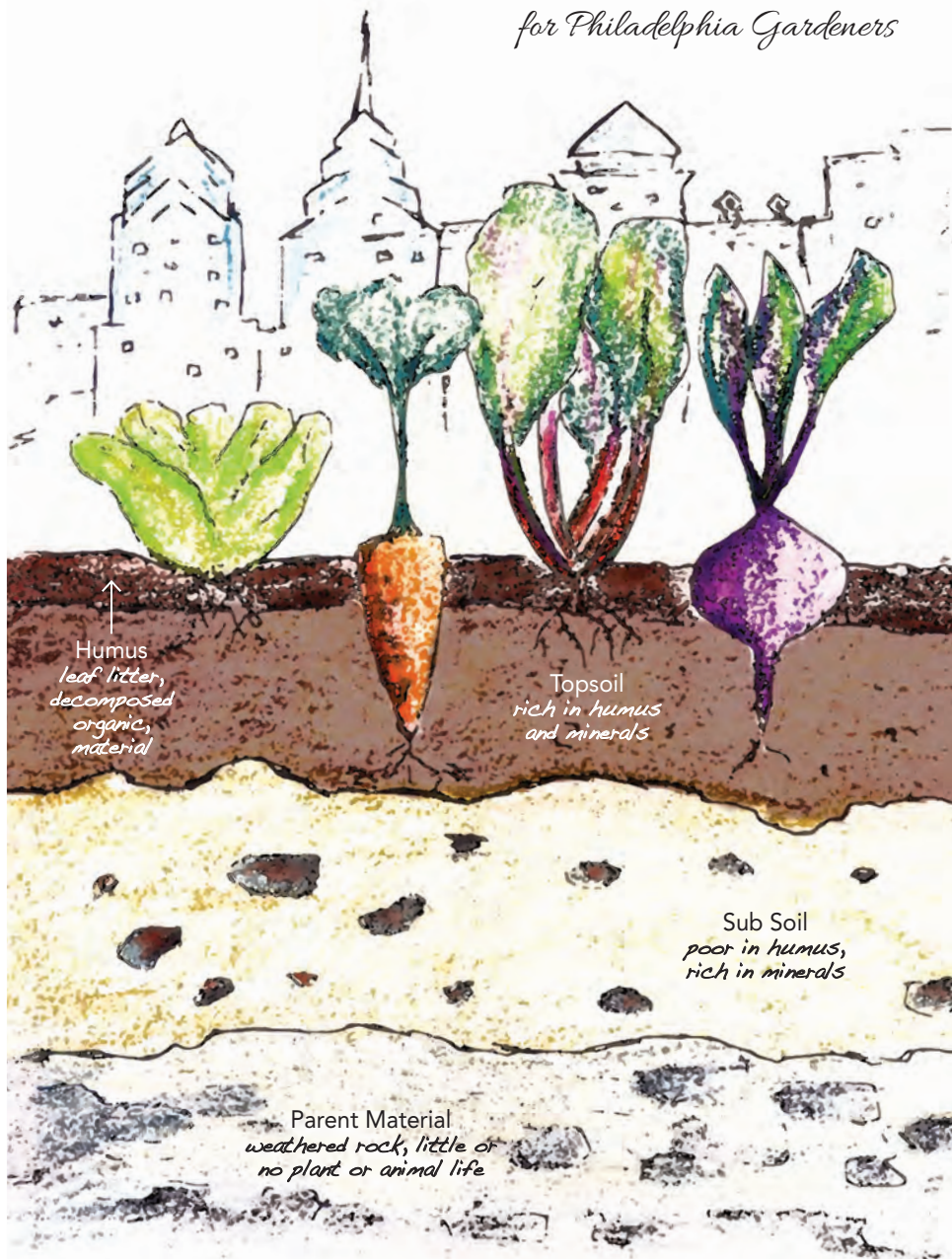


Penn State **Extension**

GARDENING FROM THE GROUND UP

*soil health and best practices
for Philadelphia Gardeners*



↑
Humus
*leaf litter,
decomposed
organic,
material*

Topsoil
*rich in humus
and minerals*

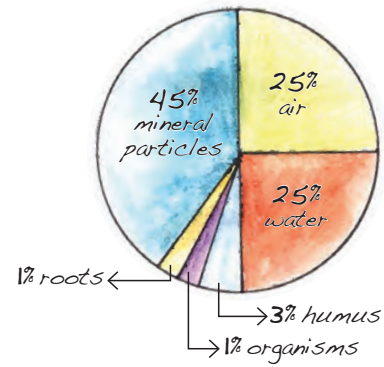
Sub Soil
*poor in humus,
rich in minerals*

Parent Material
*weathered rock, little or
no plant or animal life*

HEALTHY SOIL

for Philadelphia
Urban Gardeners

Healthy soil is the foundation of all good gardens and our actions impact this important resource. But...urban soils may be in poor health or be contaminated by prior uses.



