

Verification Report

Report for:

AvalonBay Communities Inc.

LRQA reference:	UQA00000422
Verification dates:	April - June, 2019
Verification location:	Arlington, VA
Verification criteria:	WRI/WBCSD GHG Protocol (reporting), ISO 14064-3 & LRQA's Verification Approach (verification)
Verification team:	Derek Markolf – Lead Verifier William Paddock - Verifier
LRQA Client Facing Office:	Houston

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Attachments
N/A

This report was presented to and accepted by:
Name: Mark Delisi
Job Title: Sr. Director of Corporate Responsibility

1. Executive report

Verification outcome:

LRQA, Inc. (LRQA), a member of the Lloyd's Register group of entities, was contracted by AvalonBay Communities Inc. (AvalonBay) to verify its Scope 1 (direct emission), Scope 2 (energy indirect emissions), and Scope 3 (other indirect) greenhouse gas (GHG) emissions; energy consumption for Scope 1 and Scope 2; waste generation and water consumption for calendar year 2018 (CY 2018). The Scope 3 emissions verified by LRQA were limited to emissions from business travel and employee commuting.

Water consumption and waste generation data verified by LRQA did not include data from AvalonBay construction operations. This is in alignment with the Global Real Estate Sustainability Benchmark (GRESB) Guidance document.

The verification was conducted to a limited level of assurance and at a materiality level based on the professional judgment of the verifier. The final quantities verified are as follows:

Item	Quantity	Units
Scope 1 Emissions	19,816	MT CO ₂ e
Scope 2 Emissions Location-Based	60,936	MT CO ₂ e
Scope 2 Emissions Market-Based	60,936	MT CO ₂ e
Total Scope 1 Energy	108,894	MWh
Total Scope 2 Energy	194,322	MWh
Scope 3 Emissions (business travel)	296	MT CO ₂ e
Scope 3 Emissions (employee commuting)	5,938	MT CO ₂ e
Water Consumption (Communities only) ¹	11,406,495	M ³
Subset of Waste Generated (Communities only) ^{2,3}	87,478	MT

1. Water consumption does not include water consumed by the AvalonBay construction division.
2. Waste generation does not include waste generated by the AvalonBay construction division.
3. Waste generation data is only representative of 93% of AvalonBay communities.

AvalonBay excluded refrigerant emissions from HVAC systems and combustion of diesel fuel in emergency generators.

Based on LRQA's approach, nothing has come to our attention that would cause us to believe that the total Scope 1, Scope 2, and Scope 3 GHG emissions, and Environmental Data disclosed by AvalonBay in the Reports for CY 2018, as summarized in Table 1 below, are not materially correct and that the GHG Emissions Inventory and Environmental Data Assertion have not been prepared in conformance with the WRI/WBCSD GHG Protocol, the 2018 GRESB Real Estate Reference Guide, and AvalonBay environmental data management processes.

LRQA confirms that the contents of this report, together with any evidence or notes taken during this verification will be treated in the strictest confidence and will not be disclosed to any third party, without the prior consent of the client, except as required by the accreditation authorities.

Areas for senior management attention:

- Consider expansion of the AvalonBay GHG Emissions and Environmental Data Inventory Management Plan to include coverage of:
 - Delineation of the reporting boundary for GHG and Environmental data between properties considered to be under construction and/or re-development and properties fully commissioned,
 - Organizational boundaries (i.e. operational control or financial control),
 - Operational boundaries (i.e. Scope1, Scope2 and Scope 3 emissions sources to be included & excluded), and
 - Base year selection and re-calculation policies
- Measurabl and AvalonBay should ensure the various summary reports and spreadsheets used to support the final reported data, including the DQR, are correctly aligned with the total data being reported to CDP and GRESB. Without this being addressed, it is very difficult for reviewers of the data to understand the calculations being performed in the Measurabl system.
- Going forward, it would be helpful to reviewers of the data to define the units in column headings of the file entitled 2018 Gas Data with Propane v2.

2. Verification summary

Visit objective

This report records the outcome of the LRQA verification of Greenhouse Gas (GHG) emissions and environmental data parameters for AvalonBay conducted in April to June 2019.

