.06
Panera Bread Fnd.	NGO	NA	1.00	57.00	12.09	0.00	0.06
Partners for Places	NGO	NA	1.00	82.00	9.40	0.00	0.06
PeopleForBikes	NGO	NA	1.00	118.00	133.79	0.00	0.12
Porticus North America Fnd.	NGO	NA	3.00	82.00	9.40	0.00	0.06
PPS	NGO	NA	2.00	118.00	133.79	0.00	0.12
Praxair Fnd.	NGO	NA	1.00	118.00	133.79	0.00	0.12
Reconnecting America	NGO	NA	1.00	118.00	133.79	0.00	0.12
SCORE Assc.	NGO	NA	1.00	82.00	9.40	0.00	0.06
Smart Growth America	NGO	NA	10.00	82.00	9.40	0.00	0.06
Stanley Smith Horticultural Trust	NGO	NA	18.00	82.00	9.40	0.00	0.06
State Farm Companies Fnd.	NGO	NA	1.00	82.00	9.40	0.00	0.06
Surdna Fnd.	NGO	NA	2.00	82.00	9.40	0.00	0.06
SWBG Conservation Fund	NGO	NA	2.00	82.00	9.40	0.00	0.06
The Arc	NGO	NA	1.00	107.00	24.65	0.00	0.12
The Heart Fnd.	NGO	NA	26.00	82.00	9.40	0.00	0.06
The Home Depot Fnd.	NGO	NA	1.00	82.00	9.40	0.00	0.06
Tony Hawk Fnd.	NGO	NA	2.00	118.00	133.79	0.00	0.12
UPF	NGO	NA	2.00	82.00	9.40	0.00	0.06

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Walmart Fnd.	NGO	NA	3.00	82.00	9.40	0.00	0.06
YouthBuild USA	NGO	NA	16.00	82.00	9.40	0.00	0.06
BR General Medical Center	Private Business	NA	1.00	16.00	1.12	0.00	0.02
DR Horton Construction Co.	Private Business	NA	1.00	38.00	0.84	0.00	0.01
ExxonMobil	Private Business	NA	1.00	118.00	459.64	0.00	0.13
Intl. Paper	Private Business	NA	1.00	25.00	0.26	0.00	0.02
Mosaic Co.	Private Business	NA	1.00	27.00	8.84	0.00	0.04
North Oaks Health System	Private Business	NA	2.00	55.00	352.77	0.00	0.03
OLOAH	Private Business	NA	1.00	25.00	0.26	0.00	0.02
RMC	Private Business	NA	1.00	25.00	0.26	0.00	0.02
David's Country Cottages and Café	Private Business	NA	1.00	22.00	1.67	0.00	0.01
DOW Chemical Co.	Private Business	NA	2.00	22.00	1.67	0.00	0.01
Georgia Gulf Corp.	Private Business	NA	3.00	22.00	1.67	0.00	0.01
Marmillion Gray Media	Private Business	NA	2.00	107.00	24.65	0.00	0.12
Natalbany Rentals	Private Business	NA	1.00	38.00	0.84	0.00	0.01
The Island Golf Course and Clubhouse	Private Business	NA	1.00	22.00	1.67	0.00	0.01
Whitney Natl. Bank	Private Business	NA	1.00	5.00	0.17	0.00	0.00
The Oiler Group, Inc.	Private Business	NA	1.00	13.00	5.20	0.00	0.01
Rural Behavioral Health	Private Business	NA	1.00	57.00	12.09	0.00	0.06
Bayou Taxi & Airport Cab	Private Business	NA	1.00	107.00	24.65	0.00	0.12
BCBS	Private Business	NA	1.00	57.00	12.09	0.00	0.06

