Risk Management Guideline

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PMO

PROGRAM MANAGEMENT OFFICE

SCOPE SCHEDULE COST

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Preface

The Risk Management Process, described herein, is intended to result in the effective management of project risks (threats and opportunities) during the entire project life cycle – **from Problem Screening though the completion of Construction**. The **Project Manager** and **Designer** jointly develop a **Risk Register** that enables them to identify, assess, quantify, prepare a response to, monitor and control project risks.

This document provides information that will help with risk management efforts in the following ways:

- Provide a consistent methodology for performing project risk management activities.
- Provide techniques and tools for project risk management.
- Identify data requirements for risk analysis input and output.
- Provide information on how risk management fits into the Capital Project Delivery (CPD) process
- Provide guidance on how to proactively respond to risks.

Project risk management is a customizable effort commensurate with the size and complexity of the project under consideration. Simpler projects may use simple analysis, whereas larger more complex projects may use more robust analysis techniques.

This guideline is applicable to all CPD projects. The appropriate level of project risk management to be performed depends on project size, complexity, cost, location, delivery timeframe, construction time frame, as well as other pertinent considerations.

Section Overview

Section 1	Provides an overview of risk management, the levels of risk management and the process, roles, and responsibilities
Section 2	Designed to help the Project Manager plan and implement the risk management process
Section 3	Provides instruction about risk identification and starting the Risk Register
Section 4	Provides information about performing risk analysis
Section 5	Provides information about performing quantitative risk analysis
Section 6	Provides information about developing risk response strategies and action plans
Section 7	Provides information about risk monitoring and control
Section 8	Provides information about addressing risk communication and accountability

Section 1 - Introduction

1-1 Purpose, Objectives

Purpose

The primary purpose for the formal risk management process is to provide the Project Manager and the Department with the necessary tools to assess and manage project-related risk. When risks are understood and their consequences are measured, decisions can be made to allocate risks in a manner that minimizes costs, promotes project goals and ultimately aligns the project team with the project needs and objectives.

Project Risk Management Objectives

The Risk Management Guideline has been designed to:

- Be simple and easy to use
- Be scalable to project size and complexity
- Incorporate risk communications across delivery process phases
- Actively manage risk to enhance project success
- Integrate into the current project delivery process
- Involve all functional units in the management of risks

1-2 Values and Benefits

Identifying, communicating and managing project risks require a strong risk management culture. This culture is defined by the values in which we operate. The following attributes depict risk management values required for the development of a successful risk management culture:

- Stewardship
- Accountability
- Teamwork
- Joint ownership of risks and responsibilities
- Project delivery efficiency benefits to the Project Team

The formal risk management process helps the Project Manager to manage project risks over the life of each project, enlisting the support and effort of all of the functional units as the project moves along the CPD process. This includes:

- Better ability to focus time and effort on highest rated risks
- A scalable approach, consistent with existing processes
- Enhanced coordination and transparency with functional units, which facilitates early identification of critical risks

1-3 Critical Success factors and Foundational Concepts

Critical Success factors

The following are the **Critical Success Factors** needed to achieve the desired risk management culture:

- Capital Program Management (CPM) supports the honest, realistic and open recognition of project risks even if they indicate problems with the project.
- CPM needs to provide a clear, consistent message to staff regarding project risk tolerance. When employees aren't clear about an organization's risk tolerance, they may get mixed messages around risk, which can be a real danger to a culture of accountability. A lack of clarity and insight around risk leads to assumptions that could negatively impact business or a tendency to take on more risk than is prudent.
- The Executive Regional Manager works with the Project Manager to determine the appropriate level of risk management to be performed.
- The Project Manager promotes discussion in an atmosphere where there are no risks that are out-of-bounds for discussion and no enforcement of bureaucratic hierarchy in meetings where risk identification and assessment is discussed.
- The Project Manager and Designer are committed to indentifying, describing and collecting realistic and high-quality data about risks. Risk data is often based on the judgment and expertise of informed individuals. It takes effort and organizational support to spend the time and resources needed to collect accurate data about project risk.

Foundational Concepts

The following are the foundational concepts that were used to develop a formal Risk Management process:

- Because the NJDOT informally performs many aspects of a formal risk management process, most of the risk management tasks should be incorporated into existing CPD activities.
- Risks are to be identified, documented, assessed and managed for a Capital project or proposed project, beginning as early in the project development process as is reasonably possible.
- In order to be effective, the formal risk management process should span the entire length of a Capital project from Problem Screening through Construction.
- An Alternatives Risk Analysis is to be completed for each major risk associated with the Preliminary Preferred Alternative (PPA) during Concept Development.
- If deemed appropriate by the Project Manager, a quantitative risk assessment is to be completed for severe risks on projects with a total construction cost over $100 million.
- Risks will be identified by project team members (e.g., Designer, Subject Matter Experts (SMEs)) throughout the CPD process. With the approval of the Project Manager, the risks will be assessed and logged into the Risk Register.
- During Construction, the identified risks will be monitored, and the corresponding risk response action plan will be implemented with approval from the Project Manager.

1-4 What is meant by "Risk"?