Introduction

The verification activities were conducted by Derek Markolf, Lead Verifier for LRQA and William Paddock, Verifier for LRQA with assistance from other LRQA staff where appropriate. This report includes the outcome of LRQA verification activities for the following data:

- Scope 1 and 2 greenhouse gas (GHG) emissions
- Scope 3 GHG emissions from business travel and employee commuting
- Energy inventory – Scope 1 Total Energy (consumptions of natural gas, propane and fuel oil) and Scope 2 Total Energy (consumption of electricity and steam).
- Water consumption
- Waste generation

The reporting criteria used to evaluate the CY 2018 emissions report was the WBCSD/WRI Greenhouse Gas (GHG) Protocol and the 2018 GRESB Real Estate Reference Guide. LRQA used verification criteria from ISO 14064 Part 3:2006 for the GHG data and LRQA's verification approach for the environmental data to perform the verification.

The Stage 1 verification activities included:

- Initial review and discussions – to confirm scope, objectives, criteria, level of assurance, materiality and their appropriateness for the verification
- Review of the GHG Inventory and systems in place for its derivation
- Strategic Analysis and Risk Analysis
- Verification Planning for Stage 2

The Stage 2 verification activities included:

- Assessment of Criteria Conformance
- Implementation of the data review based on the LRQA sampling plan
- Verification of Data and Information for GHG emissions sources and environmental data sets
- Development of issues log and findings

This report includes a discussion of the items listed above, together with the Verification Schedule, the Verification Plan, and the findings and their resolution.

Grading of Findings

The following definitions apply to the grading of findings in this report:

Misstatement (MIS)

A misstatement (omissions, misrepresentations and errors) in an assertion, data or information that, in the professional judgment of the verifier, is unlikely to affect the decision of the intended user. If such a finding is outstanding at the end of the verification, a positive Assurance Statement will be possible, although qualifications, limitations, and/or recommendations may be included in the Assurance Statement.

<p>Material Misstatement (MMIS)</p>	<p>A misstatement, (omissions, misrepresentations and errors) in an assertion, data, or information that, in the professional judgment of the verifier, could affect the decision of the intended user. If such a finding is left outstanding at the end of the verification then the misstatement must be corrected or a positive Assurance Statement will not be possible.</p>
<p>Non-conformity (NCN)</p>	<p>A nonconformity with the requirements of the assurance criteria (including the terms of engagement) that, in the professional judgment of the verifier, is unlikely to affect the decision of the intended user. If such a finding is outstanding at the end of the verification, a positive Assurance Statement will be possible, although qualifications, limitations, and/or recommendations may be included in the Assurance Statement.</p>
<p>Material Non-conformity (MNCN)</p>	<p>A nonconformity with the requirements of the assurance criteria (including the terms of engagement) that, in the professional judgment of the verifier, could affect the decision of the intended user. If such a finding is left outstanding at the end of the verification then the nonconformity must be corrected or a positive Assurance Statement with regard to the assurance criteria will not be possible.</p>
<p>Opportunity for Improvement (OFI)</p>	<p>An opportunity for improvement is a suggestion from the verifier to improve the operator's performance in monitoring and reporting.</p>
<p>LRQA</p>	<p>A 'follow up' item for the LRQA Verifier to track ongoing issues within the Findings Log where required.</p>

3. Findings Log

1. Grading of the finding *	2. New, Open, Closed	3. Description of the LRQA finding	4. Review by LRQA	5. Process, aspect, department or theme
6. Date of the finding	7. YYMM<Initials>seq.#	8. Clause of the applicable standard		
* MIS = Misstatement MMIS = Material Misstatement NCN = Nonconformity MNCN = Material Nonconformity OFI = Opportunity for Improvement xLRQA = LRQA Follow Up				

Grade 1	Status 2	Finding 3	Correction, root cause & corrective action review 4	Process / aspect 5	Date 6	Reference 7	Clause 8
Possible MMIS OFI	Open	<p>LR noted multiple inconsistencies with list's of properties under construction and/or fully commissioned during CY2018 when comparing the following files:</p> <ul style="list-style-type: none"> (1) Measurabl Data Quality Report (~ 12 communities per tabs: Portfolio & Property Trends); (2) 2018 Construction Utilities (36 communities); (3) 2018 AvalonBay Waste Data FINAL for LRQA Review (21 communities). <p>After review, AvalonBay informed LR that, for utility purposes, if a community has finished most of it's construction and moved into residential service, AvalonBay determines construction is completed, but all of the apartments may not have been delivered yet. While those apartments are still being delivered expense gets coded to Construction and Development. This is the same for Redevelopment.</p> <p>The delineation of the reporting boundary for GHG and Environmental data between properties considered to be under construction and/or re-development and properties fully commissioned is not clearly explained in the file entitled "AvalonBay GHG Emissions and Environmental Data Inventory Management Plan v5" (GHG & Enviro Data IMP). Nor is the process for assessing which properties are transitioning from construction to service and making the appropriate changes in GHG & Enviro Data reporting systems, including internal spreadsheets and Measurabl.</p> <p>LR suggests AvalonBay revise the GHG & Enviro Data IMP to clearly address the abovementioned delineation and the process for the AvalonBay team to perform necessary reviews and/or re-categorizations within their data management systems to ensure</p>		Construction Data	6/04/2019	1906DM01	Completeness

