

# AIR QUALITY GREEN INFRASTRUCTURE A TOOLKIT FOR SCHOOLS

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Groundwork London's London's foremost social and environmental regeneration charity that works with individuals and communities to improve their environment and support greener living and working. Our multi disciplinary team has been delivering projects in London for over 30 years helping to create a brighter, greener future for all Londoners. We currently deliver over 500 projects per year, equipping individuals, businesses, schools and communities with the knowledge and tools required to make a positive difference to their local and global environment. A core part of our work is the support and delivery of locally-led capital improvements and behaviour change programmes to improve people's immediate environment, including helping them protect themselves against environmental change and poor air quality.

If you want to discuss this toolkit or any other projects concerning air quality or wider environmental improvements, please contact **londonairquality@** groundwork.org.uk.

# AIR QUALITY GREEN INFRASTRUCTURE FOR SCHOOLS

This guide is for teachers and staff considering using green infrastructure to improve their school surroundings and to support overall air quality improvement initiatives. The toolkit provides an understanding of the major air quality issues faced by schools, gives an outline of how green infrastructure can be used in schools and provides specific information about the best types of green infrastructure to potentially reduce the impacts of air pollution on children's health and wellbeing.

## **AIR POLLUTION IN SCHOOLS**

Air pollution is currently the single biggest environmental risk to human health. Children are particularly vulnerable as their lungs are still developing. Children also breathe a higher proportion of air than adults and the air they breathe is closer to sources of emissions such as car exhausts. The health effects of air pollution can include asthma attacks, reduced lung function, impaired cognitive development and behavioural issues.<sup>1-3</sup> The UK has one of the highest prevalence rates of childhood asthma in Europe and over 400 schools in London are located in areas which exceed legal air pollution limits.<sup>4</sup>

#### **Outdoor vs. Indoor Air Pollution**

This toolkit focuses on ways to mitigate the impacts of outdoor air pollution on children's health. Children in London between the ages of 5-17 spend on average just 2.3% of their time outside, the lowest amount of time compared to any other age group (and even less than prisoners), and 1 in 5 children don't spend any time playing outside at all on an average day.<sup>4</sup> This can have profound long term physical and mental health impacts.

Creating greener outdoor spaces in schools will encourage more children to participate in outdoor activities and active play. Studies have shown that the health benefits from outdoor exercise outweigh the negative health effects of air pollution in most scenarios.<sup>5</sup> Exposure to outdoor green space in schools is associated with improved cognitive development and academic performance which can potentially mitigate the negative impacts of air pollution.<sup>6&7</sup> Improvements in outdoor air quality can also have a direct impact on indoor air quality.

Around 50% of air pollution emissions comes from road traffic in London and the best way to improve air quality is to reduce vehicle emissions. Although there are many longer term large scale programmes aimed at cutting emissions, in the shorter term green infrastructure can help to encourage behaviour change and mitigate the mental and physical health impacts of pollution.

Studies have shown that the largest cognitive benefits of children's exposure to 'greenness' occurs within schools.<sup>7</sup> Research also shows that outdoor exercise in green spaces is a better way to improve mental and physical health than indoor activity in schools.<sup>8</sup>

Although by itself green infrastructure will not solve the air pollution crisis, it can provide multiple other benefits including reducing the urban heat island effect, improving water quality and reducing flood risk. Green spaces improve life expectancy and reduce health inequality by increasing levels of physical activity and mental wellbeing for people of all ages.





## **GREEN INFRASTRUCTURE**

'Green infrastructure' (GI) can be described as a network of strategically planned green spaces and other environmental features, which together deliver multiple services and benefits to the community it serves. The types of green infrastructure recommended in this guide have been selected to provide the best air quality benefits and also reflect the financial and spatial constraints that schools in urban areas often face in order to give a realistic guide to what is achievable in the shorter term for a relatively low cost.

Plants can directly reduce the level of air pollutants by capturing particulate matter on the surface of their leaves and absorbing pollutant gases through respiration. Trees have been shown to be the most effective type of vegetation at a citywide scale for removing pollutants.9 However, at a local scale, planting is most effective when it is used as a barrier separating people from direct sources of emissions, such as hedgerows or climbing planting. The closer planting is located to the source of emissions, the more effective it is at capturing pollutants before they disperse into the air. However, the direct effect of vegetation removing pollutants is small in scale compared to the total quantity of air pollution in London.