WHAT IS SOIL?



Soil is one of the three major natural resources, alongside air and water. It is one of the marvelous products of nature and without which there would be no life.

What do you need to know when gardening on sites with past industrial and commercial uses? How do you know if your back or side yard was contaminated by residues of lead based paint? **HOW DO YOU NURTURE DEPLETED SOIL BACK TO HEALTH?**

The good news is that experts from the US Environmental Protection Agency, the Natural Resource Conservation Service (NRCS), Penn State Extension, and other major Universities conclude that in general, the benefits of urban gardening greatly outweigh the risks.

By learning more about how to assess your site, and by following the recommendations and best practices listed below, you will decrease the chances of exposure to contaminants while simultaneously building healthy productive soil to benefit your crops and the environment we all share.

Interested in learning more about Penn State Extension? Visit us at www.extension.psu.edu

Contaminated soil can be especially dangerous to young children who play on or close to the ground. Ingesting or breathing in contaminated soil is more likely to cause harm than eating food grown in contaminated soil.

Contaminants may not enter the fruits or vegetables, but the soil left behind on the leaves, on tools, toys or on a baby's hand, can then be ingested and cause harm. For more information about children and soil contact Penn State Extension.

Confused?

ASK A PENN STATE
EXTENSION MASTER
GARDENER FOR HELP!

Email us:
PhiladelphiaExt@psu.edu

STEP 1: TAKE A CLOSER LOOK

at your potential garden site

- Wear boots & gloves, bring a shovel, notebook and pencil.
- Sketch a diagram of the site, show size, location and surrounding features such as roads, neighboring buildings and your best guess about past site use.
- Walk the site and note stained soil, unusual odors, trash or debris, old tanks, pipes, dead or dying plants, burned patches, old equipment etc.
- Take photos.
- Dig several holes* in random spots and note what you discover
- Visit after a heavy rain and notice whether water absorbs well, or if it sheets and runs off (indicating compaction).
- Talk to neighbors... ask them about past site use, ask about dumping or burning they have noticed, note all information.

*To protect yourself and potential damage to utilities - you are required to call 811 at least three business days before digging to have utility lines marked - there is no charge for this service.

STEP 2: FIND OUT *about your site history*

Knowing what business or activity was conducted on your potential garden site can alert you to the presence of potential contaminants, and suggest next steps to make sure that gardening is done in the safest way possible. Knowing the history of adjacent land use is also important. A potential garden site may be down hill from a former gas station, or downwind of a former lead paint factory or the site of a chemical spill, and the soil may contain pollutants from those sites.

Resources:

Philaehistory.org

www.phila.gov/zoningarchive

www.phila.gov/brt/propertyinformation/

Visit the Free Library of Philadelphia Central Branch 4th floor to view Sandborn Maps and get help from the librarian to locate your site find out more about its past use(s):

www.libraries.psu.edu/psul/digital/sanborn.html

Soil contamination is the presence of chemicals or elements in the soil at a level that could possibly pose health risks. The table¹ below lists sources of common contaminants found on sites with commercial or industrial history.

General Source	Examples of Previous Site Uses	Specific Contaminants
Paint (before 1978)	Old residential buildings, mining, leather tanning, landfill operations, aircraft component manufacturing	Lead
High traffic areas	Next to heavily trafficked roadways or highways, near roadways built before leaded fuel was phased out	Lead, zinc, polycyclic aromatic hydrocarbons (PAHs)
Treated Lumber	Lumber treatment facilities	Arsenic, chromium, copper
Burning wastes	Landfill operations	PAHs, dioxins
Contaminated Manure	Copper and zinc salts added to animal feed	Copper, zinc
Coal ash	Coal-fired power plants, landfills	Sulfur
Sewage sludge	Sewage treatment plants, agricultural	Cadmium, copper, zinc, lead, molybdenum, persistent bioaccumulative toxins (PBTs)
Petroleum spills	Gas stations, residential / commercial/ industrial uses (anywhere an aboveground or underground storage tank is or has been located)	PAHs, benzene, toluene, xylene, ethyl benzene
Pesticides	Widespread pesticide use, such as in orchards, pesticide formulation packaging and shipping	Lead, arsenic, mercury, chlordane and other chlorinated pesticides
Commercial / industrial site use		PAHs, petroleum products, solvents, lead, other heavy metals (such as arsenic, cadmium, chromium, lead, mercury and zinc)
Dry cleaners		Stoddard solvent and tetrachloroethene
Metal finishing operations		Metals and cyanides

