ENGINEERS AUSTRALIA

Sustainable Building Materials
What's next?

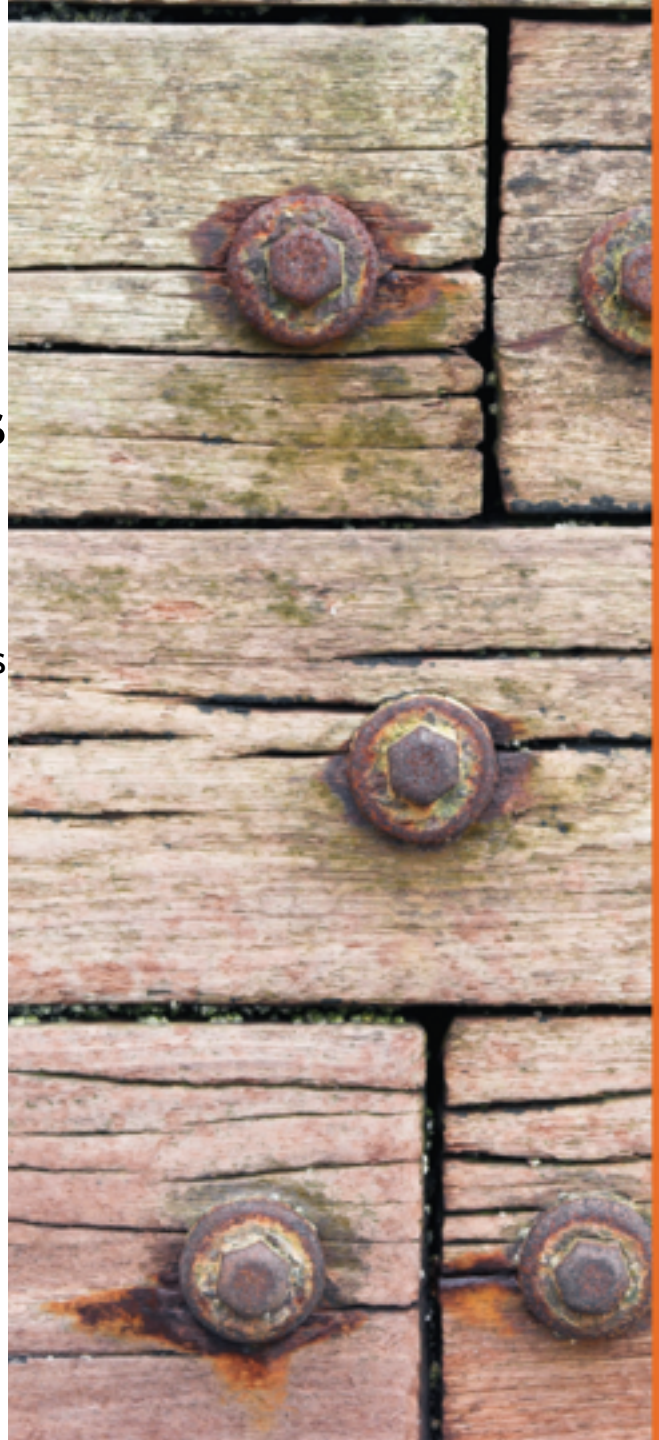
Hosted by:
Sustainable Engineering Society (SEng) Engineers

LIVING BUILDING CHALLENGE

Jeff Robinson

Sustainable Buildings Leader
Aurecon

e | jeffrey.robinson@aurecongroup.com



LIVING BUILDING CHALLENGE℠ 2.0/2.1

Materials Petal Handbook

INTERNATIONAL LIVING FUTURE INSTITUTE

May 2013


LIVING FUTURE
INSTITUTE SM
AUSTRALIA

LIVING BUILDING CHALLENGE℠

A Visionary Path to a Restorative Future

www.livingbuildingchallenge.org

INTERNATIONAL LIVING FUTURE INSTITUTE℠

THE METAPHOR OF THE FLOWER

ROOTED IN PLACE AND YET:

