

WBS 8.7 SUSTAINABLE HOME CONSTRUCTION PROJECT:
PROJECT MANAGEMENT PLAN - FINAL DELIVERABLES

Risk Management Plan

From PMGT501

By

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WBS 8.7

Sustainable Home Construction Project: Week 8 Final Deliverables

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Risk Management Plan and PERT Analysis

Purpose

This document defines the processes for conducting risk management activities for development of the project. The risk management plan establishes policy, disseminates guidance and communicates procedures to ensure the most effective use of risk management techniques within the project. A project's own people, process, and technologies can be contributors to increased risk. Economics, as well as environmental, social and political issues are sources of external risk. Risk management requires proactive risk identification, analysis, mitigation and documentation procedures and must incorporate the project team, subcontractors and key stakeholders to meet project objectives. This plan is guided by the project scope statement, cost management plan, schedule management plan, and communications plan.

Scope

The scope of this document provides risk focus for the project team on project activities including schedule, cost, and technical project aspects; and identifies parties for which some risk responsibilities will contractually be transferred. This effort involves identification, analysis, mitigation, and management of internal and external threats.

Objectives

1. The total cost of the project, including management reserve, will not exceed the \$1M.
2. The total duration of the project, including management reserve, will not exceed 9 mos.
3. Quality and scope requirements will be met, unless changes are approved through formal change order process.

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Supporting Products

The project's management plan and scope provides general guidance related to the project team's management approach, quality and budgetary goals as well as scheduling guidance. The International Building Code and minimal quality requirements as referenced in the quality management plan for this project. Stakeholders and subcontractors provide input on risk assessment continually which will be documented and become part of the project support.

Referenced Products

Referenced documents include:

- 1) Project Management Plan and Budget
- 2) Project Work Breakdown Structure (WBS)
- 3) ICC IBC (2012): International Building Code
- 4) A Guide to the Project Management Body of Knowledge

Roles and responsibilities

Risk Originator:

Risk originators are any project team member, subcontractor, stakeholder and customer involved in this projects activities who identify a risk which could affect the outcome of the project scope.

Risk Owner:

Person or entity responsible to control, mitigate, or avoid risks, as well as execute responses. The risk owner must develop and document a risk resolution action, meet resource and timeline requirements as established in project documents, immediately communicate any deviations from documented requirements to the PMO and update the risk management tracking sheet status of risks resolution.

Functional Teams/Subcontractors:

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Any group performing work within the project. Functional teams and subcontractors will analysis risks, determine addressable cause, determine impact on implementation activities, and communicate the result of this analysis to the PMO within established timelines. Teams and subcontractors are responsible to effectively manage all risks inherent in the task for which they were obligated, and if unable to do so, must report to the PMO as soon as possible.

Project Management Office:

The PMO includes the administrative staff, project management team members and the project manager. These individuals are responsible to review and validate risk analysis and qualification as well as develop proposed mitigation solutions and closure criteria. They provide assistance to establish mitigation action, assign risk owner, and communicate time requirements for risk mitigation. The PMO reviews all activity documentation to ensure accuracy and completeness. The PMO reviews project risk activity weekly and disseminates risk assessment changes. The PMO also determines primary target severity levels, and the alternate methods and resources required to mitigate the risks

Project Manager:

The project manager (PM) or designated representative is responsible to coordinate with the stakeholder, customers and any outside organization to facilitate the project. They also approve the mitigation activities of high level risks and ensure communication of the status of these activities to appropriate offices. The PM is overall responsible for the project risk mitigation and management plan.

Support Tools

Project tools to manage risk include the risk register which will be used to communicate identified risks to the project team (see appendix). This document will be provided to

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stakeholders identified by the PM. The information from the risk register will be used to manage status of qualifying risk, maintain historical records and provide for post project review data.

Risk process review will be accomplished on a monthly basis by functional team leads who will communicate status of new and previously identified issues documented in the risk register.

Budgeting

Funding for this project will be in accordance with the project cost estimate established in the Budget Approach. Funding for mitigation for risks owned under contract by subcontractors will be the responsibility of the subcontractor. In the event subcontractors are unable to mitigate risks at their level they shall notify the project management team as soon as possible and not later than two weeks prior to the activity deadline. A budgetary management reserve has been established based on 25% of the established estimated cost, and will be available for distribution under the authority of the project manager following coordination with stakeholders and the customer. The management reserve may also be used to mitigate or avoid the effects of external risk with approval as listed previously.

Risk Management Methodology and Processes

The plan intentions are to mitigate or reduce the negative risks (“risks”). Exploiting the possibilities positive risks (“opportunities”) within the project will not be handled under this plan. Opportunities to reduce schedule or cost will be identified and handled under the Change Order process. Within this document the term “risk” will mean only negative risk. Risk management is an iterative process of addressing threats to the realization of project cost, schedule, quality, and other key performance objectives.

