



# LEED for Homes Sampling Protocol for Multi-family Projects 2011 Version

This document outlines the conditions and methods for performing verification on multi-family projects that intend to utilize sampling – a process by which fewer than 100% of the units randomly undergo verification steps. The scope of this guidance document is limited to stacked multi-family projects; a separate guidance document is available for multi-home projects, including attached townhomes.

This document is a companion to the LEED for Homes Verification & Submittal Guidelines. This sampling protocol refers only to the verification and performance testing requirements, *not* implementation requirements. Every unit must be built to meet all LEED for Homes prerequisites and pursued credit requirements whether sampling is used or not.

This document consists of four main sections:

1. Eligibility & Applicability – the scope of use, and the terms, conditions, and limitations for using the sampling protocol.
2. Definitions & Acronyms –the terminology used throughout the sampling protocol.
3. Sampling Process – the details related to the sampling protocol, including initial verifications, sampling rates, and responding to failures.
4. Labeling & Certification – the basic terms and conditions for labeling and certification for projects using this sampling protocol.

Both Verification Team and Project Team members are expected to be familiar with the details of this sampling protocol.

## 1. Scope & Eligibility

The LEED for Homes Sampling Protocol may not be appropriate for every project, and every project must be pre-authorized by USGBC before it is used.

To demonstrate that a project is eligible, every project must submit a completed Project Sampling Application (see Appendix B-1). This form will include the information USGBC needs to assess whether the project is eligible to use sampling. The four areas of consideration for sampling are listed in sections 2.1 through 2.4 below.

**2.1 Scope and Scale.** Every project using the sampling protocol must meet the following criteria<sup>1</sup>:

- All units in the project must be of the same construction type, using the same envelope systems.
- All units must be in one building; for multi-building projects, sampling across multiple buildings is only allowable if each building has the same construction type, envelope type, systems, and green measures.
- All units must earn the same set of LEED for Homes credits.

If a development with multiple multi-family buildings does not meet all of these criteria, it may be acceptable to separate the buildings into multiple projects for the purposes of LEED for Homes sampling. In this way, a development with different building types may still be able to utilize sampling.

**2.2 Verification Team Qualifications.** The Provider QAD and Green Rater will be assessed by USGBC based on their experience with LEED for Homes, experience with sampling, and the quality and ongoing execution of their QA process. Verification team members must be approved by USGBC before using the sampling protocol the first time.

USGBC will be offering short seminars on sampling, and attendance at one of these seminars *may* qualify verification team members to use the sampling protocols and exempt them from the application process.

**2.3 Project Team Qualifications.** The builder must describe the details of the quality management process that describe how the organization ensures consistency in how the units are constructed, including training, internal QA protocols, contracts and scopes of work, etc. See Appendix A for information about developing a quality management process. The project team is expected to have an in-field liaison to the verification team that can implement in-house QA protocols, coordinate site visits with the verification team, and facilitate responses to failures.

The project team will be assessed based on their quality management process, as well as their experience with LEED for Homes, other energy-efficiency or green building programs, and the application of sampling.

**2.4 Project-Specific Sampling Approach.** Using the *Project Sampling Application*, the verification team must submit detailed information describing how sampling will be applied to the project, including:

- The expected number of sample sets, and the number of units in each sample set, based on the construction timeline.
- Variation in the types of models being sampled, and how the variation is reflected in the composition and size of the sample sets.

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<sup>1</sup> These requirements are somewhat more restrictive than what is included in the RESNET sampling standards.

The sampling approach will be evaluated based on whether and how well it incorporates randomness into the verification steps, how thorough the approach is at addressing variation, and how well it addresses contingencies (e.g. failures, changes to construction schedule).

## 2. Definitions

*Failed Item* – A category of failure, corresponding to a LEED for Homes prerequisite or pursued credit. For the purposes of follow-up inspections, a “failed item” is not limited to the specific instance in a unit.

*Failure* – When one or more of the requirements in a prerequisite or pursued credit are not met during verification.

*Metropolitan Area* – Metropolitan and micropolitan statistical areas as defined by the United States Office of Management and Budget (OMB) and published at [www.census.gov/population/www/metroareas/metrodef.html](http://www.census.gov/population/www/metroareas/metrodef.html). In areas not included in any defined Metropolitan Area, individual counties may be a substitute for the purposes of this sampling protocol.