Grade 1	Status 2	Finding 3	Correction, root cause & corrective action review 4	Process / aspect 5	Date 6	Reference 7	Clause 8
		properties transitioning across the delineation are reported correctly to GRESB and CDP.					
OFI	Open	Going forward, it would be helpful to reviewers of the data to define the units in column headings of the file entitled 2018 Gas Data with Propane v2.	AvalonBay informed LR that it will revise spreadsheets with this in mind going forward.	Natural Gas	5/30/2019	1906WP03	Transparency
Potential MMIS	Closed	<p>When comparing year on year total waste data for AvalonBay properties, LRQA noted significant differences (>100% change) for the following 14 of the 254 covered properties:</p> <ul style="list-style-type: none"> - CA098_Avalon Dublin Station - CA056_Eaves Warner Center - CA074_Avalon Wilshire - CA033_Eaves Foster City - CA078_Avalon Warner Place - CA072_Avalon Camarillo - WA010_Avalon ParcSquare - WA001_Avalon Redmond Place - CA007_Eaves Daly City - CA085_Avalon Walnut Creek - CA010_Eaves San Jose - NY021_Avalon Bowery Place II - NJ016_Avalon at Wesmont Station - NY015_Avalon Bowery Place <p>This could indicate errors in the CY 2017 data, or in the CY 2018 data.</p>	Waste Management confirmed that this was due to what they call their "Captured zero-bill data" estimation approach. This refers to services that were reporting at zero based on billed amount, but where they know there is recycling service. So, WM extrapolated the data based on service levels/container sizes. This was the case for all but Eaves Daly City, where they explained a similar estimation method was applied where recycling services started in 2018.	Community Waste	6/4/2019	1906DM06	Accuracy
MIS	Closed	The file entitled "Copy of AvalonBay Scope 3 Travel Commuting Emissions Data Summary (4_June_2019)_ALL DATA", includes the incorrect total MT CO2. Based on results of past verification activities, the pounds of CO2 should be pulled from the "LBS LRQA" column in the file entitled "Avalon Bay Communities - GHG Emissions Report - 2018", provided by WorldTravelService.	AvalonBay addressed this issue by revising the Scope 3 summary file.	Scope 3 Air Travel	6/4/2019	1906DM07	Accuracy
MMIS	Closed	<p>Measurabl + May also need input from AvalonBay</p> <p>When comparing the parameters to be verified in the following 3 files, multiple unexplainable inconsistencies are noted:</p> <ul style="list-style-type: none"> - 2019-05-22_AvalonBay-Communities_Data-Quality Report 	The issue was resulting in a 23,627 kWh difference in Scope 1 and a 5,536,979 kWh difference for Scope 2 due to different estimation methods between CDP and DQR. CDP emissions are not broken out by individual site (something	Total Energy, Waste, Scope 1 and Scope 2 data parameters	6/12/19	1906DM08	Accuracy

Grade 1	Status 2	Finding 3	Correction, root cause & corrective action review 4	Process / aspect 5	Date 6	Reference 7	Clause 8
		<ul style="list-style-type: none"> - 2019-06-12_AvalonBay-Communities_Data-Quality Report - AvalonBay-Communities_2019-CDP-Response (as of 6-12-2019) - AvalonBay-Communities_2019-GRESB-Response-(as of 2019-06-05) <p>See the table below for a summary of the variances noted by LR.</p> <p>LR requires a clear explanation and/or correction for all variances highlighted yellow, as well as answers to the questions in red font.</p>	that will be requested in the future). The issue was resolved by identifying the estimation method between the two methods (CDP and DQR).				
OFI	Open	Going forward, Measurabl and AvalonBay should ensure summary spreadsheets, including the DQR are correctly aligned with the total data being reported to CDP and GRESB. Without this being addressed, it is very difficult for reviewers of the data to understand the calculations being performed in the "black box" of the Measurabl system.	AvalonBay and Measurabl informed LR that it will revise spreadsheets with this in mind going forward.	All data parameters	5/30/2019	1906WP09	Transparency
OFI	Open	<p>This is a carry over OFI from CY 2016 verification activities:</p> <p>The AvalonBay GHG Emissions and Environmental Data Inventory Management Plan does a good job of describing responsible parties and the process for gathering and reporting data and information. Another common function of IMPs is to document the Organizational Boundaries (i.e. Operation Control, or Financial Control), Operational Boundaries (i.e. Scope 1, Scope 2 and Scope 3 emissions source categories to be included and/or excluded), and Base Year selection and re-calculation policies. LRQA recommends the expansion of this document to include the definition of AvalonBay boundaries mentioned above (GHGs and Environmental Data), and merging the existing Base Year selection and re-calculation policy into this document.</p>		Inventory Management Plan	5/26/17	1906DM10	GHG Protocol Chapters 3, 4 and 5