EPA's Toxic Release Inventory (TRI) can provide information to communities about sites where contaminants were released into the environment. The Envirofacts database allows users to enter location information, such as zip code, address or county location, to get information about releases in their area. The database is available online at: www.epa.gov/enviro.

¹ From [epa.gov](http://www.epa.gov). available at http://www.epa.gov/region4/foiapg/readingroom/rcra_community/urban_gardening_fina_fact_sheet.pdf

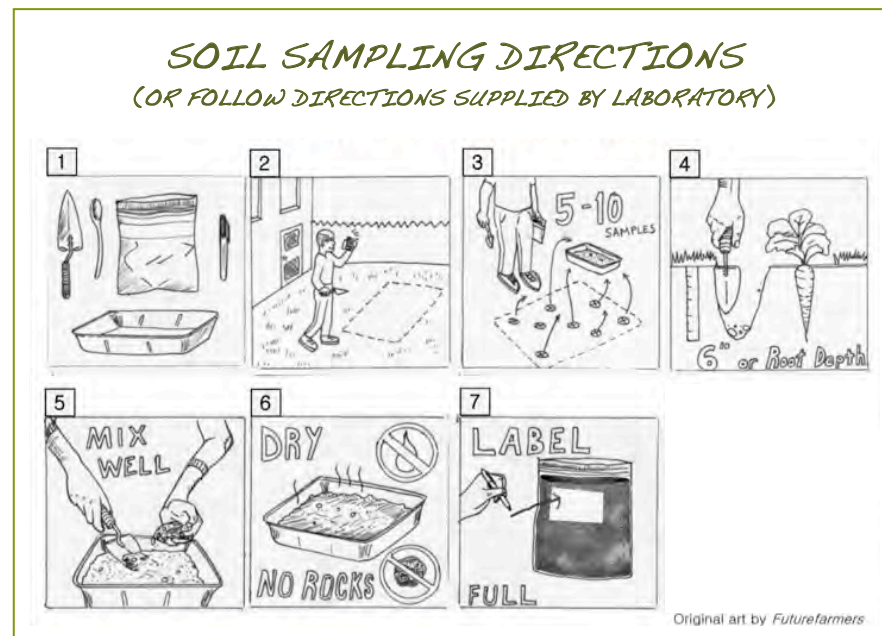
STEP 3: DON'T GUESS... *soil test!*

Soil testing can measure levels of essential plant nutrients, soil pH, salt content, heavy metals such as lead and other contaminants that may pose health risks. Other reasons for testing urban soil:

- To assess the soil fertility and pH levels
- Your site visit and site history indicated potential concerns
- To determine whether you can grow food directly in the ground or to make raised beds
- To assess if the area is safe as a play area for children
- Repurposing brownfields for community parks or gardens may require a test of the soil to meet health and safety standards.

Soil samples are collected and sent to a lab. The Penn State Soil Lab offers a basic soil test which measures soil pH, the levels of phosphorus, potassium, calcium, and magnesium and will make a nitrogen recommendation. For an additional fee, further examination of organic matter, soluble salts, and several micronutrients can be administered. Special tests for potentially harmful elements and heavy metals, such as arsenic and lead, are also available from a variety of sources – including free heavy metal screening - depending on your situation. Penn State Extension staff and PS Extension Master Gardener volunteers can assist you in determining what tests to consider and where to have these done as well as guide you towards options for free and low cost heavy metal testing. The basic soil test kit costs \$10.00 with additional fees as requests for specifics increase.

See resources on the back of this booklet for more information.



STEP 4: INTERPRETING THE TEST RESULTS *and amending soil*

The lab will send you results that measure each substance in your soil sample in units of parts per million (ppm). The lab will also include recommendations for soil amendments (compost, lime, fertilizers etc.) based the information you provided about your proposed use. Feel free to contact a Penn State Extension Master Gardener for assistance in determining amendment options for your situation.