The meaning of the term "risk" must be understood clearly for effective project risk management. In the context of a project, we are concerned about potential impacts on project objectives such as cost and schedule. A general definition of "risk" in this context is:

> ***"Risk is an uncertain event that if occurs, has a positive or negative effect on the project objectives."***

The uncertainty may be about a future event that may or may not happen and the unknown magnitude of the impact on project objectives if it does happen. Thus, a "risk" is characterized by its probability of occurrence and its uncertain impact on project objectives.

The kinds of risks appearing in a Risk Register are shown below based on when they might occur during the life cycle of a project.

- A future event that may occur at any time in a project's lifecycle is a risk. It has a probability of occurrence and an uncertain impact if it does occur.
- During Concept Development and Preliminary Engineering, uncertainty in the total cost estimate, due to uncertain quantities and unit prices is a risk. In this case, the probability is 100% (the estimate and its uncertainties exist), and the uncertainties impact the project cost.
- During Construction, a Notice of Potential Claim (NOPC) has a probability of becoming a Contract Change Order (CCO) and an uncertain cost/schedule impact if this happens. This risk is retired from the register if the claim is dismissed or if it is replaced by a CCO.
- During Construction, a CCO which has occurred (100% probability) is a risk, but its cost/schedule impact may be uncertain. If there is an estimate in the CCO Log of the project, the uncertainty is expressed as a range around the estimate. This risk is retired from the register when the CCO is executed with the contractor.

These examples are collectively referred to as "risks" in this Guideline and would all be included, when applicable, in the project's Risk Register because they contain uncertainty that affects project objectives.

Specifics about identifying risks are included in Section 3, along with examples of risk statements.

Risk vs. Issue

Risk and issue are two words that are often confused when it comes to their usage. Actually, there is some difference between them.

> ***A risk is an uncertain event that has a probability and an impact associated with it.***
>
> ***Issues are problems right now that the Project Manager has to do something about.***

Think of project risk management as a proactive effort, while issue management is reactive.

1-5 Project Risk Management Process

The Basic Process

Although the specifics may differ depending on the project, project risk management has three important parts; identification, analysis and action. Before risk can be properly managed, it must first be identified, described, understood and assessed. Analysis is a necessary step, but it is not sufficient; it must be

followed by action. A formal risk management process which does not lead to implementation of actions to deal with identified risks is incomplete and useless. The ultimate aim is to manage risk, not simply to analyze it.

The project risk management process is not difficult. It simply offers a structured way to think about risk and how to deal with it. A formal project risk management process includes these components:

***Risk Planning* -** Deciding how to approach, plan and execute the risk management activities for a project.

***Risk Identification* -** Determining which risks might affect the project and documenting their characteristics.

***Risk Analysis* -** Prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and magnitude of impact.

***Quantitative Risk Analysis* -** Analyzing probabilistically the effect of identified risks on overall project objectives.

***Risk Response Planning* -** Developing options and actions to enhance opportunities and to reduce threats to project objectives.

***Risk Monitoring and Control* -** Tracking identified risks, monitoring residual risks, identifying new risks, executing risk response action plans and evaluating their effectiveness throughout the project life cycle.

At its foundation, project risk management involves asking and answering a few simple questions:

Process Component	Simple Question
Risk Planning	What's the appropriate level of risk management for this project?
Risk Identification	What risks might negatively or positively affect achieving the project objectives?
Risk Analysis	What is the probability and impact of the risk occurring?
Quantitative Risk Analysis	How could these affect the project in terms of cost and schedule?
Risk Response Planning	What can be done about it?
Risk Monitoring	Having taken action, how did the responses effect change, and where is the project now?
Risk Communication	Who needs to know about this?

While these questions are listed sequentially and are usually conducted in this order, they are often combined, repeated as the project progresses or may even be performed out of sequence. The questions constitute a process indicating how the different elements of project risk management interact and describe how risk management can be implemented.

Risk Management Deliverables by CPD Phase

Within each CPD Phase, Risk Management deliverables are produced. Some of these deliverables are produced in one phase and updated in subsequent phases. Risk Management deliverables are produced to plan, identify, analyze and manage the risks within a project. The following are key Risk Management deliverables produced during the CPD process:

- Risk Register (updated throughout the CPD process)
- Major Risks (within the Alternatives Matrix)
- Quantitative Risk Analysis Worksheet
- Quantitative Risk Analysis Report
- Risk Summary (within CD Report)
- Risk Summary (within PE Report)
- Risk Report (within FD Submission)

Risk Management Implementation

A Risk Management Implementation Plan is included on the Risk Management Process Summary webpage to assist Project Managers integrate risk management into current projects.

1-6 Project Delivery Approach

Risk management requirements may vary depending upon the specific CPD process approach. Capital projects utilizing the Limited Scope Delivery Approach are generally smaller, less complex and have fewer impacts than projects that utilize the Standard Project Delivery Approach. As such, it is conceivable that Limited Scope Delivery Approach projects should have less project risks. To that end, Table 1 indicates the risk management requirements for each delivery approach.