(table cont'd.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
CB&I, Inc.	Private Business	NA	6.00	107.00	24.65	0.00	0.12
Fighting Tiger Taxi	Private Business	NA	1.00	107.00	24.65	0.00	0.12
Google LLC	Private Business	NA	3.00	107.00	24.65	0.00	0.12
Greyhound Lines, Inc.	Private Business	NA	1.00	107.00	24.65	0.00	0.12
Lyft, Inc.	Private Business	NA	1.00	107.00	24.65	0.00	0.12
Megabus	Private Business	NA	3.00	107.00	24.65	0.00	0.12
Mercedes-Benz	Private Business	NA	1.00	107.00	24.65	0.00	0.12
OLOLRMC	Private Business	NA	1.00	107.00	24.65	0.00	0.12
Tammy's Taxi	Private Business	NA	4.00	107.00	24.65	0.00	0.12
Uber Technologies, Inc.	Private Business	NA	9.00	107.00	24.65	0.00	0.12
ZipCar	Private Business	NA	1.00	107.00	24.65	0.00	0.12
Alvin Fairburn & Assc., LLC	Professional Services	NA	1.00	2.00	0.01	0.00	0.00
APTIM	Professional Services	NA	1.00	115.00	25.31	0.00	0.13
Bowie Urban Planners	Professional Services	NA	4.00	8.00	0.11	0.00	0.00
Burk-Kleinpeter, Inc.	Professional Services	NA	1.00	41.00	121.57	0.00	0.06
Concordia	Professional Services	NA	1.00	115.00	25.31	0.00	0.13
CPEX	Professional Services	NA	1.00	271.00	1906.20	0.00	0.54
CSRS	Professional Services	NA	1.00	55.00	66.29	0.00	0.10
Dover, Kohl & Partners	Professional Services	NA	1.00	20.00	6.29	0.00	0.03
DRW Planning Studio	Professional Services	NA	4.00	50.00	50.47	0.00	0.08
Elos Environmental, LLC	Professional Services	NA	1.00	42.00	196.33	0.00	0.01
Fernandez Plans, LLC (table cont’d.)	Professional Services	NA	1.00	13.00	5.20	0.00	0.01

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
Ferris Engineering and Surveying, LLC	Professional Services	NA	1.00	29.00	9.42	0.00	0.05
Fregonese Assc.	Professional Services	NA	1.00	62.00	116.68	0.00	0.11
G.E.C., Inc.	Professional Services	NA	1.00	32.00	11.58	0.00	0.06
Ground Rules Inc.	Professional Services	NA	1.00	8.00	0.11	0.00	0.00
Hall Planning & Engineering	Professional Services	NA	1.00	20.00	6.29	0.00	0.03
Harris & Varisco Consulting Engineers	Professional Services	NA	1.00	32.00	9.02	0.00	0.04
HDR Inc.	Professional Services	NA	3.00	8.00	0.11	0.00	0.00
Hedrick - Community Planning & Design	Professional Services	NA	1.00	13.00	5.20	0.00	0.01
HNTB	Professional Services	NA	1.00	93.00	155.33	0.00	0.22
IBTS	Professional Services	NA	1.00	29.00	9.42	0.00	0.05
JCW	Professional Services	NA	1.00	115.00	25.31	0.00	0.13
Kendig Keast Collab.	Professional Services	NA	1.00	35.00	7.87	0.00	0.03
Labarre Assc.	Professional Services	NA	1.00	8.00	1.09	0.00	0.01
LSA Assc., Inc.	Professional Services	NA	1.00	23.00	8.69	0.00	0.03
Moore Planning Group, LLC	Professional Services	NA	1.00	30.00	79.31	0.00	0.03
N-Y Assc., Inc.	Professional Services	NA	1.00	32.00	9.02	0.00	0.04
Pan American Engineers, LLC	Professional Services	NA	2.00	115.00	25.31	0.00	0.13
Planning and Design Studio	Professional Services	NA	2.00	8.00	0.11	0.00	0.00
Planning Works, LLC	Professional Services	NA	1.00	8.00	0.11	0.00	0.00
Providence	Professional Services	NA	1.00	28.00	7.60	0.00	0.03
T. Baker Smith, LLC	Professional Services	NA	1.00	5.00	0.42	0.00	0.00
Taimerica Mgmt. Co. (table cont'd.)	Professional Services	NA	1.00	5.00	0.17	0.00	0.00