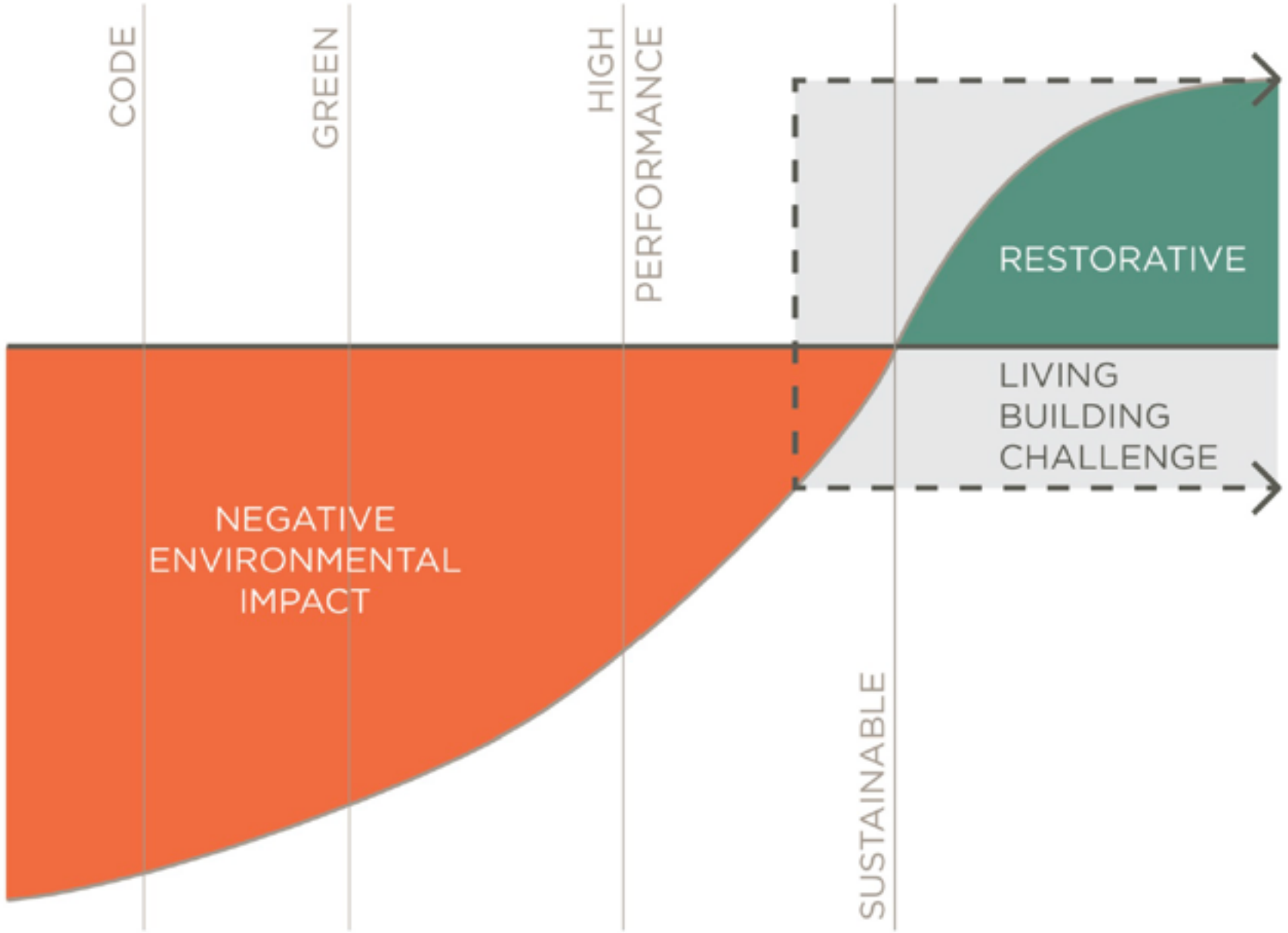
Harvests all energy + water

Is adapted to climate and site

Operates pollution free

Is comprised of integrated systems

Is beautiful



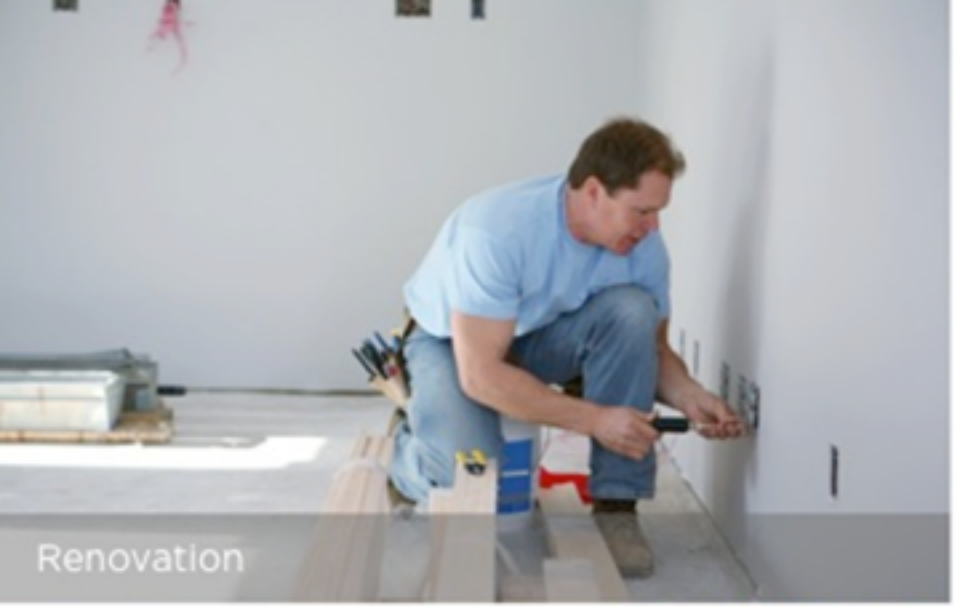
CONTEXT

EMBRACING THE PSYCHOLOGY OF THE "END GAME"