TABLE 1 – RISK MANAGEMENT REQUIREMENTS BY DELIVERY APPROACH

Delivery Process	Risk Management Requirement
Limited Scope Delivery Approach	Risk Register encouraged (Required on Bridge Deck/Superstructure Replacement Projects)
Standard Project Delivery Approach	Risk Register required

The above-referenced requirements are minimum requirements. On a project-by-project basis, the Project Manager, with concurrence from the Executive Regional Manager, may decide it is prudent to utilize the Risk Register on Limited Scope Projects based on size, complexity, impacts and anticipated risks. One of the main considerations for utilizing a Risk Register on Limited Scope Projects involves anticipated constructability risks (e.g., staged construction, detours, work zone access, Utility Proximity Act). Because of these constructability risks, a Risk Register is required on Bridge Deck/Superstructure Replacement Projects.

Other factors that the Project Manager should consider to determine what level of risk management effort is needed may include:

- Political sensitivity
- The type of the project
- Location of the project and the community it serves
- Duration of the project
- Stakeholders of the project

- The sponsor's sensitivity to the primary objectives of the project (cost and schedule)

1-7 Organization

Under the direction of the Project Manager, the Designer, through consultation with SMEs, is responsible for performing, updating and reviewing risk management work. On complex or very high risk projects (generally over $100 million), the Project Manager may obtain the services of an independent Project Risk Manager or form a Project Risk Team.

Project Risk Team Members should collectively have all of the expertise required to identify, assess and respond to the risks of the project; however, they should not hesitate to draw on the extensive talent pool available to the project for assistance. Representatives from other agencies, if any, may be invited to participate at Project Risk Team Member meetings to ensure that all parties are fully informed and thus avoid surprises.

Discussing Risks as a Team has Value

Conducting risk management meetings as a team has value. The team listens to its members discuss risks, and the team can provide input from different perspectives. This cannot occur in one-on-one discussions of risk.

In discussing risks, the work of individual team members can have an impact on the work of the rest of the team. Listening to team members, and discussing their challenges, provides a greater likelihood that the impact of a risk will be assessed properly.

1-8 Roles and Responsibilities

TABLE 2 – RISK MANAGEMENT ROLES AND RESPONSIBILITIES

Project Manager	• *Based on project complexity and size, and with input from the Executive Regional Manager, determine the:* ○ Appropriate level of risk management to be used ○ Need for a formal project Risk Management Plan • *Promote and direct risk management for the project* ○ Populate and maintain the project Risk Register with risks developed by the Designer and SMEs ○ Complete each field for each risk within the Risk Register through Designer and SME consultation ○ Ensure proactive responses to all risks (threats and opportunities) that will impact the successful delivery of the project ○ Perform risk monitoring and updating ○ Elevate major risks to the Executive Regional Manager for resolution, as necessary

	○ Inform the Executive Regional Manager about major risk management concerns ○ Schedule and conduct project risk meetings, as needed ○ Compile the lessons learned in the area of risk management
Executive Regional Manager	• Assist Project Manager with the implementation of risk management requirements • Provide risk management direction and assistance • Obtain expert risk management services, as needed • Consult with the Project Manager on significant risk management issues
Initial Risk Owners	• Identify risks • Assess and suggest appropriate risk response strategies and action plans for assigned risks
Project Risk Team Members (on Projects over $100 million)	• Assist Project Manager with the implementation of risk management requirements on projects over $100 million • Provide risk management direction and assistance • Identify and assess risks • Suggest appropriate risk response strategies • Develop risk response action plans
Designer	• All of the Project Risk Team Members responsibilities *plus*: ○ Avoid risks through responsible design, if possible ○ Produce contract documents that implement the risk response strategies
Contractor	• Implement appropriate risk response strategies and action plans, if needed • Assume project risks that have been transferred via the contract documents • Inform RE of any new risks during Construction
Risk Management Support Group	• Assist Project Manager and Designer • Assist Project Risk Team Members • Provide guidance on utilizing risk management tools • Review the Risk Report included within the Final Design Submission

1-9 Risk Communication and Accountability

Communication and consultation with Initial Risk Owners is a crucial factor in undertaking good risk management and in achieving project outcomes. It helps everyone understand the risks and trade-offs that must be made in a project. Effective risk communication ensures that all parties are fully informed.

Although risks can and should be discussed with Initial Risk Owners and the Executive Regional Manager at any time during the course of a project, it is desirable to have the Project Manager establish periodic "risk communication checkpoints" to ensure that the project does not unnecessarily proceed on a course of action that may not be feasible and may be changed later. Risk communication checkpoints aid in the Project Manager's ability to achieve project accountability.

Detailed information regarding NJDOT risk communication will be provided in this Section at a later date.

1-10 Risk Reporting

Regular reporting is an important component of communication. Reports on the current status of risks are an important part of the formal risk management process.

Detailed information regarding NJDOT risk reporting will be provided in this Section at a later date.

Section 2 - Risk Planning

2-1 Risk Planning Overview

Risk planning can either occur in the Problem Screening phase or at the beginning of the Concept Development phase. Risk planning ensures that the level, type and visibility of project risk management are commensurate with both the risk and importance of the project to NJDOT. The Project Manager, with concurrence from the Executive Regional Manager, will:

- Determine the correct level of risk management for the project
- Decide who will be Project Risk Team Members, if applicable
- Determine the necessity for a formal Risk Management Plan
- Establish the appropriate frequency of risk meetings, if applicable
- Determine the desired risk communication checkpoints
- Ensure that the correct amount of risk management activities are included in the project's Scope Statements

2-2 Risk Management Plan

A Risk Management Plan defines the level of risk management to be performed on a project and the frequency of risk management meetings. It lists the Project Risk Team Members (if applicable) involved in the project and sets a budget and schedule for additional risk management work efforts or activities. The Risk Management Plan also ensures a clear trail regarding the risk structure and assumptions and the reasons for particular risk judgments and decisions.