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
TischlerBise, Inc.	Professional Services	NA	2.00	2.00	0.27	0.00	0.00
TMG Consulting	Professional Services	NA	1.00	24.00	7.06	0.00	0.03
Villavaso & Associates, LLC	Professional Services	NA	1.00	25.00	913.26	0.00	0.03
Waggoner & Ball Architects	Professional Services	NA	1.00	141.00	195.86	0.00	0.18
Wallace Roberts & Todd, LLC	Professional Services	NA	1.00	23.00	8.69	0.00	0.03
Witt O'Brien's	Professional Services	NA	1.00	7.00	0.76	0.00	0.01
Burk & Assc., Inc.	Professional Services	NA	1.00	32.00	9.02	0.00	0.04
Coastal Environments, Inc.	Professional Services	NA	1.00	32.00	9.02	0.00	0.04
Comite Resources, Inc.	Professional Services	NA	1.00	44.00	16.99	0.00	0.06
USA Environmental	Professional Services	NA	1.00	9.00	0.47	0.00	0.02
A. Wilbert’s Sons, LLC	Professional Services	NA	1.00	22.00	1.67	0.00	0.01
ARCADIS	Professional Services	NA	1.00	23.00	2.18	0.00	0.02
CH Fenstermaker & Assc., LLC	Professional Services	NA	1.00	48.00	216.18	0.00	0.06
Charles M. Higgins Consultants, Inc.	Professional Services	NA	1.00	13.00	5.20	0.00	0.01
Charlier Assc., Inc.	Professional Services	NA	5.00	23.00	2.18	0.00	0.02
Code Studio, Inc.	Professional Services	NA	1.00	23.00	2.18	0.00	0.02
Dana Brown & Assc.	Professional Services	NA	4.00	14.00	5.91	0.00	0.02
Digital Engineering	Professional Services	NA	1.00	14.00	5.91	0.00	0.02
ECONorthwest	Professional Services	NA	1.00	39.00	96.11	0.00	0.05
Franklin Assc.	Professional Services	NA	1.00	145.00	598.43	0.00	0.18
GCR & Assc., Inc.	Professional Services	NA	1.00	118.00	66.16	0.00	0.14
Greg Cantrell, Inc.	Professional Services	NA	1.00	44.00	16.99	0.00	0.06

(table cont’d.)

Node	Organization Type	Government Level	Degree (2-Mode)	Degree	Betweenness	Closeness	Eigenvector
GTC, Inc.	Professional Services	NA	1.00	44.00	16.99	0.00	0.06
Kimley-Horn & Assc., Inc.	Professional Services	NA	1.00	136.00	308.26	0.00	0.20
Marionneaux & Marionneaux Law Firm	Professional Services	NA	1.00	22.00	1.67	0.00	0.01
Meyer Engineers, Ltd.	Professional Services	NA	1.00	68.00	161.25	0.00	0.10
MIG Consulting, LLC	Professional Services	NA	2.00	23.00	2.18	0.00	0.02
Neel-Schaffer, Inc.	Professional Services	NA	1.00	107.00	24.65	0.00	0.12
Sizeler Architects	Professional Services	NA	1.00	44.00	16.99	0.00	0.06
Spangler Engineering	Professional Services	NA	1.00	38.00	0.84	0.00	0.01
Tharp Planning Group	Professional Services	NA	1.00	19.00	2.86	0.00	0.02
Woods & Poole Economics, Inc.	Professional Services	NA	9.00	107.00	24.65	0.00	0.12

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VITA

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