TWO RULES

1. All Imperatives assigned to a Typology are mandatory.

2. Living Building Challenge certification is based on actual, rather than modeled or anticipated, performance.



FOUR TYPOLOGIES



SCALE JUMPING

SITE

Restoring a healthy coexistence with nature

WATER

Creating water independent sites, buildings + communities

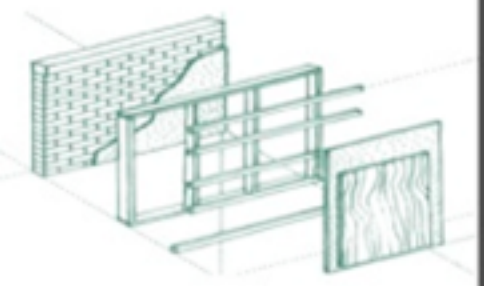
www.livingbuildingchallenge.org

ENERGY

Relying only on current solar income

HEALTH

Maximizing physical and psychological health + well being



MATERIALS

Endorsing products + processes that are safe for all species through time

EQUITY

Supporting a just, equitable world

BEAUTY

Celebrating design that creates transformative change

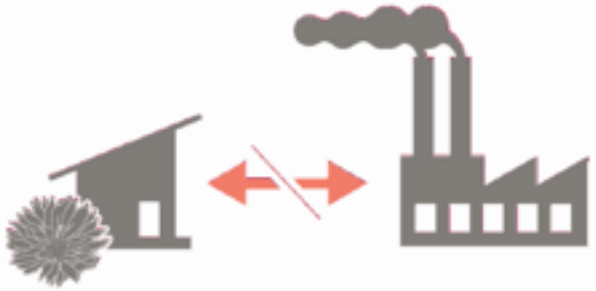
www.livingbuildingchallenge.org

	NEIGHBORHOOD	BUILDING	LANDSCAPE + INFRASTRUCTURE	RENOVATION	
					Imperative is optional for the corresponding Typology — scale: Solutions beyond project area are permissible
SITE					LIMITS TO GROWTH
	scale jumping	scale jumping			URBAN AGRICULTURE
	scale jumping	scale jumping	scale jumping	scale jumping	HABITAT EXCHANGE
					CAR FREE LIVING
WATER	scale jumping	scale jumping	scale jumping	scale jumping	NET ZERO WATER
	scale jumping	scale jumping	scale jumping		ECOLOGICAL WATER FLOW
ENERGY	scale jumping	scale jumping	scale jumping	scale jumping	NET ZERO ENERGY
HEALTH					CIVILIZED ENVIRONMENT
					HEALTHY AIR
					BIOPHILIA
MATERIALS					RED LIST
	scale jumping	scale jumping	scale jumping		EMBODIED CARBON FOOTPRINT
					RESPONSIBLE INDUSTRY
					APPROPRIATE SOURCING
					CONSERVATION + REUSE
EQUITY					HUMAN SCALE + HUMANE PLACES
					DEMOCRACY + SOCIAL JUSTICE
					RIGHTS TO NATURE
BEAUTY					BEAUTY + SPIRIT
					INSPIRATION + EDUCATION

SUMMARY MATRIX

RED LIST CHALLENGE

DISCONNECT



TRANSPARENCY

PERSISTENT BIOACCUMALATIVE AND TOXIC CHEMICALS

LIVING BUILDING CHALLENGE

LIVING BUILDING CHALLENGE℠ 2.0/2.1
Materials Petal Handbook

MATERIALS Imperitives

1. Red List
2. Embodied Carbon Footprint
3. Responsible Industry
4. Appropriate Sourcing
5. Conservation + Reuse

RED LIST

LIVING BUILDING CHALLENGE

INTENT

The intent of the Red List Imperative is to eliminate from the market worst-in-case materials/chemicals with the greatest impact to human and ecosystem health.

REQUIREMENT

The project cannot contain any of the following Red List materials or chemicals:

- Asbestos
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethlene
- Chlorofluorocarbons (CFCs)
- Chloroprene (Neoprene)
- Formaldehyde (added)
- Halogenated Flame Retardants
- Hydrochlorofluorocarbons (HCFCs)
- Lead (added)
- Mercury
- Petrochemical Fertilizers and Pesticides
- Phthalates
- Polyvinyl Chloride (PVC)
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol

Table 1. Established Exceptions by Red List Materials/Chemicals

MATERIALS/ CHEMICALS	EXCEPTION		NOTES
Asbestos	NA		
Cadmium	I11-E16 11/2012	Galvanized metal	
Chlorinated & Cholorsulfonated Polyethylene	~~11-E6 11/2009~~	~~HDPE and LDPE~~	Footnote 43 of the Standard. See Clarifications.
Chlorofluorocarbons (CFCs)	NA		
Chloroprene (Neoprene)	I11-E3 4/2010	Hydrotech vegetated roof system	Flex-Flash parts are Small Components
Formaldehyde	I11-E10 8/2008	Glulam beams	Phenol formaldehyde is allowed
	I11-E11 1/2009	SIPS panels	Phenol formaldehyde allowed in the OSB
	I11-E11 1/2009	Composite wood sheet goods	Phenol formaldehyde allowed in structural composite wood sheet goods
Halogenated Flame Retardants	I11-E12 9/2010	Spray foam insulation	Other options are available in some areas
	I11-E12 9/2010	SIPS	
	I11-E12 9/2010	Rigid insulation	
	NA		Boron is allowed
	I11-E19 11/2011	Motorized window shades	
Hydrocholorflouorocarbons (HCFCs)	I11-E14 10/2012	Tenant Improvements	When <25% of existing chiller floor area
Lead: added	I11-E7 2/2009	Solar battery systems	
	I11-E8 1/2009	Door Hardware	
	I11-E9 1/2009	Paint	If "no intentionally added lead"
	I11-E16 11/2010	Recycled Steel	
	I11-E16 11/2010	Galvanized metal	If not intentionally added for finish
	I11-E16 11/2010	Gypsum Wall Board	Traces of cadmium, mercury or lead are allowed
	I11-E17 2/2009	Plumbing	See Exceptions
	I11-E18 8/2011	Commercial water systems	See Exceptions
Mercury	I11-E16 11/2010	Portland Cement	Traces of mercury or lead are allowed
	I11-E16 11/2010	Products with fly ash as a common ingredient	Examples: cement, carpet, and fiber board
	I11-E13 6/2012	Fluorescent Lighting	See Exceptions
Petrochemical Fertilizers and Pesticides	NA		
Phthalates	NA		
Polyvinyl Chloride (PVC)	I11-E3 4/2010	Irrigation valves and fittings	Considered small components
	I11-E5 3/2009	When code mandated (i.e. wiring or piping)	Exception expanded to other materials.
Creosote, Arsenic or Pentachlorophenol: in wood treatments	NA		ACQ is allowed

EMBODIED CARBON FOOTPRINT

INTENT

The intent of the Embodied Carbon Footprint imperative is to compensate for a project's climate change related impacts associated with the construction process.