GI is most effective in schools when it is used in combination with other measures which improve public awareness of air quality issues, promotes active travel, engages local communities and provides outdoor teaching resources linked to the curriculum. GI can be used to encourage positive behaviour change through the use of moveable planters to alter traffic flows, relocate parking and sign posting alternative walking routes, as well as improving the street scene along lower emission routes. There is not one particular solution which will fit all schools and the most appropriate intervention will be dependant upon the following questions:

## 1. Where are the nearest sources of traffic related air pollution?

Look out for busy main roads, intersections or crossings where traffic is idling, bus stops and school drop off areas.

2. Where do pupils spend the majority of their time when outside? Key areas include playgrounds, sports pitches, school drop off areas and main entrances which are close to emissions sources.

3. What scope is there for planting?

Is there room to move outdoor spaces away from emissions sources? Are there opportunities to plant between the emissions sources and outdoor spaces, or in front of classroom windows? Can green spaces encourage more exercise?





## OUTDOOR CLASSROOMS

Only 10% of children in the UK have access to outdoor learning, and yet active play is the primary way that children learn. Outdoor classrooms can provide a wide range of air quality benefits in schools and contribute towards increasing the amount of green space in London. The design and composition of an outdoor classroom depends upon the existing size and type of landscape around the school. Ideally outdoor classrooms should be located in an area furthest away from major sources of emissions, and the classroom should be easily accessible and beneficial for all ages and abilities.

#### What is an Outdoor Classroom?

Outdoor classrooms can contain a variety of different plants such as trees, hedges, shrubs and climbers selected for their air quality performance, with information provided about the multiple benefits that plants provide. There should be shelter and shade provided by trees or physical structures so that the classroom can be used all year round. Informal seating and multiple entrances and paths provide better access and potential use, and the provision of storage sheds and compost areas might encourage students to get more involved in the planting and maintenance of the classroom.

#### What are the benefits?

- Outdoor learning improves children's health and increases their physical activity
- Outdoor classrooms provide an immersive teaching resource for air quality related lessons
- They can involve a range of different air quality planting with multiple benefits

• Potential for wider community engagement and involvement

#### What are the issues?

- There is no 'off the shelf' product so some initial design input is required
- They require regular maintenance which could be carried out by a class or club

#### What are the costs?

The typical costs of an outdoor classroom depends upon whether a structure is being included, but can generally range from £15-40k

#### Who can supply it?

Learning through Landscapes, Trees for Cities, Forest School Association and Groundwork can provide advice: <u>https://www.groundwork.</u> <u>org.uk/Sites/projecttoolkit/pages/</u> <u>community-projects-in-schoolgrounds</u>

Permanent timber structures -TG Escapes, The Stable Company, Father Nature, Cabinco Structures.



## **GREEN GATEWAYS**

Improving the air quality around a school's main entrance can benefit the whole school as well as parents and the wider community. A green gateway has the potential to increase public awareness of air quality issues and influence behaviour. If a green gateway includes attractive shelter, seating and cycle/scooter parking this should encourage more active travel by pupils, staff and parents alike, thereby reducing vehicular emissions at school drop off areas. Children are most exposed to air pollution when travelling in cars compared to using public transport and walking/cycling.<sup>10</sup>

#### What is a Green Gateway?

Planting can be used as a barrier between roads and school entrances to intercept pollutants, and trees can also provide shelter and shade for parents waiting to collect pupils. Greenery can be used alongside signs or banners to improve a school's visibility to motorists and discourage idling. In some instances, planters or 'parklets' can be installed on the road to keep vehicles away from the school entrance and provide safer pedestrianised spaces for children at drop-off and pick-up times. On-street planting can also be used to encourage behaviour change by creating more attractive 'clean air walking routes' to reduce exposure from more polluted roads. Greener commuting routes to school have been shown to improve students memory,<sup>7</sup> and higher levels of greenery around schools is associated with lower indoor and outdoor traffic related air pollution levels more generally.

Trees and hedges planted near to classroom windows can potentially reduce indoor pollutants and

provide shading and cooling during the summer months to reduce the use of air conditioning.

#### What are the benefits?

- Encourages active travel
- Better public awareness
- Cooling buildings to reduce the use of air conditioning

#### What are the issues?

- Often little scope to move school entrances away from emissions sources
- Permission would need to be sought for any work outside of the school land ownership area

#### What are the costs?

 $\pm$ 8-10k for a single parking space sized 'parklet' or  $\pm$ 5-15k for planting to create a green gateway

#### Who can supply it?

Temporary Parklets - Meristem Design, Vestre, Cyclehoop Planting – Jacksons, Suttons, Thompson & Morgan or other local plant nurseries





## TREES AND HEDGEROWS

In London, trees currently remove 2241 tonnes of pollution per year which saves around £126million per annum. However, we are currently losing more trees than we are planting in the UK, with approximately 10,000 trees being cut down every year in London alone. The average reduction of particulate matter near a tree is between 7-24%, and the localised cooling effect of a tree is up to 2C.<sup>11</sup> Hedges can also provide localised air quality benefits when used as a barrier between roads and schools.