*Pursued Credit* – A LEED for Homes credit (optional measure) that was planned to be earned by project.

*Sample Set* – a group of similar units that are all ready for the same phase of verification during a site visit. Only one unit in each sample set is to be randomly selected for sampling controls. The maximum sample set size is determined by the verification team based on project team experience and project specifics. Note that a large project may have numerous sample sets. (Again, one unit in each sample set is sampled.) See example scenarios in Appendix E.

*Sampling Controls* – A collection or set of required verification steps performed for a sample set of units, typically corresponding to the Verification & Submittal Guidelines for a specific prerequisite or credit. “Sampling controls” may refer to the entire set of verification steps, or to a particular phase of verification (e.g. pre-drywall, final).

*Verification Phase* – A time period associated with specific verification measures. The verification team will determine how many phases are needed, but typical projects include two phases: 1) pre-drywall phase and 2) final verification phase.

## 3. Sampling Process

The sampling process consists of five main steps, outlined below.

**3.1. Preparation and Planning.** The project team must work with the verification team to complete the following steps.

*Preliminary review* – As per ID 1.1, the builder and project team must meet with the Provider QAD and/or Green Rater to conduct a preliminary rating. During this meeting the verification team should review the scope and eligibility requirements for sampling, as well as the basic sampling process.

Planning sample sets – The project team must work with the verification team to develop a plan for how the units will be organized into sample sets. The plan should take into consideration any differences in models, as well as the construction schedule, and it should identify the sample sets and sampling rates.

*What if the construction schedule changes?* This step is designed to identify issues that might affect how units are grouped into sample sets. If the construction schedule changes, the verification team should be flexible and update the sample sets as necessary. However, a slower-than-planned construction schedule may require smaller sample sets and increase the overall sampling rate.

Determining the maximum sample set size (i.e. sampling rate) - LEED for Homes does not allow more than ten units within a sample set for multi-family buildings, but the maximum may be set lower based on the experience level of the builder with LEED for Homes and sampling. See Appendix D for guidelines on choosing the appropriate maximum sample set size. *Note: the maximum allowable sample set size is different for multi-family buildings and single-family developments.*

The verification team has limited discretion on setting the sampling rate, and may only increase (not decrease) the sampling rate relative to the guidelines in Appendix D.

*What if the number of units ready for verification is larger or smaller than the maximum sample set size?* If the number of units ready for verification exceeds the maximum sample set size, the units can be grouped into multiple sample sets. If the number of units ready for verification is smaller than the maximum sample set size, then the sample set simply includes all of the units.

Example: A project is allowed a maximum sample set of 7 units by the verification team. If the project has 12 units ready for verification at once, the units should be grouped into two different sample sets – with 7 and 5 units, respectively. If the project has only 5 units ready for verification at once, the sample set is equal to 5 units, but future sample sets could be as many as 7 units.

Worst-case analysis & sampling controls – As early as possible, the project team must work with the verification team to identify the credits being earned by all units in the building, and determine the worst-case set of measures to include in the checklist. If one or more units – but not all units in the building - contain additional LEED measures not reflected in the worst-case analysis, those additional measures must be disregarded for the purposes of the LEED for Homes certification (i.e., the credits may not be awarded).

Complete and submit the Project Sampling Application – once the sample sets and the package of pursued credits are agreed on, the basic information about the sampling plan must be submitted to USGBC for approval.

*What if the project includes customer options that may result in some homes earning additional credits? Generally, unless a measure is earned in every unit, the additional credits must be ignored for the purposes of LEED for Homes, and use a worst-case set of credits are used to create the sampling controls and rate the building.*

In a case where residents are given different options for how to meet a credit (e.g. EPP flooring) but each unit is guaranteed to satisfy the credit requirements – albeit in different ways – credit may still be awarded. For example, if customers are given only a choice between bamboo flooring and FSC flooring, credit may be awarded in MR 2.2 for EPP flooring – because in either case the credit will be earned.