REQUIREMENT

The project must account for the total footprint of embodied carbon (tCO2e) from its construction and projected replacement parts through a one-time carbon offset tied to the project boundary.

CLARIFICATIONS

To meet this imperative, project teams must first calculate the project's total estimated carbon footprint and then purchase Certified Emission Reductions (CERs) carbon offsets through an acceptable, 3rd party verified program to offset 100% of the project's carbon contribution related to the construction process.

Acceptable Carbon Calculators

While many calculators exist to help project teams determine their embodied carbon footprint, carbon calculation is still rudimentary or generalized in many instances and the amount of knowledge about and accounting for downstream impacts is limited. To address this, the Institute has identified three pre-approved calculators that are free and available to the public:

- Rocky Mountain Institute's Green Footstep
  www.greenfootstep.org
- Environment Agency's carbon calculator for construction activities
  www.environment-agency.gov.uk/business/sectors/136252.aspx
- eTool
  http://etool.net.au

RESPONSIBLE INDUSTRY

LIVING BUILDING CHALLENGE

INTENT

The intent of the Responsible Industry Imperative is to reduce the damaging environmental and social impacts related to industries reliant on natural resource extraction.

REQUIREMENT

The project must advocate for the creation and adoption of third-party certified standards for sustainable resource extraction and fair labor practices. Applicable raw materials include stone, rock, metals and timber.

For timber, all wood must be certified by the Forest Stewardship Council (FSC), from salvaged sources, or from the intentional harvest of timber onsite for the purpose of clearing the area for construction.

CLARIFICATIONS

Industry Advocacy

Currently, only the timber industry has established third-party certified standards for sustainable resource extraction and fair labor practices. This Imperative will be expanded as new standards emerge related to the extraction of other raw materials such as stone, rock, metal and minerals.

For these industries that do not yet have standards in place, the project team must send advocacy letters to the corresponding national trade association and ASTM International encouraging the development and enforcement of independent, third-party standards that are not funded by the industry themselves. Only one letter per industry sector is required to be submitted by the project team. Sample letter templates are posted online under this Imperative in the Dialogue (from Footnote 47 of the Standard).

Forest Stewardship Council Certification In-progress

Since market transformation is a goal of this Imperative, wood from in-progress FSC certifications can be acceptable if the timber is processed (either harvested or milled, as relevant) after the FSC certification audit has occurred, even if final certification of the mill or forest is still pending. The FSC certification audit is Step 3 in the FSC Steps to Certification per http://ic.fsc.org/5-steps-to-certification.36.htm

Salvaged Wood

Third party certification is not tracked for salvaged wood.

Down and dead trees are not considered salvaged. Salvaged wood has already been extracted from the forest and used for some purpose. Use of down and dead trees from the owner's property may be acceptable on a case by case basis.

Forest Stewardship Council Mixed Source

The Institute recognizes that depending on the product category, FSC-Mixed may be the only option available for new wood-based material. It is acceptable for project teams to specify Mixed when FSC-100% is not offered by the market. Project teams must show a due diligence to source FSC-100% where feasible.

APPROPIATE SOURCING

INTENT

The intent of the Appropriate Sourcing Imperative is to support regional economies and expertise and to reduce the environmental impacts associated with transporting people and products.