A formal Risk Management Plan is not required for all CPD projects; however, CPD projects over $100 million should have a project-specific Risk Management Plan. A project-specific Risk Management Plan is a standalone document that expands upon the information included within "Section 2.8 - Risk Management" of the Project Management Plan template. The Risk Management section of the Project Management Plan documents any atypical risk management requirements needed to ensure reasonable

and appropriate risk management is followed. A Project Management Plan is recommended for all CPD projects. A Risk Management Plan template is included on the Risk Management Process Summary webpage.

2-3 First Project Risk Management Meeting

Based on the complexity of the project or as directed by the Project Manager (typically on projects over $100 million), a Project Risk Meeting may be held. The first time that the Project Risk Team Members meet, the Project Manager should brief the team on the following:

- The importance and objectives of the project risk management process
- The roles and responsibilities
- The Risk Register
- The communication check points
- Key risk management activities in the project schedule
- The expectation that risk will be managed, documented and reported

Section 3 - Risk Identification

3-1 Risk Identification Overview

Risk identification determines *what* might happen that could affect the objectives of the project and *how* those things might happen. Although it can occur throughout all phases of the CPD process, it is most likely to occur during the Problem Screening, Concept Development and Preliminary Engineering phases. Risk identification is an interactive process because new risks may become known as the project progresses through its life cycle, previously-identified risks may drop out and other risks may be updated.

3-2 Threats or Opportunities

The concept of risk can include positive and negative impacts. This means that the word “risk” can be used to describe uncertainties that, if they occurred, would have a positive or helpful effect. The same word can also describe uncertainties that, if they occurred, would have a negative or harmful effect. In short, there are two sides to risk: threats and opportunities.

Projects in planning and development stages have the greatest potential for opportunities because the project is still open to changes. Risk reduction and avoidance are opportunities, as are value analyses, constructability reviews and innovations in design, construction methods and materials.

Once a project enters Construction, the project objectives (scope, schedule and cost) are fixed contractually, so opportunities to save money and time are fewer. Any changes must be made using a Contract Change Order (CCO), and only a negative CCO such as one resulting from a Value Engineering Construction Proposal by the contractor would still afford an opportunity to save money and time. Otherwise, CCOs add cost and/or time to the project. So, the focus of risk management during construction is on reducing or eliminating risks.

3-3 Risk Register

A Risk Register is a tool that the Project Manager and Designer can use to address and document project risks throughout the project life cycle. It is a living document that includes a comprehensive listing of risks and the manner in which they are being addressed as part of the project risk management process. A Risk Register template is included on the Risk Management Process Summary webpage.

Why use a Risk Register?

Subject Matter Experts and their representatives (Initial Risk Owners) are identified for every specific project and disbanded when the project is completed. Although not desirable, these Initial Risk Owners sometimes change, and the project experiences change over the course of the project. Communication between the Project Manager and Initial Risk Owners about project objectives (scope, schedule and cost) is vital. The Risk Register communicates project risks and helps the Initial Risk Owners understand the status of the risks as a project moves from inception toward completion.

When to use a Risk Register

The project-specific Risk Register should be prepared by the Project Manager when risks are identified. This can be as early as the Problem Screening phase. If not prepared in Problem Screening, the Risk Register should be prepared at the beginning of the Concept Development phase.

When clear direction is given by the Core Group on a draft PPA, the Project Manager should instruct the Designer to populate the Risk Register with the associated risks for the draft PPA. Thereafter, the Risk Register should be continuously used to document, assess and plan for project risks.

While populating the Risk Register with the associated risks for the draft PPA, the Designer should also utilize the Sample Risk List. The Sample Risk List is a guidance document that provides a list of positional risks categorized by specific NJDOT functional areas (e.g., access, survey, utilities). It is not intended as an exhaustive list, nor is it a substitute for other methods of identifying risks. The Sample Risk List provides the Project Manager and Designer with common risks that can be applied to projects to simplify the identification process and will be continually updated to include new risks identified through lessons learned. The Sample Risk List is included on the Risk Management Process Summary webpage.

How to use a Risk Register

A Risk Register is best utilized as a living document throughout the project's entire life cycle, from Problem Screening through Construction, to record the evolution of project risks. There is no prescription for how extensive a project's Risk Register should be completed. The Project Manager, with input from the Executive Regional Manager and Designer, decides the most beneficial use of the Risk Register, with the objective of minimizing the adverse risk impacts and maximizing beneficial risks.

TABLE 3 - RISK REGISTER FIELDS AND DESCRIPTIONS

Field	Field Description
Risk Rank	The rank of each risk compared to other risks that is based on the final risk score.
Unique Risk ID #	A unique identifying number for each risk.