Risk management procedures include identification, analysis, assignment of responsibility, mitigation, and tracking of potential risks and emerging issues. Risks are adverse

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threats that have not yet materialized, while issues are risks that have materialized and begun to impact the project. The main risk management procedures are:

- 1) Identify risks and issues in a timely manner
- 2) Analyze severity and probability of risk factors
- 3) Plan mitigations to minimize impact on objectives
- 4) Implement risk and issue mitigations
- 5) Accept risk
- 6) Monitor and document risk / issue



Figure 1: Risk Management Process Steps

This section identifies the step-by-step risk management process utilized in this project. The iterative nature of the risk management process means that every activity should be reviewed for potential risks. Following identification, analysis and actions must be taken to resolve emerging issues. Risk management processes are integral to our project strategy and implementation. Figure 2 outlines the steps for risk management.

Identify Risks

Utilizing a Risk Breakdown Structure, the team will brainstorm risk ideas and submitted them to the PMO three weeks prior to the proposed project start date. Two weeks prior to project start the project management team, stakeholders, subcontractors, and customer will meet to discuss, evaluate and categorize identified risks. The PMO will forward the risk register to all team members not later than one week prior to the project start date.

All members of the project team are responsibility to identify and communicate potential risks. This process requires constant attentiveness to ensure accuracy. Proactive risk management relies on identification of potential risks prior to the risk materialization including evaluation of all project activities, internal and external which may impact the project cost,

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schedule and/or performance objectives. The risk register will be updated and forward as a report to the appropriate team lead and PMO (see appendix). Initial risk assessment can be accomplished by the team member using this sheet. Final assessment of the risk shall be accomplished by the PMO. If necessary the PMO will coordinate with risk owners to categorize identified risks. As defined in the communication plan, weekly reports will be sent to the PMO on all issues that arise. This will include mitigation of risks and completion of tasks.

If new risks are identified, the PM or PMO will forward information to the team and make an initial evaluation as to whether there is a need to meet to revise the risk mitigation plan. As risks are mitigated and tasks completed there will be no further need to report or evaluate the identified risks. Documentation of the results of the risk elevation shall be forward to the PMO upon completion of risk owner responsibilities and not later than two weeks prior to the established project complete date.

Analyze Risk

Two effective ways to establish the result of risk on a project are to evaluate the likelihood or the probability, of risk occurrence, and the impact, or the severity, of the negative effect if the risk occurs. Upon identification of a possible risk an initial analysis must be made and the risk register accomplished and forwarded. The PMO will evaluate and may decide to collaborate with the rest of the team to validate and create an execution plan for the risk. The weekly project team meeting serves as forum for disseminating risk information. During this meeting the impact of the risk across all functional areas will be discussed. The PMO then designates the risk owner. This process allows for multiple inputs on each activity and provides a broad level of review. This process not only aides in risk identification and qualification but also

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prioritizing risk resolution activities. The tools are used to assess qualitative and quantitative analyze risk are demonstrated in the following tables.

Table 1 provides guidelines to determine the probability of occurrence of the risk.

Table 1: Probability of Occurrence

Likelihood	Estimated Probability	Effect
Remote	5%	Negative outcome is almost non-existent
Unlikely	15%	Negative outcome is not likely
Even Chance	50%	Negative outcome is likely
Highly Likely	85%	Negative outcome is very likely
Near Certain	95%	Negative outcome is almost certain

Table 2 provides guidelines to assess impact on the project if the event occurs.

Table 2: Significance of Impact

Impact	Cost	Schedule	Quality
Low	Resolution expected to cost less than 5% of project budget	Minimal or no impact	No reduction in performance or structural integrity
Minor	Resolution expected to cost between 5% and 12% of project budget	Chance of missing checkpoints. No impact to project complete date	No reduction in performance to critical system or component functions
Moderate	Resolution expected to cost between 12% and 15% of project budget	checkpoints will not be met, Minor schedule slip of no more than 1 weeks to critical path activities	Does not meet LEED code objectives; may not pass initial inspection without minor resolution
Significant	Resolution expected to cost between 15% and 20% of project budget	Critical path affected by 2 week schedule slip. Will not meet checkpoints or milestones	Does not meet Project criteria or pass building code without Major redress
High	Resolution expected to cost 25% or more than of project budget	Will not meet activity delivery by 1 month schedule slip to critical path required	Does not pass building code or meet Scope requirements as documented

Once the risk is factored for the probability of occurrence and significance of impact from the tables above, it is plotted on the risk matrix, shown in Figure 2. Not only does this process help to prioritize risks, but it allows the team to understand which level of the

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organization can accept risk. Using this matrix we can place different risks into one priority listing for attention, mitigations, or funds allocation.