Verifier: Derek Markolf and William Paddock

Verification of:	Terms of Engagement - Contract Conditions Confirmation	Auditee(s):	Mark Delisi and Kevin Mulcahy
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Audit trails and sources of evidence:

Contract Condition Confirmation

Evaluation and conclusions:

Scope: Data Verification of the following items:

- Scope 1 (direct) GHG emissions: natural gas, fuel oil, and propane (operational control)
- Scope 2 (indirect) GHG emissions: purchased electricity and steam (operational control)
- Scope 3 (Other indirect) GHG emissions: business travel
- Scope 3 (other indirect) GHG emissions: employee commuting
- Energy Consumption:
 - Scope 1: total MWh (operational control)
 - Scope 2: total MWh (operational control)
- Water consumption (financial control)
- Waste generation (financial control)

Objectives: Verification of AvalonBay's GHG emissions, energy consumption, water consumption and waste generation for CY 2018. The verification is intended to provide AvalonBay with an independent opinion on the completeness and accuracy of the data provided.

Criteria:

- World Resource Institute / World Business Council for Sustainable Development (WRI/WBCSD) GHG Protocol;
- 2018 GRESB Real Estate Reference Guide;
- Verification protocol follows ISO 14064-3: Specification with guidance for validation and verification of greenhouse gas assertions and LRQA verification approach
- AvalonBay GHG Emissions and Environmental Data Inventory Management Plan v5, and supporting policies and procedures

Level of Assurance: Limited Assurance

Materiality: Qualitative materiality based on the professional judgment of the verifier

Changes to Terms of Engagement: None

In completing this report, the LRQA verifiers confirm their independence from the client and that there was no known conflict of interest during the engagement.

Verification of:	Strategic Analysis and Risk Analysis (SARA)	Auditee(s):	Mark Delisi, and Kevin Mulcahy
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Strategic Analysis:

Through the Strategic Analysis, the Verifier determined the significance of the items of information and data to be verified. This judgement of significance is based on the nature and scale of the information and data as they relate to the scheme requirements.

Information or Data Source	Significance	Basis of Significance
Natural gas	M	Accounts for ~22% of Scope 1&2 GHG emissions
Fuel oil	L	Accounts for <1% of Scope 1&2 GHG emissions
Propane	L	Accounts for <1% of Scope 1&2 GHG emissions
Electricity	H	Accounts for ~76% of Scope 1&2 GHG emissions
Steam	L	Accounts for 1% of Scope 1&2 GHG emissions
Scope 3 business travel - air	M	Accounts for 5% of Scope 3 GHG emissions
Scope 3 business travel - car	L	Accounts for <1% of Scope 3 GHG emissions
Scope 3 business travel - hotel	L	Accounts for <1% of Scope 3 GHG emissions
Scope 3 employee commuting	H	Accounts for 94% of Scope 3 GHG emissions

NOTE: Much of the environmental data to be verified are activity data for the GHG emissions quantification, so the above Strategic Analysis is also applicable to this data.

Each of the environmental data parameters included in the Environmental Data Assertion was assessed separately for materiality.

Information or Data Source	Significance	Basis of Significance
Total Scope 1 Energy	H	Separate materiality for each environmental data parameter leads to each being highly significant.
Total Scope 2 Energy	H	Separate materiality for each environmental data parameter leads to each being highly significant.
Water Consumption	H	Separate materiality for each environmental data parameter leads to each being highly significant.
Waste Generation	H	Separate materiality for each environmental data parameter leads to each being highly significant.