REQUIREMENT

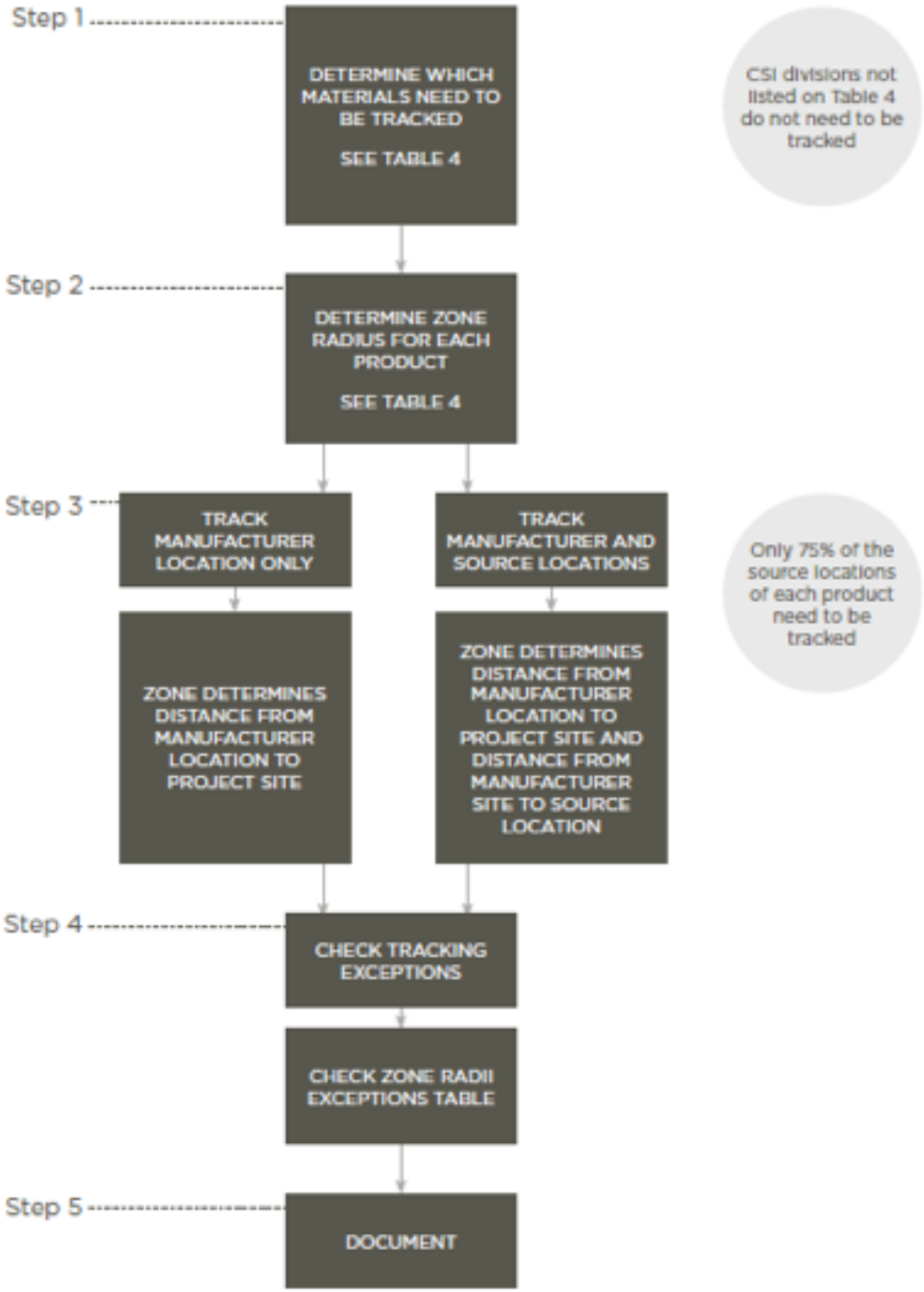
The project must incorporate place-based solutions and contribute to the expansion of a regional economy rooted in sustainable practices, products and services. Source locations for materials and services must adhere to the restrictions found in Table 3.

Table 3. Zone Restrictions

ZONE	MAX. DIST.	MATERIALS OR SERVICES	MASTERFORMAT 2012 CLASSIFICATION
7	20,004 km (12,430 mi)	Ideas	-
6	15,000 km (9,321 mi)	Renewable Technologies	Divisions: 42, 48
5	5,000 km (3,107 mi)	Assemblies that actively contribute to project performance and adaptable reuse once installed	Divisions: 08 (all exterior products), 14*, 22, 23*, 26*, 33*, 44*, 46* Sections: 07 33 00, 07 50 00*, 10 22 00*, 10 70 00*, 44 40 00*
4	2,500 km (1,553 mi)	Consultant Travel	-
3	2,000 km (1,243 mi)	Light or low-density materials	Sections: 07 31 00, 07 40 00, 09 50 00, 09 60 00
2	1,000 km (621 mi)	Medium weight and density materials	Divisions: 06, 08 (all interior products) Sections: 07 32 00, 09 20 00, 09 30 00, 12 30 00
1	500 km (311 mi)	Heavy or high-density materials	Divisions: 03, 04, 05*, 31, 32

* Zone designation refers to the location of the manufacturing facility only; source location is not tracked. Note that this is a clarification to the language in the Standard.

Appropriate Sourcing Process



CONSERVATION + REUSE

INTENT

The intent of the Conservation + Reuse Imperative is to reduce environmental burdens from end-of-life materials processing and from the extraction and processing of raw materials.

REQUIREMENT

All project teams must strive to reduce or eliminate the production of waste during design, construction, operation and end of life in order to conserve natural resources. All projects must comply with the following:

Project teams must create a Material Conservation Management Plan that explains how the project optimizes materials in each of the following phases:

- Design Phase, including the consideration of appropriate durability in product specification
- Construction Phase, including product optimization and collection of wasted materials
- Operation Phase, including a collection plan for consumables and durables
- End of Life Phase, including a plan for Adaptable Reuse and Deconstruction

During construction, teams must divert wasted material from landfills to the levels found in Table 7.

Table 7. Material Diversion Requirements

MATERIAL	MINIMUM DIVERTED/WEIGHT
Metals	95%
Paper and cardboard	95%
Soil and biomass	100%
Rigid foam, carpet & insulation	90%
All others - combined weighted average	80%

Hazardous materials in demolition waste, such as lead-based paint, asbestos and polychlorinated biphenyls (PCBs), are exempt from percentage calculations.

For all Typologies, there must be dedicated infrastructure for the collection of recyclables and compostable food scraps. For a Neighborhood project, there must be onsite compost facilities to accommodate all food scraps.

Documentation Requirements - Materials

LIVING BUILDING CHALLENGE℠ 2.0

RENOVATION, LANDSCAPE + INFRASTUCTURE, AND BUILDING TYPOLOGIES

INTERNATIONAL LIVING BUILDING INSTITUTE℠

M-1: Completed Project Portal Materials Petal Tracking Table that includes a list of products used in the project and characteristics that influence Imperatives 11: Red List, 13: Responsible Industry and 14: Appropriate Sourcing. The Table is organized by product within its corresponding CSI MasterFormat Division and Section.

In addition, support information must be uploaded as outlined in each Imperative as follows.

IMPERATIVE 11: RED LIST

Typology: All
Verification Method: Documentation + Audit

I11-1. Copy of supporting data for each product researched such as Material Safety Data Sheets (MSDS), manufacturer's published claim and/or ingredient list.

I11-2. Copy of letters written to the manufacturer for each product that contained a Red List item and was granted an exception for use.