Risk Statement	A description of the event and its potential impacts on the project if this risk were to occur. See Section 3-4 for the structure of the risk statement.
Initial Risk Owner	The functional area representative or SME, as designated by the Project Manager, who is responsible for risk analysis and risk response planning for a designated risk. (e.g., Environmental, Access, ROW, Construction)
Risk May Occur In	The CPD phase in which the risk may occur.
Risk Probability	The probability that the risk may occur.
Risk Impact - Schedule	The estimated schedule impact should the risk occur.
Risk Impact - Cost	The estimated cost impact should the risk occur.
Schedule Score	The product of the numeric value of the probability multiplied by the numeric value of the schedule impact.
Cost Score	The product of the numeric value of the probability multiplied by the numeric value of the cost impact.
Final Score	The sum of the schedule score and the cost score.
Risk Response Strategy	The strategy applied to managing risk.
Risk Response Action Plan	The specific risk action plan based upon the determined strategy that is implemented if the risk occurs.
Final Risk Owner	The stakeholder who owns the risk after the risk response strategy is implemented.
Action Plan Status	The current status of the risk response action plan.
Risk Last Updated	Date that the risk information was last updated.

Note: The Risk Register template does not contain a field for the risk "trigger," because many risks do not have a clear trigger. So as not to take space from a crowded Risk Register, if a trigger is identified for a risk, it should be described in relation to the risk response.

3-4 Identifying Project Risks

Risk identification documents risks that might affect the project and their characteristics of probability and impact. A common challenge in risk identification is avoiding confusion between *causes* of risk, genuine *risks* and the *effects* of risks. A risk may have one or more causes and, if it occurs, one or more effects.

- *Causes* are definite events or sets of circumstances which exist in the project or its environment, and which give rise to uncertainty. Examples include the need to use an unproven new technology, the lack of skilled personnel, or the fact that the organization has never done a similar project before. Causes themselves are not uncertain since they are facts or requirements, so they are not the main focus of the risk management process.
- *Risks* are uncertainties which, if they occur, would affect the project objectives either negatively (threats) or positively (opportunities). Examples include the possibility that planned completion targets might not be met, escalation rates might fluctuate, or the chance that requirements may be

misunderstood. These uncertainties should be managed proactively through the risk management process.

- *Effects* are unplanned variations from project objectives, either positive or negative, which would arise as a result of risks occurring. Examples include early milestone completion, exceeding the authorized budget, or failing to meet agreed quality targets. Effects are contingent events, unplanned potential future variations which will not occur unless risks happen. As effects do not yet exist, and they may never exist, they cannot be managed directly through the risk management process.

Including causes or effects in a list of identified risks obscures genuine risks, which may not receive the appropriate degree of attention they deserve. One way to clearly separate risks from their causes and effects is to use a description with required elements to provide a three-part structured "risk statement": "As a result of <*definite cause*>, <*uncertain event*> may occur, which would lead to <*effect on objective(s)*>."

Examples include:

- "As a result of using a new technology (definite cause), unexpected design problems may occur (uncertain risk), which would lead to overspending on the project (effect on objective)."

- "Because our organization has never done a project like this before (definite cause), we might misunderstand the requirements (uncertain risk), and our project would not meet the performance criteria (effect on objective)."

TABLE 4 - EXAMPLES OF RISK STATEMENTS

Functional Area	Risk Statement
Survey	Inaccuracies or incomplete information in the survey file could lead to rework of the design.
Environmental	A design change that is outside the parameters contemplated in the Environmental Document triggers a supplemental Environmental Reevaluation (ER) which causes a delay due to the public comment period.
	Potential lawsuits may challenge the Environmental Document, delaying the start of construction or threatening loss of funding.
	Nesting birds, protected from harassment under the Migratory Bird Treaty Act, may delay construction during the nesting season.
Right of Way	Due to the complex nature of the staging, additional ROW or construction easements may be required to complete the work as contemplated, resulting in additional cost to the project.
	Due to the large number of parcels and businesses, the condemnation process may have to be used to acquire ROW, which could delay start of construction by up to one year and increase construction costs.

Construction	Hazardous materials encountered during construction will require an on-site storage area and potential additional costs to dispose.
	Unanticipated buried man-made objects uncovered during construction require removal and disposal, resulting in additional costs.

At the risk identification stage, the impacts on cost and schedule are not analyzed – that happens in the qualitative risk analysis (Section 4) or quantitative risk analysis (Section 5) processes.

The Designer, along with Initial Risk Owners, identifies the potential risks (threats and opportunities) using any combination of:

- Brainstorming
- Challenging of assumptions
- Looking for "newness" (e.g., new materials, technologies or processes)
- Their knowledge of the project or similar projects
- Consultation with others who have significant knowledge of the project or its environment
- Consultation with others who have significant knowledge of similar projects
- The experience of project stakeholders or others in the organization
- The Sample Risk List

In identifying risks, the team considers and documents:

- What may happen or not go according to plan?
- What the impacts to the project objectives would be should the risk arise?
- What the assumptions and current status are that support the assessment of the risk?
- What action, if any, has been taken to respond to the risk?
- What further options might be available for responding to the risk?

Once the identified risk is approved by the Project Manager, the risk is entered into the Risk Register. Each risk is assigned to the applicable SME or representative within a functional area (Environmental, Access, etc.) who becomes the Initial Risk Owner. The Risk Register is reviewed and updated throughout the project.