Risk Analysis:

Through the Risk Analysis, the Verifier determined the potential risk of an omission, misrepresentation or error in relation to information and data sources. This determination included, but was not necessarily limited to, a judgement based on:

- the inherent risk associated with the data / information management
- the level of control applied to the data / information management
- the control of monitoring and metering used to gather data
- the number of personnel involved in the data management, their competence, attitude, and commitment.

Information or Data Source	Significance	Data Gathering	Measuring Equipment	People	OVERALL RISK
Natural gas	M	L	L	L	M
Fuel oil	L	L	M	L	L
Propane	L	L	M	L	L
Electricity	H	L	L	L	M
Steam	L	M	L	L	L
Scope 3 business travel - air	M	M	L	L	M
Scope 3 business travel - car	L	M	L	L	L
Scope 3 business travel - hotel	L	M	L	L	L
Scope 3 employee commuting	H	M	M	L	M

NOTE: The energy data to be verified are activity data for the GHG emissions quantification, so the above Risk Analysis is also applicable to this data.

Information or Data Source	Significance	Data Gathering	Measuring Equipment	People	OVERALL RISK
Water Consumption	H	L	L	L	M
Waste Generation	H	M	M	L	M

Client note: Generally, the outputs of the Risk Analysis influence the Verification Plan to manage the risk of LRQA detecting omissions, misrepresentations and errors in the following way:

High Overall Risk – detailed verification and data sampling

Medium Overall Risk – verification and data sampling to a lesser extent than High Overall Risk

Low Overall Risk – limited verification, simple checks only.

The Verifier will manage the degree of sampling through their Data and Information Sampling Plan.

Verification Planning:

As a result of the completion of the Strategic Analysis and Risk Analysis, a Verification Plan was developed. The Verification Plan, included in Section 5, defines the key elements of the verification and when those elements will be covered. The Verification Plan is supported by a Data / Information Sampling Plan which defines all the specific items of data and information which the Verification Team has identified as relevant and the depth to which relevant data is to be verified.

The following changes to the original Verification Plan / Data and Information Sampling Plan took place: The original schedule for the verification plan was delayed due to time necessary for AvalonBay to finalize the GHG and environmental data for verification.

Verification of:	Criteria Conformance	Auditee(s):	Mark Delisi Kevin Mulcahy Eric Abramson (Measurabl)
<p>Audit trails and sources of evidence:</p> <p>Discussions with corporate representatives Discussions with Measurabl representative overseeing AvalonBay data management within Measurabl platform. Overview of AvalonBay utility bill management through their third party services (Cass) Careful review of reporting boundaries with AvalonBay representatives GHG Emissions and Environmental Data Inventory Management Plan v5</p> <p>Evaluation and conclusions:</p> <p>No findings were raised related to conformance with criteria.</p> <p>Two opportunities for improvement were added, one which was a carry-over from CY 2016 verification activities, and a second from CY 2018 verification activities, both of which were related to suggested improvements to the GHG Emissions and Environmental Data Inventory Management Plan v5. Refer to item 1906DM01 and 1906DM10 in the findings log for more details.</p>			

Verification of:	Data & Information Verification	Auditee(s):	Mark Delisi Kevin Mulcahy Eric Abramson (Measurabl)
<p>Audit trails and sources of evidence:</p> <p>Measurabl CDP and GRESB reports with final data to be verified Measurabl Data Quality Report 2017–18 Scope of activity data, references for EFs and GWPs, conversion factors, and calculation methodologies within Measurabl software. Utility bill (NG, electricity and water) data downloads from Cass AVB GRESB Data Check 2019_Apr22 (1)-LR 2018 Electric Data.xls 2018 Gas Data with Updated Propane.xls 2018 Water Data.xls AvalonBay Scope 3 Travel Commuting Emissions Data Summary (4_June_2019)_ALL DATA Commuting Scope 3 Calculation AVB 2018 2019-06-17__AvalonBay-Communities__Data-Quality (1) - + multiple previous versions of DQR</p>			

Evaluation and conclusions:

The revised Verification Plan and Data Sampling / Evidence Gathering Plan were followed to completion.

AvalonBay utilised a cloud based climate change and sustainability data management and reporting platform called Measurabl who caters primarily to the real estate sector. The two reports generated by Measurabl for AvalonBay are the CDP report and the GRESB report, both of which are intended to be uploaded directly to the CDP and GRESB in the form of completed questionnaires.

AvalonBay populates energy and water data for each of their 280 communities in the US EPA Energy Star platform. Measruabl is then populated by a direct automated transfer of data from Energy Star to Measurabl. For waste data, AvalonBay enters the data directly into Measurabl.