Potential additional documentation:

For each exception granted to this Imperative based on code requirements, the following documentation is required:

I11-a. Letter/official document from the Authority Having Jurisdiction (AHU) citing the requirement to use the specific product or approach.

I11-b. Copy of the appeal or variance request to use a Living Building Challenge compliant product or approach submitted to the AHU.

I11-c. Evidence from the AHU of the response to the appeal or variance request (acceptance or denial, in the form of written or electronic communication).

IMPERATIVE 12: EMBODIED CARBON FOOTPRINT

Typology: All
Verification Method: Documentation + Audit

I12-1. The input for and results from a carbon calculator showing TCO_2e for the project (Note: onsite mitigation such as landscape restoration, renewable energy production, etc. may not be credited in the calculation.)

I12-2. Receipt from a carbon offset program as proof-of-purchase.

IMPERATIVE 13: RESPONSIBLE INDUSTRY

Typology: All
Verification Method: Documentation + Audit

I13-1. Receipts referencing FSC certified wood acquisition and the Chain-of-custody numbers, and receipts from the seller/broker of all salvaged wood procurements.

I13-2. Copy of letters written to the national trade associations and ASTM International requesting third-party standards be implemented for the metals, stone and rock industries.

Potential additional documentation

I13-a. For timber harvested, one-page illustrated narrative describing how tree removal was required for construction or part of a reforestation/restoration program and the milling process to create finish goods.

IMPERATIVE 14: APPROPRIATE SOURCING

Typology: All
Verification Method: Documentation

I14-1. Zone 4: If not already included in the General Information submitted, a roster including the name of each organization or individual participant on the Team, role, office location, and proximity to the project site (in kilometers traveled).

I14-2. Copy of supporting data for each product listed, such as letter from manufacturer, printed promotional material or website screen-capture, etc.

Potential additional documentation:

I14-a. For each exception granted as a result of a manufacturer making "proprietary claims" and not releasing product information, the Team must also submit a copy of each letter written to a manufacturer as a basis for jumping a Zone to procure a product.

IMPERATIVE 15: CONSERVATION + REUSE

Typology: All
Verification Method: Documentation

I15-1. Completed Conservation Management Plan.

I15-2. Copy of receipts, recycling percentage reports and addresses for all tipping fees, recyclers, and building materials salvage services.

I15-3. Calculation showing percentages of construction waste diverted (by weight) in each category (metals; paper + cardboard; soil + biomass; rigid foam, carpet + insulation; and all others). The calculation must be based on tangible data that correlates to receipts provided.

I15-4. Photographs of specific designated area onsite for separated or comingled construction waste.

Summary of Project Team's approach to achieving the Materials Petal Imperatives, including special considerations for each phase (design, construction, operation, end of life/adaptive reuse):

Notable successful Red List substitutions:
(CSI Masterformat, Original Product, Red List Item, Specified Manufacturer + Product Names)

Summary of the product classes and/or specific products that presented particular challenges:

Notable regional products specified:
(CSI Masterformat, Specified Manufacturer + Product Names, Manufacturing location)

Notable manufacturers who made 'Proprietary Claims' when asked about product contents:
(CSI Masterformat, Manufacturer + Product Names)

Sources for wood: *(check all that apply)*
- ☐ certified by Forest Stewardship Council (FSC)
- ☐ salvaged
- ☐ harvested onsite

Notable manufacturers of FSC certified wood products:
(CSI Masterformat, Manufacturer + Product Names)

Name of organizations and/or individuals that assisted with timber harvest and lumber seasoning process:
Brokers that assisted in sourcing salvaged materials: *(Company Name, website and/or contact information)*

Embodied carbon footprint: (TCO_2e):
Name of Carbon Offset project:
Location of Carbon Offset project:
Name of Carbon Offset provider:
Carbon Offset provider website:

Related regulatory appeals, including whether successful, name of Authority Having Jurisdiction and location (attach any relevant documents to submission):

Additional Material Petal comments:
Additional Material Petal support documents:

TRANSPARENCY

WHAT IS DECLARE?

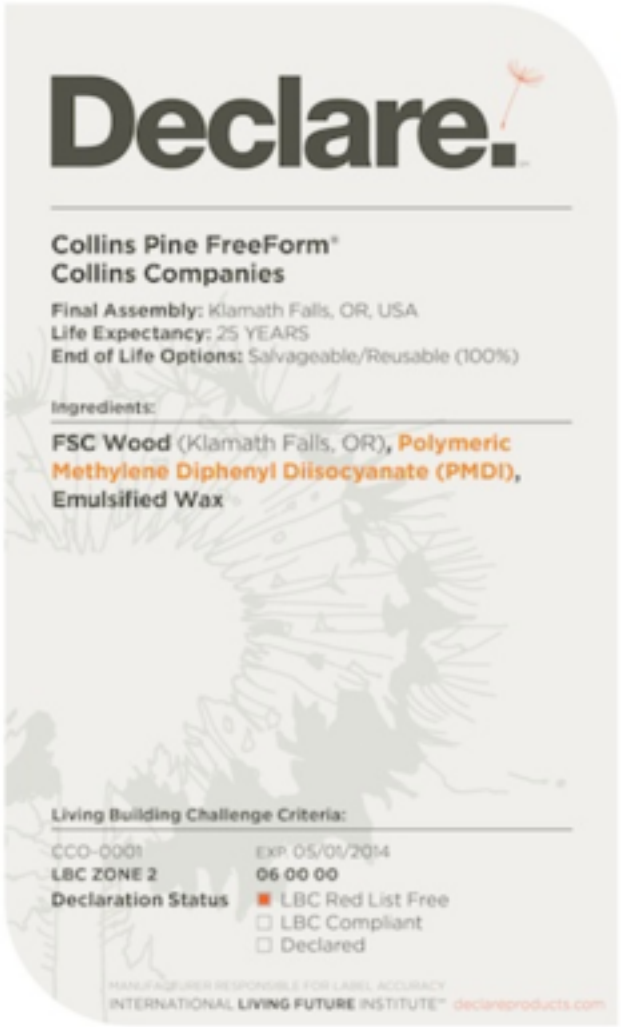
- AN INGREDIENTS LABEL FOR BUILDING PRODUCTS
- AN ENDEAVOR TO INCREASE TRANSPARENCY IN THE MATERIALS MARKETPLACE
- AN OPPORTUNITY FOR MANUFACTURERS CONNECT TO LIVING BUILDING CHALLENGE TEAMS
- A SUPPORT RESOURCE FOR LIVING BUILDING CHALLENGE PROJECT TEAMS