Impact	Remote	Unlikely	Even Chance	Highly Likely	Near Certain
High	5	6	7	8	9
Significant	4	5	6	7	8
Moderate	3	4	5	6	7
Minor	2	3	4	5	6
Low	1	2	3	4	5

Figure 2: Risk Matrix

Plan Response

Upon completion of the risk analysis, a response will be determined by the PMO with input from subject matter experts, documented, and communicated to the risk owner. The PMO shall assign a risk owner who will report on risk activities in accordance with previously established guidelines. Risk activities mitigation strategy and status are a priority topic during the weekly project team meeting.

Table 3: Strategies for Mitigating Risk

ACTION	DESCRIPTION
Mitigate	Reduces likelihood or impact of a risk possibly to elimination. Mitigation can occur at any point within the project.
Avoid	Changes of the project management plan to eliminate the threat. To find an alternative method of accomplish task to do away with the risk
Transfer	Place responsibility of the risk on another organization, example: using contractual agreements, subcontractors assume the risk and provide warranties or the customer to assume some of the risk.
Accept	Tolerate the risk while attempting to elude its consequences

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Risk Acceptance

Once an issue has been mitigated and all actions have been taken to control, the PM will review the results and determine if the residual risk is acceptable to continue. Residual risk is the risk that the issue, once resolved will remain mitigated or re-emerge as an issue. Only the PM can accept closure of the action items associated with a medium or high risk issue.

One month prior to project complete date, the PMO will organize risk management documents for archiving. Final evaluations and acceptance of all issues and risks shall be forwarded to the PMO two weeks prior to project complete date. One week prior to project completed date the PMO, stakeholders, subcontractors, and customer will convene to review and suggest risk management strategies for future projects. From this meeting a final risk management report will be generated and submitted to the project archive.

Tracking

Using the risk register allow the project team to identify document and monitor risks. The risk register shall have an assigned risk number and each element of the register will be completed. The risk originator has the responsibility to ensure notification is made to the PM that a new entry has been made on the risk register. The PMO will ensure that all unresolved risks are part of the weekly project team meeting. The PM will identify the risk owner and provide a copy of the risk register line item for remediation and monitoring. The risk owner is will mitigate the risk following guidance and follow up on status at least weekly one day prior to the weekly project team meeting. Upon completion of the risk mitigation, the risk owner will notify the PM and complete the remainder of the documentation and forward the data sheet to the PMO for archiving.

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Program Evaluation and Review Technique (PERT)

The focus of this home construction project is an industry leading, beautiful, and environmentally efficient home, a high degree of planning is required to ensure projects are on time and within budget. The use of the Program Evaluation and Review Technique (PERT) is statistical technique used to review activities, cost, and “assessing projected risk” (Larson & Gray, 2014, p. 213). PERT analysis “assumes a statistical distribution (range between optimistic and pessimistic) for each activity duration...[to produce a] relative probability...of an activity becoming critical...” (p. 213). This analysis allows the project manager to evaluate the potential of an activity becoming a schedule risk. Armed with this knowledge, the project manager can identify potential risk factors and develop mitigation strategies that will increase the assurance that the project can be completed as planned.

The three time estimates used in the PERT analysis are shown in Table 1: Duration Distribution Table below. The first is the Optimistic time the best case scenario that all things will come together with no issues and the identified task or activity will be completed by this time. Larson and Gray, 2014 define optimistic in the PERT analysis as “a 1 chance in 100 of completing the activity earlier under normal conditions” (p. 240). The next estimate is the Most Likely time in which the activity may be completed based on professional experience and past project data. The final time estimate is Pessimistic and is based on the possibility that some issues might arise and cause a slowdown of the activity. Larson and Gray also define Pessimistic in the PERT analysis “a 1 chance in 100 of completing the activity later under normal conditions” (p. 240).

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Expert opinion provided the basis for the estimated values defined in Table 4 and were used to determine the most reliable duration of each project task using the following PERT formula below.

Equation 1: PERT Formula

$$\frac{a + 4m + b}{6}$$

The results of the PERT analysis will provide the project manager a weighted average (rounded) for each project task which will be used in performing forward and backward pass activities to define the project’s duration and identify the critical path.