Utility Risk Assessment Plan

Claims and change orders involving utility impacts have a significant effect on the overall Capital Program Management budget. To help reduce the effect and overall impacts during Construction, a Utility Risk Assessment Plan has been developed.

The Utility Risk Assessment Plan is a risk management tool that is initiated during Concept Development by the Designer to identify significant utility risks and modified during Preliminary Engineering to show mitigated risks and unavoidable impacts/risks. The Utility Risk Assessment Plan shows all known utilities within the project limits and identifies, documents and addresses utility related project risks with significant cost and schedule implications. If project specific utility risks are identified, the Designer informs the Project Manager to consider adding these risks to the Risk Register.

As the project advances to Preliminary Engineering, the Utility Risk Assessment Plan is modified to reflect utility solutions as they evolve and identifies utility related action items. During Final Design, the

plan will be used to develop utility construction plans, utility construction staging plans and the utility constraint plan for use during construction to implement risk mitigation measures.

A Utility Risk Assessment Plan template is included on the Risk Management Process Summary webpage.

Section 4 - Risk Analysis

Risk analysis includes methods for prioritizing the identified risks for further action, such as risk response. By focusing on high-priority risks, the Project Manager may improve the project's performance.

The Project Manager should revisit risk analysis during the project's lifecycle. When analysis for individual risks is reevaluated, trends may emerge in the results. These trends can indicate the need for more or less risk management action on particular risks or even show whether a risk mitigation plan is working.

4-1 Performing Risk Analysis

Risk analysis is performed on all risks listed in the Risk Register. The analysis consists of determining the risk probability and impact. Determining risk probability and impact sounds complicated, but the concept is actually something that most people use in their everyday life.

Each potential risk event is evaluated based on the likelihood that it will occur. It is also separately evaluated regarding how much of a threat or opportunity would be created if it were to occur.

Since this evaluation can be very subjective without parameters, an Impact Definition Table was created with schedule and cost definitions for each category. Theses definitions "quantify" the impacts. The schedule definitions quantify the impacts in terms of schedule improvement or slippage (months increase or decrease). The cost definitions quantify the impacts in terms of percentage of cost increase or decrease.

The Project Manager or Designer utilizes the Impact Definition Table to determine the appropriate probability and impact for each risk.

TABLE 5 – IMPACT DEFINITIONS

Impact Definitions					
Rating -->	**Very Low = 1**	**Low = 2**	**Moderate = 4**	**High = 7**	**Very High = 10**
Cost Impact of Threat	Insignificant cost increase	<5% cost increase	5-10% cost increase	10-20% cost increase	>20% cost increase
Cost Impact of Opportunity	Insignificant cost reduction	<1% cost decrease	1-3% cost decrease	3-5% cost decrease	>5% cost decrease
Schedule Impact of Threat	Insignificant slippage	<1 month slippage	1-3 months slippage	3-6 months slippage	>6 months slippage
Schedule Impact of Opportunity	Insignificant improvement	<1 month improvement	1-2 months improvement	2-3 months improvement	>3 months improvement
Probability	1–9%	10–19%	20–39%	40–59%	60–99%

The impact definition for each field is correlated to a numeric value (i.e., Very Low = 1, Low = 2, Moderate = 3, High = 7, and Very High = 10). The percent of probability is also correlated to a numeric value (i.e., Very Low = 1, Low = 2, Moderate = 3, High = 4, and Very High = 5). These numeric values are used in Table 6 - Risk Matrix.

TABLE 6 – RISK MATRIX

Risk Matrix							
Probability Rating	**Very High**	**5**	**5**	**10**	**20**	**35**	**50**
	High	**4**	**4**	**8**	**16**	**28**	**40**
	Moderate	**3**	**3**	**6**	**12**	**21**	**30**
	Low	**2**	**2**	**4**	**8**	**14**	**20**
	Very Low	**1**	**1**	**2**	**4**	**7**	**10**
			1	**2**	**4**	**7**	**10**
			Very Low	**Low**	**Moderate**	**High**	**Very High**
			Impact Rating				

The Risk Matrix is used to calculate the Schedule Score and Cost Score in the Risk Register.

For example: If a risk has a 15% probability of occurring, the probability level is low (a numeric value of 2). If the risk also has a potential threat impact to delay the project schedule by 5 months, the impact level is High (a numeric value of 7). The resulting Schedule Score would be a 14 (2*7=14). This score represents a medium risk level. The risk color in the Risk Matrix represents the following risk levels:

Green	**Low Risk**
Yellow	**Medium Risk**
Red	**High Risk**

The higher the risk score, the higher the risk level associated with the risk that is being analyzed. The color of the risk (red, yellow, green) is simply meant to bring attention to high impact risks and provide a

comparison to other project risks. The Project Manager may decide to appropriately alter risk response strategies and action plans based upon the risk score and associated color.

4-2 Entering Risk Analysis Data into Risk Register

The Project Manager or the Designer utilizes the Impact Definitions table to determine the appropriate probability and impact for the risk. Select the appropriate risk probability (from the drop down box) and the appropriate impact to both schedule and cost. When the impact and cost field values are selected, the system will populate the Risk Analysis Matrix section in the Risk Register with the corresponding numeric values for the schedule, cost and final scores.