**3.2. Demonstrating Consistency: Initial Verification Requirements.** After the sampling plan has been approved by USGBC, but prior to the use of sampling, the following requirement must be met: at least five (5) consecutive units must be individually and sequentially verified without a failure. If a failure occurs, sampling may not proceed until five (5) units in the subdivision are sequentially verified without another failure.

These initial verification requirements apply to each verification phase (e.g. pre-drywall, final). Once the initial verification requirements are completed for one phase, sampling may be used for that phase even if the initial verification requirements are not met for other phases.

*If the initial verification requirements are met for 5 consecutive units in the pre-drywall phase, can sampling be used – even if the initial verification requirements for the final verification phase have not been completed? Yes. Once the sampling controls for a given phase are completed, sampling may begin for that phase.*

In this example, the initial verification requirements still must be completed for 5 consecutive units at the final verification phase before sampling may be used in the final construction phase.

The verification team has the discretion to expand the number of units in the initial verification step for any reason, including: prior bad experiences with the builder or developer, concerns or questions that arise during the initial verification, changes to the construction crew, changes to the designs, etc.

Over time, if there is a significant change to the construction crew or site supervisor, or substantial change in architectural designs, the initial verification requirement – verifying five (5) units consecutively without a failure - must be repeated.

**3.3. Organizing Units into Sample Sets.** When defining the sample sets, all units within a given sample set must meet the following requirements:

- All units are at the same stage of construction (e.g. pre-drywall, final) and available for sampling controls. The Green Rater must be able to choose randomly from among the units within the sample set.
- All units are eligible and available for the applicable sampling controls within a 30 calendar day period. If the number of units eligible and available for the sampling controls is fewer than the planned sampling rate, the sample set must be cut off at the number of units that are available within that 30-day period – i.e., the actual sampling rate will need to be greater than the planned sample rate.
- All units must have the same basic design and layout, as it pertains to the sampling controls being applied. For example, units with different ventilation system layouts may not be included in the same sample set when conducting air flow tests for EQ 4.3.

A project may have numerous sample sets. Sample sets may vary in size based on the construction timeline and variation in model types, etc.

Units grouped into a sample set for one verification phase (e.g. pre-drywall) may be grouped differently for the next verification phase (e.g. final).

**3.4. Applying Sampling Controls.** The Provider QAD and Green Rater select the elements to include in the sampling controls based on the LEED for Homes Verification & Submittal Guidelines. The Provider QAD and Green Rater may choose to verify some measures in every unit (i.e. not use sampling).

The pre-determined sampling controls must be completed in full at least once for each sample set. Sampling controls may all be completed on a single unit or distributed across several units within a given sample set.

*What does it mean to distribute sampling controls across several units?*

Sampling controls include verification for various prerequisite and credits. It is not required that verification for all prerequisites and credits be conducted on a single unit; instead, it's acceptable to conduct verification for some measures on one unit within the sample set and conduct verification for other measures on a different unit within the sample set.

Sampling controls may be completed on a project without interruption until a failure occurs or there is a significant change to the construction crew or site supervisor, or substantial change in architectural designs. The following section outlines how failures are handled; if there are significant changes to the crew or unit designs, the sampling process must begin again with the initial verification steps in Section 3.2 above.

**3.5. Failures.** When one or more of the verification requirements for a prerequisite or pursued credit are not met, this is considered a failure and the relevant requirement is referred to as a “failed item”. This section describes how failures must be handled by the project team and verification team.

Contingency planning - Testing and/or verification for any item(s) that may become inaccessible during the construction process (e.g. wall insulation) must be timed so additional testing and/or verifications can occur on other units in the sample set before they become inaccessible for inspection or testing.

Failures during the initial verification step – If a failure occurs during the initial verification steps, sampling controls must continue to be completed on all units until the requirements outlined in Section 3.2 are satisfied.

First failure during sampling – The first time a failure occurs during sampling (i.e. after the initial verification step), the failed item(s) must be tested or verified in two (2) additional units from the sample set. In a case where the sample set is 2 or 3 units, this may require verification of the failed item(s) in every unit in the sample set.