Scope 1, Scope 2 and Scope 3 GHG Emissions:

A high level review of Measurabl energy data and GHG emissions data reported to CDP and GRESB was performed to identify areas where the data differs. LRQA noted numerous differences and was then informed of the unique reporting criteria that GRESB has and how it differs from standard GHG emissions accounting principles.

The raw utility bill data for natural gas and electricity was checked against final data reported in Measruabl for a representative sample of facilities. During this check the emissions factors for natural gas combustion and electricity grid factors were checked for accuracy.

One finding was raised related to Energy, Waste, and Scope 1 & Scope 2 emissions data, which was closed. See the findings log for details and resolution.

AvalonBay reported both location-based and market-based Scope 2 emissions. For market-based emissions, AvalonBay has opted to utilise the lowest tier on the GHG Protocol Scope 2 Guidance market-based hierarchy, which results in the same Scope 2 emissions data being reported for both location-based and market-based methods. See the sampling plan for details of the analysis performed on the Scope 2 data.

One finding was raised related to Energy, Waste, and Scope 1 & Scope 2 emissions data, which was closed. See the findings log for details and resolution.

AvalonBay uses a third party travel service to book all travel and one of the services provided by the booking company is to track Scope 3 GHG emissions for AvalonBay and provide reports of the emissions upon request. AvalonBay received a report for CY 2018 Scope 3 emissions from air travel, car travel and hotel room occupancy. LRQA sampled the data Scope 3 air travel data per the sampling plan. No errors were noted in the execution of the functions in the travel services database.

Scope 3 GHG emissions from employee commuting was reported per the AvalonBay Commuting Scope 3 Calculation methodology provided to LRQA in a word document. LRQA confirmed the databases and calculations used for derivation of employee numbers and their distance from workplace were appropriate. Also, the assumptions made for emissions calculations were checked and considered appropriate.

One finding was raised related Scope 3 air travel emissions, which was closed. See the findings log for details and resolution.

Verification of environmental data parameters included in Environmental Data Assertion:

The energy data reported by AvalonBay are closely related to GHG activity data. LRQA performed checks against the Measurabl GHG emissions reports to confirm all environmental data being verified was consistent with verified GHG emissions activity data.

For the other environmental data parameters related to water consumption and waste generation, LRQA gained an understanding of the processes and procedures in place through interviews with AvalonBay personnel whom oversee the respective data management systems. Key files from the system were sampled, and data was tracked from source to sink (Measurabl).

LRQA was only contracted to verify waste generation related to a subset of the AvalonBay communities (93%). LRQA verified the percentage of communities represented and will include clear documentation of the scope of the verification in the assurance statement. Also, the boundaries for AvalonBay waste and water data exclude waste and water data related to construction activities. This is in alignment with the GRESB reporting guidelines.

One finding was raised related to waste data, which was closed. See the findings log for details and resolution.

One OFI was raised related to all data parameters, and remains open. See the findings log for details.

Verification of:	Errors and Corrections	Auditee(s):	Mark Delisi Kevin Mulcahy Eric Abramson (Measurabl)
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Audit trails and sources of evidence:

2019-06-25_AvalonBay-Communities_2019-CDP-Response-v1
 2019-06-25_AvalonBay-Communities_2019-GRESB-Response-v1
 AvalonBay Scope 3 Travel Commuting Emissions Data Summary (4_June_2019)_ALL DATA
 Multiple emails explaining differences between DQR and CDP & GRESB reports
 Commuting Scope 3 Calculation AVB 2018
 AvalonBay - CY18 Workbook

Evaluation and conclusions:

During the verification activities AvalonBay provided clarification regarding discrepancies noted by LRQA between various data sources. LRQA confirmed that appropriate amendments were made to the GHG emissions inventory and the environmental data assertion.