4-3 Alternative Risk Analysis

During Concept Development, alternatives are developed to address the purpose and need of the transportation deficiency. Each alternative has characteristics and impacts (e.g., utility impacts, ROW acquisitions, environmental impacts). These characteristics and impacts are included within the Alternatives Matrix. Within the Alternatives Matrix the Major Risks are listed for each alternative so that risks can be considered when selecting the PPA. Major Risks specific to each alternative should not be included within the Risk Register. Once the PPA is selected, the Major Risks for the PPA are transferred to the Risk Register to calculate probability and impact.

Section 5 - Quantitative Risk Analysis

Quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and schedule objectives. If approved by the Project Manager and concurred with by the Executive Regional Manager, the Designer performs quantitative risk analysis for projects with a total construction cost over $100 million. Quantitative Analysis may be performed on projects under $100 million if approved by the Project Manager.

Utilizing the Quantitative Risk Analysis Worksheet, the Designer includes each major risk for each alternative. If needed, the Designer may utilize the Sample Risk List when populating the Quantitative Risk Analysis Worksheet. For each risk that is added to the worksheet, the Designer calculates the probability of occurrence and magnitude of schedule and cost impact. For each risk that has a high or very high probability of occurrence and a high or very high magnitude of impact, the Designer performs quantitative risk analysis. Quantitative risk analysis results in a more accurate estimation of probability of occurrence and a numerical value in days of schedule impact and dollars of cost impact.

5-1 Quantifying the Risks

Quantitative risk analysis provides the Project Manager and Core Group with additional cost and schedule impact information to assist in selecting the PPA. Methods to quantify cost and schedule impacts vary, and the Designer and Project Manager should determine how best to calculate these impacts.

The quantitative risk analysis is documented in the Quantitative Risk Analysis Report. A Quantitative Risk Analysis Worksheet template is included on the Risk Management Process Summary webpage.

Section 6 - Risk Response Planning

Risk Response Planning is the process of developing strategic options and determining actions to enhance opportunities and reduce threats to the project's objectives. An Initial Risk Owner is assigned to take responsibility for each risk response strategy and action plan. This process ensures that each risk requiring a response has an owner monitoring the responses, although the owner may delegate implementation of a response to someone else.

6-1 Risk Response Strategies

The following are the response strategies for threats and opportunities:

For Threats

***Avoid Threat* -** Risk can be avoided by removing the cause of the risk or executing the project in a different way while still aiming to achieve project objectives. Not all risks can be avoided or eliminated, and for others, this approach may be too expensive or time-consuming. However, this should be the first strategy considered.

***Transfer Threat* -** Transferring risk involves finding another party who is willing to take responsibility for its management, and who will bear the liability of the risk should it occur. The aim is to ensure that the risk is owned and managed by the party best able to deal with it effectively. Risk transfer usually involves payment of a premium, and the cost-effectiveness of this must be considered when deciding whether to adopt a transfer strategy.

***Mitigate Threat* -** Risk mitigation reduces the probability and/or impact of an adverse risk event to an acceptable threshold. Taking early action to reduce the probability and/or impact of a risk is often more effective than trying to repair the damage after the risk has occurred. Risk mitigation may require resources or time and thus presents a tradeoff between doing nothing versus the cost of mitigating the risk.

For Opportunities

***Exploit Opportunity* -** The aim is to ensure that the opportunity is realized. This strategy seeks to eliminate the uncertainty associated with a particular upside risk by making the opportunity definitely happen. Exploit is an aggressive response strategy, best reserved for those "golden opportunities" having high probability and impacts.

***Share Opportunity* -** Allocate risk ownership of an opportunity to another party who is best able to maximize its probability of occurrence and increase the potential benefits if it does occur. Transferring threats and sharing opportunities are similar in that a third party is used. Those to whom threats are transferred take on the liability and those to whom opportunities are allocated should be allowed to share in the potential benefits.

***Enhance Opportunity* -** This response aims to modify the "size" of the positive risk. The opportunity is enhanced by increasing its probability and/or impact, thereby maximizing benefits realized for the project. If the probability can be increased to 100 percent, this is effectively an exploit response.

For Threats and Opportunities

Accept Threat or Opportunity **-** This strategy is adopted when it is not possible or practical to respond to the risk by the other strategies, or a response is not warranted by the importance of the risk. When the Project Manager and Initial Risk Owners decide to accept a risk, they are agreeing to address the risk if and when it occurs. A contingency plan, work around plan and/or contingency reserve may be developed for that eventuality.

6-2 Responding to Risks

Following identification and analysis of project risks, the Project Manager takes action in response to the risks to improve the odds in favor of project success. Ultimately, it is not possible to eliminate all threats or take advantage of all opportunities – but they will be documented to provide awareness that they exist and have been identified. Successful risk response will change the risk profile throughout the project life cycle, and risk exposure will diminish.

Risk Response Planning involves:

- The Project Manager, with input from the Initial Risk Owner, determines which risk response strategy is best for each risk.
- The Initial Risk Owner recommends a risk response action plan to the Project Manager. The acceptable plans are entered into the Risk Register.
- The risk response action plan is enacted when the risk trigger occurs.