Second failure during sampling – When a second failure of the same verification requirement occurs during sampling, the following actions are triggered:<sup>2</sup>

- The builder must conduct a “root cause analysis” to identify the source of the problem causing the failure and undertake any remedial actions necessary to fix the underlying problem, including re-designs and re-training of trades and crew. This root cause analysis must be submitted to the Provider QAD (see Appendix C for a template).
- The problems that led to the failure must be corrected and the failed item must be tested and/or verified for every unit in the sample set;
- The verification team may increase the sampling rate for the failed item for the remainder of the project, or remove it from the sampling controls altogether (i.e. require verification of the failed item in every unit).

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<sup>2</sup> The policy for additional failures is different than what is required by RESNET; the RESNET sampling standard does not require a root cause analysis until multiple additional failures occur.

*If a failure occurs for an optional credit, can the project just choose to drop the credit? Yes. If a failure occurs in the verification of a credit requirement, the project team may choose to simply drop the credit and have it removed from future sampling controls. However, it still is considered a failure and the protocols outlined in this document must be followed because it indicates a potential weakness in the builder's quality management process and may portend failures in other areas.*

Multiple failures during sampling – if a project experiences three total failures within a ninety (90) calendar day period – even for different verification requirements - the following actions are triggered:

- The builder must conduct a “root cause analysis” to identify the source of the problem causing the failures and undertake any remedial actions necessary to fix the underlying problem, including re-designs and training of trades and crew. This root cause analysis must be submitted to the Provider QAD (see Appendix C for a template).
- The problems that led to the failures must be corrected and the failed items must be tested and/or verified in every unit in the sample set;
- If the multiple failures all apply to the same failed item, the failed item must be removed from the sampling controls – i.e. the builder shall submit to 100% testing and verification for that failed item for the remainder of the project.<sup>3</sup> Sampling may continue using other sampling controls.
- If the multiple failures include multiple different failed items, the sampling process must start over with the initial verification requirements (see Section 3.2, Situation #2). The maximum sample set size must be decreased (i.e. the overall sampling rate must be increased) for the remainder of the project.

*If the project team makes a change during design but does not alert the Green Rater, does it still count as a “failure” because the Green Rater cannot verify the item? The project team is responsible for notifying the verification team of any changes that may affect LEED for Homes measures. If the requirements for a planned measure are not met, this should be counted as a failure unless there is clear evidence (i.e. in scopes of work, written communication to crew members) that the measure was removed during design.*

## 4. Labeling & Certification

Each multi-family building is provided with a LEED for Homes certificate, and no distinction shall be made between units that undergo verification and those that do not. Since certificates are awarded to entire building, not individual units, certification may not

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<sup>3</sup> The policy for multiple failures of the same failed item is different than what is required by RESNET.

proceed until the sampling protocol is successfully completed for the entire building. Within multi-building developments, individual buildings may be certified prior to the entire development being completed.

Upon submittal for certification, the Provider QAD must submit detailed information about how the sampling protocol was applied, including:

- Number of buildings in the project
- Number of units in the project
- Number of units in the initial verification phase
- Number of sample sets
- Number of units tested and verified
- Number and types of failures, as well as remediative actions taken

When submitting the project for certification, project teams are encouraged to review the batch submittal guidelines from USGBC. These guidelines outline how to streamline the documentation and certification review process.

## **Appendix A.**

### **Developing a Quality Management Process**

Many builders have existing and well-developed quality management plans. Other builders do not have one. Sampling is a process whereby the responsibility for quality management is shared between the builder and the LEED for Homes verification team. The builder's quality management plan is the builder's commitment to their share of the quality management process.

A builder that chooses to use this sampling protocol must have a quality management plan. If the builder does not have one, the first step is to create one. Basic elements of a quality management plan include:

1. Designate and train builder's in-field supervisors and their specific oversight and sign-off responsibilities;
2. Develop detailed scopes of work for each trade that are focused on quality-critical tasks;
3. Include scopes of work, and compliance requirements in all trade contracts;
4. Plan and conduct kick-off meetings for each project (e.g., subdivision) where performance goals and consequences of missing performance goals are clearly specified;
5. Provide appropriate training on green home building, inspections, and performance testing requirements to all trades before starting work on the project;
6. Require trade and builder supervisor approval and sign-off on all quality-critical measures; and
7. Schedule the LEED for Homes Rater to be on-site during the completion of each measure (that requires testing) in the first unit in each sample set.