Verification of:	Materiality Conclusion	Auditee(s):	Mark Delisi Kevin Mulcahy Eric Abramson (Measurabl)
<p>Audit trails and sources of evidence:</p> <p>2019-06-25_AvalonBay-Communities_2019-CDP-Response-v1 2019-06-25_AvalonBay-Communities_2019-GRESB-Response-v1 AvalonBay Scope 3 Travel Commuting Emissions Data Summary (4_June_2019)_ALL DATA Multiple emails explaining differences between DQR and CDP & GRESB reports Commuting Scope 3 Calculation AVB 2018 AvalonBay - CY18 Workbook</p> <p>Evaluation and conclusions:</p> <p>Based on LRQA's approach, nothing has come to our attention that would cause us to believe that the total Scope 1, Scope 2, and Scope 3 GHG emissions, and Environmental Data disclosed by AvalonBay in the Reports for CY 2018 are not materially correct and that the GHG Emissions Inventory and Environmental Data Assertion have not been prepared in conformance with the WRI/WBCSD GHG Protocol, the 2018 GRESB Real Estate Reference Guide, and AvalonBay environmental data management processes.</p>			

Evidence list:

-  2018 Construction Utilities.xlsx
-  2018 Data for LRQA.zip
-  2018 Electric Data.xlsx
-  2018 Gas Data with Propane.xlsx
-  2018 Steam Data.xlsx
-  2018 Vacant Data.xlsx
-  2018 Water Data.xlsx
-  Data for Verification .msg
-  RE DC504 & DC511 Oil.msg
-  RE Oil Budget - NY015 & NY021.msg
-  RE Oil Budget - NY525.msg
-  2018 Electric Data v2.xlsx
-  2018 Gas Data with Propane v2.xlsx
-  2018 Water Data v2.xlsx
-  Final Data.msg
-  Solar Invoices.xlsx
-  01-AvalonBay Scope 3 Emissions - Travel Data for 2018.msg
-  02-RE AvalonBay Scope 3 Emissions - Travel Data for 2018.msg
-  03-RE AvalonBay Scope 3 Emissions - Travel Data for 2017.msg
-  04-Scope 3 Employee Commuting.msg
-  Avalon Bay Communities - Car GHG Emissions Report - 2018.pdf
-  Avalon Bay Communities - GHG Emissions Report - 2018.xlsx
-  Avalon Bay Communities - Hotel GHG Emissions Report - 2018.pdf
-  Commuting Scope 3 Calculation AVB 2018.docx
-  Copy of AvalonBay Scope 3 Travel Commuting Emissions Data Summary (4_June_2019)_ALL DAT...
-  RE AvalonBay Scope 3 Emissions - Travel Data for 2018.msg
-  2018 AvalonBay Waste Data FINAL for LRQA Review.xlsx
-  2019-06-03_AvalonBay-Communities_Data-Quality (1).xlsx
-  AVB GRESB Data Check 2019_Apr22 (1).xlsx
-  AVB GRESB Data Check 2019_Apr22 (1)-LR.xlsx
-  AVB Waste Data.msg
-  Re AVB Waste Data.msg
-  Re EXT Re AVB Waste Data.msg
-  2019-05-22_AvalonBay-Communities_Data-Quality.xlsx
-  Measurabl GHG Calculation Methodology.pdf
-  2019-06-25_AvalonBay-Communities_2019-CDP-Response-v1.docx
-  2019-06-25_AvalonBay-Communities_2019-GRESB-Response-v1.docx

-  2018 AvalonBay Waste Data FINAL for LRQA Review v2.xlsx
-  Avalon Bay CY 2018 - Findings Log-06-04-19.pdf
-  Avalon Bay CY 2018 - Findings Log-06-10-19-AVB.docx
-  Commuting Scope 3 Calculation AVB 2018 v2.docx
-  RE LRQA Finding on AVB Waste Data.msg
-  RE Verification List of Findings-1.msg
-  RE Verification List of Findings-2.msg
-  RE Verification List of Findings-3.msg
-  RE Verification List of Findings-4.msg
-  RE Verification List of Findings5.msg
-  Re Verification List of Findings-6.msg
-  Re Verification List of Findings-7.msg
-  Re Verification List of Findings-8.msg
-  Re Verification List of Findings-9.msg
-  Scope 3 Employee Commuting.msg