TABLE 7 - EXAMPLES OF RISK RESPONSE ACTION PLANS

(Table 7 repeats the example risk statements from Table 4 and shows a risk response for each.)

Functional Area	Risk Statement	Risk Response Strategy	Risk Response Action Plan
Survey	Inaccuracies or incomplete information in the survey file could lead to rework of the design.	Mitigate	Work with Survey to verify that the survey file is accurate and complete. Perform additional surveys as needed.
Environmental	A design change that is outside the parameters contemplated in the Environmental Document triggers a supplemental ER which causes a delay due to the public comment period.	Avoid	Monitor design changes against the Environmental Document to avoid an ER unless the opportunity outweighs the threat.
	Potential lawsuits may challenge the Environmental Document, delaying the start of construction or threatening loss of funding.	Mitigate	Address concerns of stakeholders and public during environmental process. Schedule additional public outreach.

	Nesting birds, protected from harassment under the Migratory Bird Treaty Act, may delay construction during the nesting season.	Mitigate	Schedule contract work to avoid the nesting season or remove nesting habitat before starting work.
ROW	Due to the complex nature of the staging, additional ROW or construction easements may be required to complete the work as contemplated, resulting in additional cost to the project.	Mitigate	Re-sequence the work to enable ROW Certification.
	Due to the large number of parcels and businesses, the condemnation process may have to be used to acquire ROW, which could delay start of construction by up to one year and increase construction costs.	Mitigate	Work with the ROW Bureau and Project Management to prioritize work and secure additional ROW resources to reduce impact.
Construction	Hazardous materials encountered during construction will require an on-site storage area and potential additional costs to dispose.	Accept	Ensure storage space will be available.
	Unanticipated buried man-made objects uncovered during construction require removal and disposal, resulting in additional costs.	Accept	Include a Supplemental Work item to cover this risk.

Chapter 7 - Risk Monitoring and Control

7-1 General Monitoring and Control Concepts

Continuous monitoring by the Project Manager ensures that new and changing risks are detected and managed and that risk response actions are implemented and effective. Risk monitoring and control keeps track of the identified risks, residual risks and new risks. It also monitors the execution of planned strategies for the identified risks and evaluates their effectiveness.

Risk monitoring and control continues for the life of the project. The list of project risks changes as the project matures, new risks develop or anticipated risks disappear. Risk ratings and prioritizations can also change during the project lifecycle.

Typically, during project execution, risk meetings should be held regularly to update the status of risks and/or add new risks in the Risk Register. Periodic project risk reviews repeat the process of identification, analysis and response planning.

If an unanticipated risk emerges, or a risk's impact is greater than expected, the planned response may not be adequate. The Project Manager should coordinate the development of additional responses to control the risk.

Monitoring also determines whether:

- Initial Risk Owners are performing periodic risk reviews and updating appropriately
- Risk management policies and procedures are being followed
- The remaining contingency reserves for cost and schedule are adequate

It may involve recommending:

- Alternative risk responses
- Implementing a contingency plan
- Taking corrective actions
- Changing the project objectives

7-2 Risk Review and Updating

Periodically, the Project Manager may convene the Designer and Initial Risk Owners to review the project's Risk Register and update risk response strategies and action plans. This review should include the following tasks:

- Review the execution of risk response actions and evaluate their effectiveness
- Re-assess existing risks, verify that the assumptions are still valid and modify the previous assessments as necessary
- Assign additional risk response efforts to the Initial Risk Owner
- Retire risks whose opportunity to impact the project has elapsed, or whose residual impact on the project is deemed to have reached an acceptable level

7-3 Specific NJDOT Risk Monitoring and Control Guidance

Specific NJDOT risk monitoring and control information and guidance has not been developed yet.

Appendix A: Definitions

Initial Risk Owner - The functional area representative or SME, as designated by the Project Manager, who is responsible for risk analysis and risk response planning for a designated risk.

Project Life Cycle - All phases of project delivery, from project initiation to project close-out.

Project Manager - Facilitates the risk management process and acts as gatekeeper for the Risk Register.

Project Objectives - The agreed upon delivery targets, such as cost, schedule and scope.

Project Risk - An uncertain event or condition that, if it occurs, has a positive or a negative effect on at least one project objective.

Project Risk Management - A process for identifying, communicating and managing project risks through all phases of project delivery.

Quantitative Risk Analysis - The process of probabilistically analyzing the cost and schedule effects of identified risks on overall project objectives.

Risk - An uncertain event or condition that, if it occurs, has a negative or positive effect on at least one project objective.

Risk Analysis - The process of assessing and prioritizing risks; sometimes referred to as qualitative risk analysis.

Risk Register - A document that contains the results of a qualitative risk analysis and/or a quantitative risk analysis and a risk response and action plan.

Risk Response - Actions taken to enhance opportunities and reduce threats to the achievement of project objectives.

Scalable Approach - Provides the minimum level of effort of project risk management that is appropriate to a particular project depending on its size and complexity.

Utility Risk Assessment Plan - A plan sheet that documents all known utilities within the project limits and identifies, documents and addresses utility related project risks with significant cost and schedule implications.