#### **References & Resources**

US DOE Building America Quality Assurance Roadmap for High Performance Residential Buildings  
[www.toolbase.org/Best-Practices/Quality-Management/quality-assurance-roadmap](http://www.toolbase.org/Best-Practices/Quality-Management/quality-assurance-roadmap)

NAHB Research Center National Housing Quality Certified Builder Program for builders and contractors  
[www.nahbrc.com/builder/quality](http://www.nahbrc.com/builder/quality)

# Appendix B-1

## Project Sampling Application

The following form must be completed and signed by the Provider QAD and Project Team Leader, and submitted to USGBC for approval prior to the use of sampling.

### Project Information

Development Name:		Development City/State:	
# of buildings:		# of building types:	
# of units:		# of unit types:	
Start date:		Planned end date:	

### Developer

Company name:		Primary contact:	
Contact phone #:		Contact e-mail:	

### Builder

Company name:		Primary contact:	
Contact phone #:		Contact e-mail:	
# of LEED buildings certified:		# of Energy Star buildings certified:	

### Project Team QA Responsibilities

Site Supervisor:		QA Manager:	
Phone #:		Phone #:	

### Verification Team

Provider company:		Provider QAD name:	
Green Rater company:		Green Rater name:	
Green Rater company:		Green Rater name:	
Energy Rater company:		Energy Rater name:	

### Scope & Eligibility

As per Section 2.1 in the sampling protocols, every project seeking to use sampling must meet a set of eligibility requirements. Please answer the following questions:

1. All buildings in the project are the same construction type?  Yes  No
2. All units in each building are the same construction type?  Yes  No

**Appendix B-1: Project Sampling Application**

If the answer to any question is no, please give a detailed explanation: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Project Team Qualifications**

- 3. Has this builder had any previous developments or buildings certified through LEED for Homes or Energy Star that have used sampling? If so, please provide the project name, # of units and buildings, and status of the projects: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 4. Please submit the builder's quality management plan.

**Project-Specific Approach**

- 5. What is the proposed maximum sample set size? \_\_\_\_\_
- 6. What is the expected average sample rate (% of units verified)? \_\_\_\_\_
- 7. Describe the expected monthly build-out schedule? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 8. Describe any variations among the units, and how this affects the sampling approach: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Appendix B-2

### Provider QAD Sampling Application

The following form must be completed and signed by the Provider QAD and submitted to USGBC for approval prior to the use of sampling on a project. Sampling may not be used until the Provider QAD, Green Rater, and project have all been approved by USGBC. Approval is only required once for each Provider QAD.

*Note:* USGBC will be offering short seminars on sampling, and attendance at one of these seminars may supersede this application and automatically qualify Provider QADs to use the sampling protocols.

#### Basic Information

Name:		Company:	
Phone #:		E-mail:	

#### Experience

Date of QAD training (mo/yr):		# of years working on LEED for Homes:	
# of Energy Star buildings labeled:		# of LEED projects certified:	

Please list below all Energy Star projects that involved sampling. Please provide the project name, completion date or current status, number of buildings and units in the project, and Provider QADs role on the project.

#### Sampling QA Plan

Please submit a QA plan that outlines when and how Green Raters will be training on the sampling process, as well as how the QAD or other Provider staff will ensure that the sampling protocol is followed appropriately.

**Signed:** \_\_\_\_\_

**Date:** \_\_\_\_\_

## Appendix B-3

### Green Rater Sampling Application

The following form must be completed and signed by the Provider QAD and Green Rater and submitted to USGBC for approval prior to the use of sampling on a project. Sampling may not be used until the Provider QAD, Green Rater, and project have all been approved by USGBC. Approval is only required once for each Green Rater.

*Note:* USGBC will be offering short seminars on sampling, and attendance at one of these seminars may supersede this application and automatically qualify Green Raters to use the sampling protocols.

#### Basic Information

Name:		Company:	
Phone #:		E-mail:	
LEED-H Provider (s):			

#### Experience

Date of USGBC Green Rater training (mo/yr):		# of years working on LEED for Homes:	
# of years working on Energy Star for Homes:		# of LEED projects certified:	
Please describe any formal or informal training you've received related to sampling.			
Please list below all Energy Star projects that involved sampling. Please provide the project name, completion date or current status, number of buildings and units in the project, and Provider QADs role on the project.			