#### Which trees and hedges?

Trees should be planted in schools wherever possible as they capture large quantities of pollutants and reduce the urban heat island effect. Evergreen hedges and trees will provide year round protection from pollution as opposed to deciduous species, but it is important to select the correct species for the site conditions to ensure their long term survival. It is also important to use low allergen species to avoid exacerbating pollen related allergies.

Planting trees of different heights and shapes creates more air turbulence which increases the amount of particulate deposition. Trees in planters have a limited lifespan and it is always preferable to plant trees directly in the ground wherever possible.

#### What are the benefits?

- Trees and hedges are very flexible, low cost and attractive
- They improve biodiversity and provide multiple ecosystem services

What are the issues?

- Trees and hedges are much cheaper to purchase at smaller sizes but will have a better air quality impact when they reach maturity which can take several years
- More space is needed for larger trees
- Existing soft landscape is required otherwise there is a high cost to create planting beds

#### What are the costs?

- £2-5 per linear metre for 60cm high hedgerow
- £150-250 per linear metre for 1.8m instant hedgerow
- £250-500 per linear metre for a 3-4m high tree

#### Who can supply it?

Free trees for Schools: Woodland Trust, Trees for Cities, Tree Council

Commercial Tree Nurseries: Barcham Trees, Hillier, Ashridge Nurseries, Deepdale







## PLANTERS AND GREEN SCREENS

Raised planters can be used when there is no existing soil and there are no opportunities to convert hard space into soft landscape for planting. Raised planters require watering in summer which can be done by hand or via an automated irrigation system. Typical materials for planters include timber, fibreglass and powder coated steel. The wider the planter, the more opportunity there is to incorporate a range of air quality planting and therefore provide more of the benefits.

#### Which planters and green screens?

Raised beds made of timber sleepers can provide informal seating opportunities for pupils and can make the maintenance of planting easier. Timber or metal planters can be adapted to include trellis panels or mesh, which will allow climbers to grow vertically - these are known as 'Green Screens'.

Ivy is most commonly used in green screens as it is evergreen and has a large leaf area, although there are other planting options available. Although studies have shown that green screens can reduce localised air pollution adjacent to the leaves, there is no evidence as of yet to show if this improves the overall air quality of playgrounds and outdoor spaces in schools. However, the cognitive, academic and health benefits of looking out onto greenery from classrooms and exercising in outdoor green spaces have been clearly demonstrated.<sup>12</sup>

#### What are the benefits?

• Instant green screens can have

an almost immediate effect on increasing greening levels

• Can be used where planting in the ground is impossible

#### What are the issues?

- Require an automated irrigation system
- Planters are much more expensive than planting directly

#### What are the costs?

into the soil

The cost of planters very much depends on the material used, but you should expect to pay around  $\pounds 100-200$  per linear metre for a standard planter and around  $\pounds 250-350$  per linear metre for an instant green screen. Costs can be reduced by planting climbers and allowing them to grow instead of purchasing an instant green screen.

#### Who can supply it?

Green Screens – Mobilane, Green-Tech, Meristem Design, Scotscape Planters – Broxap, Iota, Woodscape, Marshalls, Furnitubes



## EDUCATIONAL BENEFITS

There are many ways to relate air quality green infrastructure to the curriculum and involve students in the planting, monitoring and maintenance of plants. Groundwork London are able to provide cross curriculum air quality workshops in schools. The workshops combine the science behind the dangers of air pollution to our health and using artwork such as digital stop motion animation to create compelling messages around reducing pollution. The following resources provide some ideas about how to get the most educational benefit from air quality green infrastructure.

#### Groundwork London

https://www.groundwork.org.uk/Sites/london/pages/eduction-lon

#### Clean Air 4 Primary Schools Toolkit

https://www.london.gov.uk/sites/default/files/ca4s\_toolkit.pdf

#### Friends of the Earth Clean Air School Packs

https://friendsoftheearth.uk/sites/default/files/downloads/clean-air-schools-pack-103300.pdf

#### Greenpeace Air Pollution Teaching Resources

https://www.eco-schools.org.uk/wp-content/uploads/2016/11/Air-Pollution-Teachers-Pack.pdf

#### Healthy Air Teaching Pack

https://www.healthyair.org.uk/documents/2013/02/healthy-air-education-pack-2012.pdf/

#### Clean Air Day Schools Toolkit

https://www.cleanairday.org.uk/forms/schools-toolkit

#### **Outdoor Classroom Day**

https://outdoorclassroomday.org.uk/resource/the-impact-of-outdoor-learning-and-playtime-at-school-and-beyond/





## COMMUNITY INVOLVEMENT

Air quality green infrastructure provides opportunities to engage with and involve the wider community such as parents, residents, and local businesses. School air pollution awareness campaigns have the potential to reach a wide audience and encourage motorists to change their behaviour.