DECLARE: AN INGREDIENTS LABEL

Salad
Ingredients: organic romaine lettuce, organic bell peppers,
Sourced from: Hood River,
OR
End of Life: Compostable

Counter Top
Ingredients: ???
Sourced from: ???
End of life: ???

DECLARE: AN INGREDIENTS LABEL



END OF LIFE OPTIONS: TAKE-BACK PROGRAMS, SALVAGEABLE OR REUSABLE IN ITS ENTIRETY, RECYCLABLE (%); LANDFILL; HAZARDOUS WASTE

DECLARE IDENTIFIER FOR COMPANY + PRODUCT, VALID FOR 12 MONTHS.

ALL CONSTITUENT PARTS OF A PRODUCT INGREDIENTS ARE COLOR-CODED TO COMMUNICATE THE RED LIST ITEMS.

ZONE DESIGNATION PER THE APPROPRIATE SOURCING IMPERATIVE.

TEMPORARY RED LIST EXCEPTIONS APPLIED FOR SPECIFIC PRODUCT TYPES.

CSI MASTERFORMAT 2010 CLASSIFICATION

VERIFICATION THAT PRODUCT COMPLIES WITH LIVING BUILDING CHALLENGE RED LIST.

DECLARE: LABEL EXPLANATION

THREE DECLATION STATUS

RED LIST FREE: ALL INGREDIENTS FULLY DISCLOSED

RED LIST COMPLIANT: AT LEAST 99% OF INGREDIENTS DISCLOSED, ALLOWED DUE TO A TEMPORARY EXCEPTION

DECLARED: CONTAINS A RED LIST INGREDIENT BUT AT LEAST 99% OF INGREDIENTS DISCLOSED

DECLARE

Intentionally simple in scope. By focusing on product ingredients, we hope to 'level the playing field' and create a platform for constructive conversations about the human health and ecological impacts of the decisions we make.

Options: Take back program; Salvageable or reusable in its entirety; Recyclable (%); Landfill; Hazardous waste (%).

All constituent parts of a product, including trace elements, whether directly added or otherwise present – even if 'naturally occurring'. Items are color coded to communicate potential hazards:

Living Building Challenge Red List

US EPA Pollution Prevention + Toxics Existing Chemicals Program or European Chemicals Agency REACH Substances of Very High Concern

Not referenced in any of the three programs noted above

Declare identifier for company + product
Valid for 12 months, starting with the date of issue

Designation per the Appropriate Sourcing Imperative in the Living Building Challenge, intended to support the growth of regional economies rooted in sustainable practices, products and services.

CSI MasterFormat 2010 classification

IMAGE DEPICTS A 'BLANK' LABEL PRIOR TO CUSTOMIZATION BY MANUFACTURER

Advanced Vegetative Roof System Tray

Product Description:

Vegetative Roof System

Declare ID:

CGT-0001

FOR CONSUMERS
FOR MANUFACTURERS
PRODUCT DATABASE

DECLARE LABEL

INGREDIENTS LIST

Component	Name	CAS #	%	Red List	Source City	State	Country
Tray	Polypropylene Copolymer	9010-79-1	88	No	Orlando	FL	USA
Tray & Hooks	Adipic Acid	32131-17-2	12	No	Orlando	FL	USA
Tray	Talc	14807-96-6	< 2	No			
Tray	Ethene-1-Octene Copolymer	26221-73-8	< 1	No			
Tray	Ethylene-Propylene-Ethylidenennorbornene	25038-36-2	< 1				
Tray	Water	7732-18-5	< 1				
Tray	Diatomaceous earth, flux calcined	68855-54-9	< 1				
Pins	Nylon 5/6 Black	32131-17-2	< 1				

Manufacturer Name:
Columbia Green Technologies

Product Website:
www.columbia-green.com

CSI Master Format Number:
09 50 00

Final Assembly City:
Washougal

Final Assembly State/Province:
WA

Final Assembly Country:
USA

Research and Images by Healthy Building Network

TRANSPARENCY AND RED LIST SUCCESS

MANUFACTURER INFLUENCE

Contact manufacturers to determine whether Red List materials are present within their product(s)

"Thank you for your honesty, but we cannot use your product."

Prosoco, maker of the liquid applied air and water barrier system FastFlash® reformulated their product to exclude phthalates.