**Signed (Green Rater):** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Signed (Provider QAD):** \_\_\_\_\_

**Date:** \_\_\_\_\_

## Appendix C. Root Cause Analysis Template

The following form is a template, to be used by the builder to describe the underlying causes for a verification failure and how the failure has been remedied. The root cause analysis must be kept by the Provider QAD for at least three years.

Related Credit or Prerequisite: \_\_\_\_\_

Failed Item: \_\_\_\_\_

\_\_\_\_\_

Description of problem(s) uncovered by the analysis: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Explanation of the underlying reason(s) that the problem(s) occurred, including flaws in the design or implementation of the quality management process: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Description of the process to correct the underlying cause(s), including when and how the process has been carried out: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Appendix D for Multi-family Projects.

### Guidelines for Setting the Maximum Sample Set Size

The following section outlines how the maximum sample set size is determined for LEED for Homes projects. The verification team has limited discretion on determining the maximum sample set size, and may only increase (not decrease) the sampling rate relative to the guidelines below. By request, USGBC will consider exceptions to the guidelines below.

Maximum Sample Set Size	Minimum Sampling Rate	Required Experience with Sampling
10 units	10%	Certified 2 LEED projects, both with sampling <b>OR</b> Certified 3 LEED projects, including 1 with sampling
7 units	14%	Certified 1 LEED project with sampling <b>OR</b> Certified 2 LEED projects
5 units	20%	Has never used sampling, and/or new to LEED for Homes

In this context, a project includes an entire building or multi-building development. Please provide details related to experience in the Project Sampling Application.

If the number of units ready for verification exceeds the maximum sample set size, the units can be grouped into multiple sample sets. If the number of units ready for verification is smaller than the maximum sample set size, then the sample set simply includes all of the units.

Since the actual sample sets for a project are determined largely by the construction schedule, the actual sampling rate may significantly exceed the minimum allowable.

**Example:**

A project is allowed a maximum sample set of 7 units by the verification team. The project team has 12 units ready for mid-construction verification in January, and only 3 units ready for mid-construction verification in February.

In January, the units should be grouped into two different sample sets – with 7 and 5 units, respectively. In February, the units are grouped into a single sample set of 3 units.

In this example, the average sampling rate during the two-month period is 20% (3 of 15), even though the minimum allowable sampling rate was 14%.

## **Appendix E.**

### **Example Scenarios for Multi-family Projects**

The following three scenarios are provided as examples, to illustrate how the sampling protocol may be applied. In each case, it's assumed that the project has met the eligibility requirements to use sampling, including approval from USGBC.

In the verification schedules for each scenario, the following notations is used: "available" refers to units that are ready for verification within the month; "initial" refers to units that are verified as part of the initial verification phase (see Section 3.2); and "sampled" refers to units that are verified during the sampling verification phase.

**Appendix E: Example Scenarios**

**Scenario 1: Inexperienced Green Builder, no Failures**

Project snapshot:

- Experience level - builder is new to green building
- Project scope - 60-unit multi-family building, no variations among units
- Failures – the project experiences no verification failures

Narrative:

The project team is new to green building and sampling. Hence, the verification team allows a maximum sample set size of 5 units.

As per Section 3.2, at least 5 units must be consecutively verified prior to sampling. If there are no failures, based on the construction schedule the verification team intends to apply sampling controls to 11 of the remaining 55 units (20%).

The actual construction schedule falls behind, but there are no failures during the initial verification requirements or during sampling. The resulting verification is outline below.