Table 4: Duration Distribution Table

Task	Optimistic (a)	Most Likely (m)	Pessimistic (b)	Weighted Task Duration
Initiation	1	2	3	2
Design	30	47	60	46
Permitting	15	30	45	30
Foundation	20	22	25	22
Geothermal Heat pump	8	11	15	11
Framing	15	17	25	18
HVAC system	10	13	16	13
Electrical	6	9	12	9
Plumbing	8	11	15	11
Communication system	5	10	15	10
Solar system	3	4	6	4
Exterior finish	25	30	40	31
Interior	60	69	80	69

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Landscaping	20	26	35	27
Closing	1	3	5	3

When the project’s information is reviewed utilizing PERT as in Table 5, we determined the project duration to be 246 days. (Larson & Gray, 2014 Table 1) The use of PERT also provides the probability for each project primary activity which is not shown. A great advantage to being able to utilize PERT and the information it provides also allows for identifying specific risks and being able to mitigate those risks. (Larson & Gray, 2014, p. 213)

Table 5: Forward and Backward Pass Analysis

Sustainable Home Construction Project Solution								
Activity	Start node	End node	Activity time[JLR1]	Early Start	Early Finish	Late Start	Late Finish	Slack
Project			246					
Project planning	0	1	47	0	47	199	246	199
Design	2	3	47	0	47	0	47	0
Permitting	3	4	30	47	77	89	119	42
Executing	4	5	127	77	204	119	246	42
Foundation	3	6	22	47	69	47	69	0
Geothermal Heat pump Ground Unit	6	7	11	69	80	69	80	0
Framing	7	8	17	80	97	80	97	0
HVAC system	8	9	13	97	110	97	110	0
Electrical	9	10	9	110	119	110	119	0
Plumbing	10	11	11	119	130	119	130	0
Communication system wiring	11	12	10	130	140	130	140	0
Solar system	12	13	4	140	144	140	144	0
Exterior finish	13	14	30	144	174	144	174	0
Interior	14	15	69	174	243	174	243	0
Landscaping	14	16	26	174	200	220	246	46
Closing	15	16	3	243	246	243	246	0

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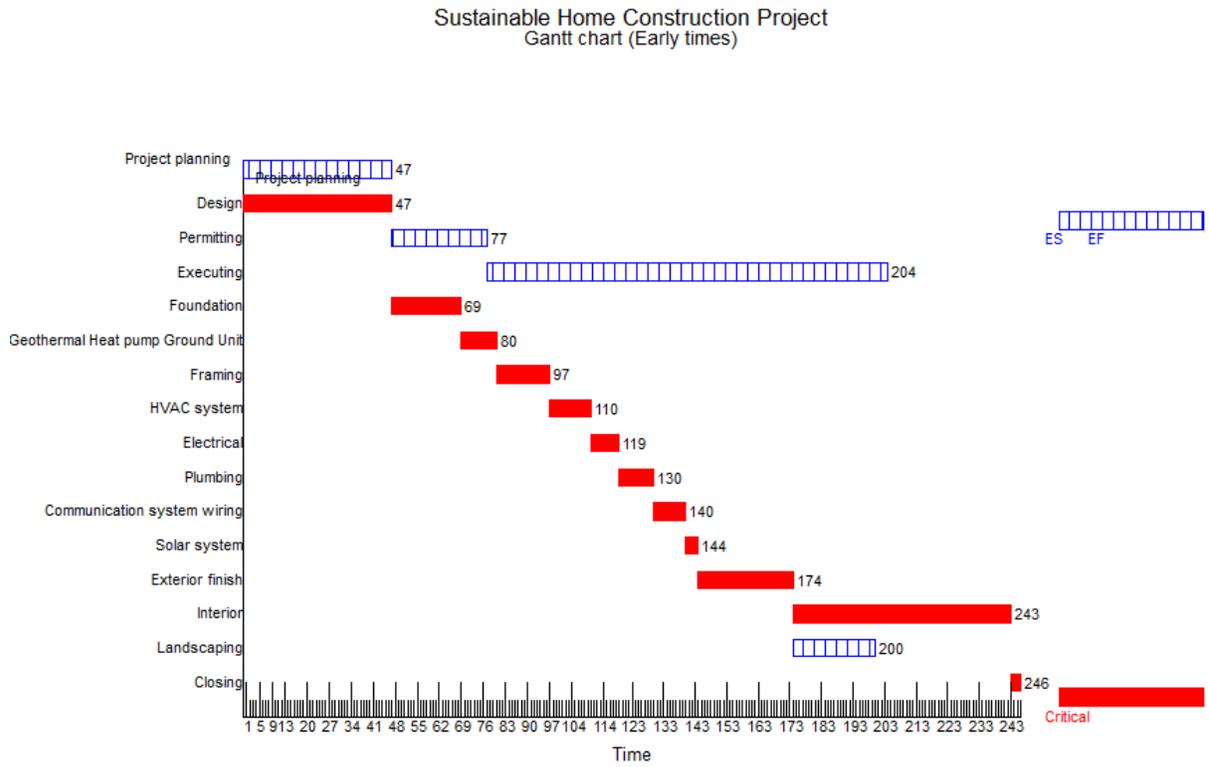


Figure 3: PERT Analysis Graph

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