4. Verification plan

Verification Objectives:	To provide AvalonBay Communities, Inc. (Avalon Bay) with an independent opinion on the completeness of the data and information being submitted to CDP & GRESB.	
Verification Criteria:		
Protocols and Standards:	WRI/WBCSD GHG Protocol AvalonBay's Environmental Data Management Processes ISO 14064-3 (GHG Verification standard) LRQA Verification Approach - (Environmental data)	
Verification Scope:		
Description of Industry/Sources:	REIT which owns, operates, develops and re-develops multi-family communities.	
Geographic Boundaries:	North America	
Reporting Period:	CY 2018	
Greenhouse Gas Verified:	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ , Energy use, Water use, Waste generated	
Scopes covered:	Scope 1, 2 and 3. Scope 3 includes business travel and employee commuting only.	
Reporting Basis:	Operational Control: GHG Emissions & Energy Financial Control: Water Consumption & Waste Generated	
Level of Assurance:	Limited	
Materiality Threshold:		
	Professional judgement of the verifier	
LRQA Verification Team:		
Lead Verifier:	Derek Markolf	
Verifier:	William Paddock	
Technical Reviewer (QA/QC):	Heather Moore	
Verification Activities and Schedules:		
Scheduled for week of:	Task	
March 11, 2019	Kick-Off Meeting	
April 15, 2019	Delivery of Scope 3 Business Travel and Employee Commute Reported GHG Emissions and Supporting Spreadsheets	
April 22, 2019	Delivery of GHG Inventory, Key Supporting Spreadsheets & Environmental data plan	
April 29, 2019	Strategic Review / Risk Assessment	
April 29, 2019	Screen Share Meeting & Initial Data Request	
May 6, 2019	Initial Data submitted to LRQA	
May 13 & June 3, 2019	LRQA data verification	
June 3, 2019	LRQA Final Review	
June 3, 2019	Delivery of Final List of Findings	
June 3 & June 17, 2019	Client to address Findings	
June 24, 2019	LRQA to conduct internal Technical Review and Assurance Statement Review	
June 24, 2019	Delivery of Final Verification Report and Verification Statement	
Verification Plan approval:		
Name:	Derek Markolf	
Date:	March 13, 2019	
Revision Date:	June 17, 2019	
Revision Date:		

5. Data and Information Sampling Plan

Sampling Code #	Item to be Sampled	Data and Information Requirement (evidence gathering plan)	Lead Verifier Reasoning
01	Scope 2 GHG Emissions & Electricity Use	Check total CY 2018 elect. utility bill data against Measurabl GHG emissions for 30 communities. Divide Measurabl Scope 2 GHG emissions by utility bill electricity use and confirm results in correct eGRID EF. Check raw utility bill data for 3 communities.	This will check revenue metered data from utility bills (first tier of data aggregation) against final data in Measurabl used for reporting total GHG emissions (final tier of data aggregation). Will also confirm correct EFs used.
02	Scope 1 GHG Emissions from NG combustion.	Check total CY 2018 NG utility bill data against Measurabl GHG emissions for 30 communities. Divide Measurabl Scope 1 GHG emissions by NG consumption and confirm results in correct EF for NG combustion. Check raw utility bill data for 3 communities.	This will check revenue metered data from utility bills (first tier of data aggregation) against final data in Measurabl used for reporting total GHG emissions (final tier of data aggregation). Will also confirm correct EFs used.
03	Scope 3 GHG emissions from business travel (Air, car and hotel)	Obtain copy of calculation methodology for travel emissions and check the line item air travel records against the calculation method to confirm accurate execution of calculations.	Air travel accounts for 5% of the Scope 3 emissions.
04	Scope 3 GHG emissions from employee commutes	Obtain copy of estimation/calculation methodology for employee commute emissions and check pertinent employee records against the calculation method to confirm accurate execution of calculations.	Employee commuting accounts for 94% of Scope 3 emissions, and this is the first year they're reporting these emissions

Sampling Code #	Item to be Sampled	Data and Information Requirement (evidence gathering plan)	Lead Verifier Reasoning
05	Water Data	Check total CY 2018 water utility bill data against Measurabl water consumption for 30 communities. Check raw utility bill data for 3 communities.	This will check revenue metered data from utility bills (first tier of data aggregation) against final data in Measurabl used for reporting.
06	Total GHG Emissions calculated in Measurabl	Confirm all GHG emissions source categories are included in Measurabl calculated GHG emissions. Also, check reasoning for all properties with >100% year on year change between Cy2016 and CY 2018.	High level check of aggregate Scope 1 and Scope 2 activity data against aggregate GHG emissions calculated in Measurabl. YOY change may indicate missing properties.
07	Waste	(1) Confirm Waste Management uploads to Measurabl are complete and accurate through interviews with Measurabl teams and sampling of Waste Management files. (2) Confirm percent coverage of the waste data in measurabl is accurately calculated.	Waste measured and billed by haulers is relatively straightforward, as the date is straight from the Waste Management billing system.
08	Boundaries	Confirm operational control (GHG emissions) and financial control (water & waste) are accurately applied throughout all communities.	There was some confusion during the CY2015 site visit about application of boundaries. For the most part the boundaries have been straightened out, but still need close attention.