Volunteering events can be organised for the community to get involved in planting and maintaining green infrastructure within schools, therefore creating a sense of community ownership. Local groups could also use green spaces in schools for horticultural training and community activities during the weekends and the school holidays, thereby benefiting a wider range of people and ensuring that the spaces are valued.

Groundwork London are able to arrange corporate volunteering days and community gardeners to visit schools - please contact Alex Forrester for more details on 020 7922 1230 or email corporate.partnerships@ groundwork.org.uk

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11. 'Planting Health Air' (2016) Report by The Nature Conservancy

12. Dongying L, Sullivan W (2015) 'Impact of views to school landscapes on recovery from stress and mental fatigue' Landscape and Urban Planning







## CASE STUDY: NATURE'S HELPER WALLS

The Nature's Helper Walls project, run by Corpus Christi Catholic Primary School Parents Association, has installed "walls" of ivy along the wire fencing of the school's two playgrounds. This project transpired as a response to the school's recent pollution monitoring, which showed nitrogen dioxide (NO2) levels exceeding legal limits. Parents and teachers were then determined to reduce risks to the students' health by making the play area safer.

The school's green living wall aims to improve air quality by providing a barrier between the playground and the source of pollution, therefore reducing exposure to toxic air. At Corpus Christi School, this will ultimately reduce health risks for the 450 children and 50 staff that use the playground. Other benefits to the school's natural living wall include: increasing levels of biodiversity, creating a positive impact on peoples' mental wellbeing, providing a natural play environment for students, supplying more privacy to the children and reducing noise pollution.

The Community Green Spaces Grant provided £20,000 for the Nature's Helper Walls project. This

"I'm really happy that we've got our green wall because we know there's a lot of pollution around us. I can't wait to spend more time playing there."

- School student (aged 7)

funding supported the majority of the installation with approximately 78m of ivy screen and fibreglass. Nature's Helper Walls also secured a further £8,000+ match funding from a group of committed parents and two local businesses, who paid for the remainder of the wall and some materials for the volunteers. Since the project has started, the school has also been inspired to do more to green the playground, starting with adding trees in planters.

The project has proven to be a huge success and a great educational experience for the students, who have been involved from the beginning, learning about pollution and how and why the green wall would help. The school has also created a "Green Committee" of students, parents and teachers. who will be responsible for the maintenance of the wall and increasing awareness of air quality issues. The wall is also fitted with drip-irrigation systems which automatically water three times a day (this can be adapted for dry or wet spells).



The installation event itself took place over the weekend of the anniversary of the Grenfell Tower fire, in which a member of staff lost her young niece. The school wanted to commemorate this in a positive way for the children to remember, so they started the initiative "Green for Grenfell", where the children created green hearts and art work to hang up along with the ivy wall.

Since the creation of the living wall, other schools in Lambeth have been inspired to start planning their own. When asked what advice the school would give to similar projects, they suggested to first have a clear understanding of the air quality in the area with accurate data. This is a great way to get the local community passionate about ways to improve the air quality, and allows before and after readings so projects can measure their impact. They also suggest recruiting a core team of at least three committed volunteers who meet regularly to discuss ivy wall options with multiple providers, as they will be able to offer lots of information.

Students, parents and teachers alike are excited to see the future readings of pollution in the playground, and hope that their efforts will encourage other schools to install their own green walls. "I just want to say thank you to the Mayor's Office for giving us the funding to deal with such a serious problem. There is a school down the road who undertook a similar project, and in just one year they have seen a reduction of 50% of pollution levels in their playground – fingers crossed we can report the same in a year's time!"

- School Head Teacher





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#### Sustainability Values:

"Our strategy is all about investing in and improving central London real estate to unlock the often hidden potential. A key aspect of unlocking this potential and delivering long-term value is to create enduring, sustainable relationships with the communities where we are working.

As a business 100% focused on central London, we want to help address some of London's key social and environmental challenges. As a result, we have made a three-year commitment to work with our charity partner Groundwork London, to support them in their work to address air quality issues in schools through urban green infrastructure."

Janine Cole, Head of Sustainability

GREAT PORTLAND ESTATES