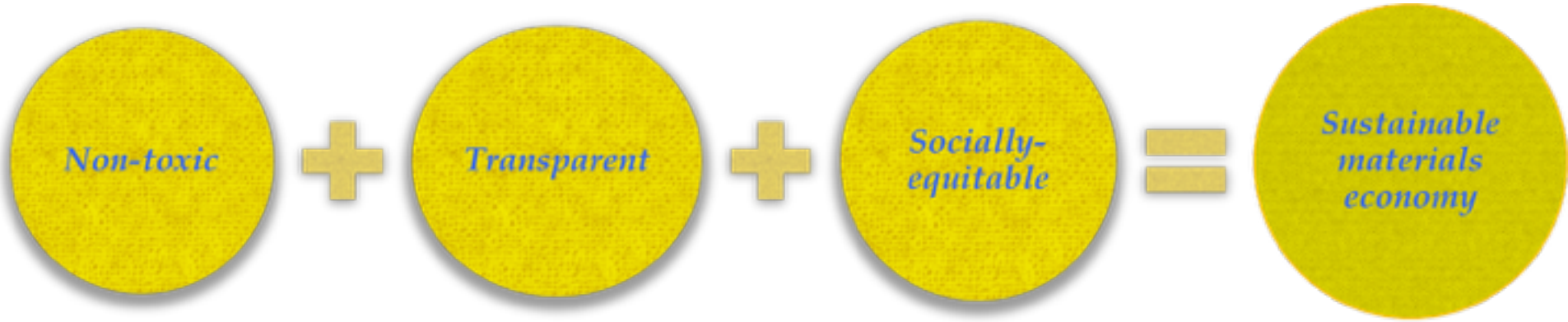
Currently applying the Red List to Prosoco's entire product line

Photo credit: John Stamets

MATERIALS PETAL AUSTRALIAN CASE STUDY

SUSTAINABLE BUILDING RESEARCH CENTRE

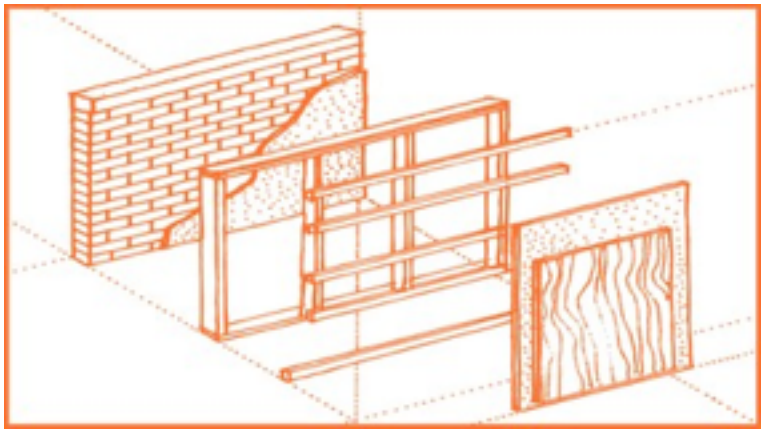
LIVING BUILDING CHALLENGE



MATERIALS

IMPERATIVES

- **Red list**
  CFCs, PVC, formaldehyde, etc.
- **Embodied Carbon Footprint**
  Carbon accounting and offsets
- **Responsible Industry**
  FSC, sustainable resources
- **Appropriate Sourcing**
  Local and regional
- **Conservation + Reuse**
  Divert waste and create Material Conservation Management Plan



LBC 2014

POTENTIAL BARRIERS

- Materials selection
- Sourcing
- Documentation
- Cost
- Time

SUSTAINABLE BUILDING RESEARCH CENTRE

Building / site size
- 2,600/8,000m2

Occupants
- 50 UOW and industry research and support staff and students

Materials highlights
- Reused brick external walls
- Recycled Australian timber


SPECIALIZED

EARLY PROJECT PLANNING

- Green Star 6 Star target
- Strong vision and mission driving sustainability
- Targeted LBC early in the design

greenstar

LIVING BUILDING CHALLENGE

- **Time**
  2 months of research
  Documentation

- **Distance**

Zone	Max. Distance	Materials or Services	MasterFormat 2012 Classification[52]
7	20,004 km	Ideas	-
6	15,000 km	Renewable Technologies[53]	Divisions: 42[54], 48
5	5,000 km	Assemblies that actively contribute to project performance[55] and adaptable reuse once installed	Divisions: 08 (all exterior products), 14*, 22[56], 23*, 26*, 33*, 44*, 46* Sections: 07 33 00[57], 07 50 00*, 10 22 00*, 10 70 00*, 44 40 00*
4	2,500 km	Consultant Travel[58]	-
3[59]	2,000 km	Light or low-density materials	Sections: 07 31 00, 07 40 00, 09 50 00, 09 60 00
2	1,000 km	Medium weight and density materials	Divisions: 06[60], 08 (all interior products) Sections: 07 32 00, 09 20 00, 09 30 00, 12 30 00
1	500 km	Heavy or high-density materials	Divisions: 03, 04, 05*[61], 31[62], 32[63]

Many manufactures just don’t know where there materials come from

- Integrated design process
- Postgraduate research
- Materials database
- Collaboration with the LBC

Interperative Signs — Materials

Materials

SBRC 2014

Environmentally Safe Materials
Building materials predominantly free of Red Listed chemicals.

Materials

Reused Materials
Extensive use of reused timber, bricks, rubber and steel railway tracks.

Locally Sourced Materials
All primary materials have been sourced within a limited radius of site.

Materials


SDRC

The Project team must document conditions prior to the start of work.

On-site landscape may only include native and/or naturalized species, planted in such a way that emulates density and biodiversity of indigenous ecosystems and supports succession.

plant succession The gradual evolution of vegetation over time and a means to plant community restoration.


THANKS FOR LISTENING!SM
QUESTION?