	<b>Planned Schedule</b> (units verified per month)		<b>Actual Schedule</b> (units verified per month)	
	Pre-drywall	Final	Pre-drywall	Final
Jan	15 available 5 initial 2 sampled		12 available 5 initial 2 sampled	
Feb	15 available 3 sampled		13 available 3 sampled	
Mar	15 available 3 sampled		15 available 3 sampled	
Apr	15 available 3 sampled	15 available 5 initial 2 sampled	12 available 3 sampled	10 available 5 initial 1 sampled
May		15 available 3 sampled	8 available 2 sampled	12 available 3 sampled
Jun		15 available 3 sampled		17 available 4 sampled
Jul		15 available 3 sampled		10 available 2 sampled
Aug				8 available 2 sampled
Sep				3 available 1 sampled
<b>Total</b>	<b>60 units 16 verified</b>	<b>60 units 16 verified</b>	<b>60 units 18 verified</b>	<b>60 units 18 verified</b>

**Appendix E: Example Scenarios**

**Scenario 2: Very experienced Green Builder, no Failures**

Project snapshot:

- Experience level - builder is very experienced with green building and sampling
- Project scope - 60-unit multi-family building, a few homebuyer options
- Failures – the project experiences no verification failures

Narrative:

The project includes a few homebuyer options (e.g. EPP countertops, 100% hard-surface flooring) that could change the point totals. The project team decides not to take credit for these upgrades and evaluate only the worst-case scenario. Because, the builder is very experienced with green building, the verification team allows a *maximum sample set size* of 10 units.

As per Section 3.2, at least 5 units must be consecutively verified prior to sampling. If there are no failures, based on the construction schedule the verification team intends to apply sampling controls to 7 of the remaining 53 units (13%).

The actual construction schedule changes, but there are no failures during the initial verification requirements or during sampling. The resulting verification is outline below.

	<b>Planned Schedule</b> (units verified per month)		<b>Actual Schedule</b> (units verified per month)	
	Pre-drywall	Final	Pre-drywall	Final
Jan	16 available 5 initial 2 sampled		13 available 5 initial 1 sampled	
Feb	29 available 3 sampled		20 available 2 sampled	
Mar	15 available 2 sampled		17 available 2 sampled	
Apr		12 available 5 initial 1 sampled	10 available 1 sampled	9 available 5 initial 1 sampled
May		25 available 3 sampled		23 available 3 sampled
Jun		23 available 3 sampled		22 available 3 sampled
Jul				6 available 1 sampled
<b>Total</b>	<b>60 units 12 verified</b>	<b>60 units 12 verified</b>	<b>60 units 11 verified</b>	<b>60 units 13 verified</b>

## Appendix E: Example Scenarios

### **Scenario 3: Moderately experienced Green Builder, A Few Failures**

Project snapshot:

- Experience – some experience with LEED-H; no experience with sampling
- Project scope - 50-unit multi-family building, including five special units
- Failures – the project experiences a few failures

Narrative:

The project includes 50 total units, but five units on the first floor are ADA-compliant and include numerous differences. These five units are excluded from the sampling, and each is tested and verified separately. The remaining 45 units are identical. Because the project team has previously certified two LEED projects, the verification team allows a maximum sample set size of 7 units.

As per Section 3.2, at least 5 units must be consecutively verified prior to sampling. If there are no failures, based on the construction schedule the verification team intends to apply sampling controls to 7 of the remaining 40 units (18%).

There are no failures during the entire pre-drywall verification phase. However, during the final verification phase, the 3<sup>rd</sup> unit fails the ventilation air flow test in the initial verification requirements. As a result, 5 additional units must be consecutively verified (8 total) before sampling is allowed during the final verification phase. In May, a couple of other failures are discovered, so the maximum sample set size is changed to 5 units for the remainder of the project.

	<b>Planned Schedule</b> (units verified per month)		<b>Actual Schedule</b> (units verified per month)	
	Pre-drywall	Final	Pre-drywall	Final
Jan	15 available 5 initial 2 sampled		15 available 5 initial 2 sampled	
Feb	12 available 2 sampled		10 available 2 sampled	
Mar	12 available 2 sampled		10 available 2 sampled	
Apr	6 available 1 sampled	12 available 5 initial* 1 sampled	10 available 2 sampled	12 available 8 initial* 1 sampled
May		13 available 2 sampled		13 available 3 sampled**
Jun		11 available 2 sampled		11 available 3 sampled
Jul		9 available 2 sampled		9 available 2 sampled
<b>Total</b>	<b>45 units 12 verified</b>	<b>45 units 12 verified</b>	<b>45 units 13 verified</b>	<b>45 units 17 verified</b>

\* Failure during initial verification results in three additional units being verified.

\*\* Sampling rate is increased due to a couple additional failures.