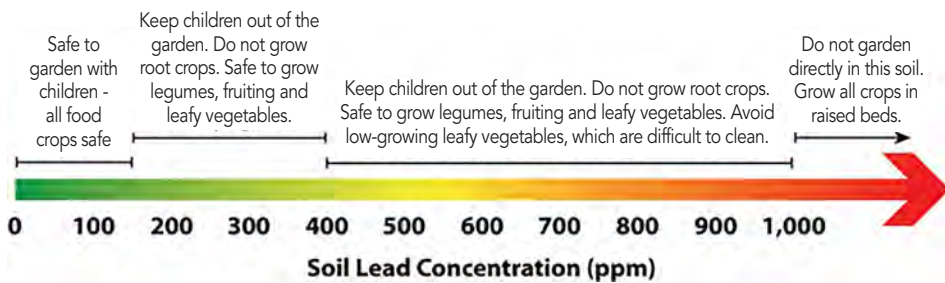
If you have tested for heavy metals it is important to know that there is no agreed upon standard measurement or definition of acceptable levels of contaminants in soil. Most urban soils will carry some level of lead, cadmium, soluble salts, or other chemical residues that are natural to the soil or have accumulated over time. Some cities have "guidelines" based on complex analysis of possible routes to contamination. Several environmental institutions have also set research-based recommendations for safe exposure levels. This chart from the Kansas State University Agricultural Experiment Station who has done considerable work on urban and contaminated soils is one good source of guidance. Penn State Extension can assist you in learning more.

pH
ENSURE YOUR PH IS CLOSE TO 7 TO KEEP ANY HEAVY METALS SUCH AS LEAD OR CADMIUM "LOCKED UP" IN THE SOIL, RATHER THAN FREE TO BE ABSORBED BY EDIBLE PLANTS. 6.5-7 PH IS ALSO THE OPTIMUM RANGE FOR PLANT GROWTH.

Recommended soil lead level limits for growing food in most gardens

from Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Kansas State University Agricultural Experiment Station has done considerable work on urban and contaminated soils. The chart below presents a protective generalized approach on gardening in soils containing different concentrations of lead. The chart is not an "all cases" guidance as research has shown that several variables, including soil and plant type, can influence plant uptake.



DON'T BE DISCOURAGED OR SCARED AWAY BY THE RESULTS OF YOUR TEST!

There are a number of ways you can reduce the risks of working and growing in contaminated soils. Contact your Philadelphia Extension Office or ask a Master Gardener to help you.

BEST PRACTICES IN THE GARDEN

for all gardeners

The easiest way to reduce the chance of coming into contact with potential contaminants is to make or build raised beds from clean, untreated wood or to garden in containers. Use a mixture of tested clean soil and compost. Cover pathways with mulch (such as wood chips). Maintain soil pH of 6.5-7 which keeps lead bound up in the soil, and therefore less available for plant uptake.

To add another layer of protection if you have raised beds or if you are planting directly in the ground:

- Locate gardens away from old painted buildings and roads with heavy traffic.
- Add high rates of compost and other organic amendments directly to soil (up to 50:50 by volume) in order to dilute contaminant concentrations, improve the physical and biological properties of soil.
- Limit exposure and prevent direct contact with highly contaminated soil. Place landscape fabric between ground soil and new, clean soil. The soil dust in the air is the most common pathway of human exposure.
- Avoid over-fertilization which can increase salts and other chemicals that harm the soil micro-organisms needed for growing healthy plants.
- Avoid harmful pesticides and herbicides by practicing integrated pest management (IPM). Ask a Penn State Extension Master Gardener for more info on this topic.
- Wear gloves as a barrier between your hands and the soil and wash hands well after gardening.
- Clean tools, gloves and shoes before bringing them indoors.
- Always wash produce using running water before preparing or eating.
- To be safe, avoid growing root vegetables and leafy greens in highly contaminated soil as they are most likely to have direct contact and uptake contaminants.

MORE INFORMATION

This pamphlet was created with support from the **Natural Resources Conservation Service**, whose web-site has a wealth of information about soil, water, and other important conservation topics.

www.nrcs.usda.gov/wps/portal/nrcs/main/pa/soils/health/

Environmental Protection Agency

REUSING POTENTIALLY CONTAMINATED LANDSCAPES: Growing Gardens in Urban Soils

www.epa.gov/region4/foiapggs/readingroom/rcra_community/urban_gardening_fina_fact_sheet.pdf

Toronto Public Health Guide for soil testing in urban gardens

www1.toronto.ca/wps/portal/contentonly?vgnextoid=8b1d5ce6dfb31410VgnVCM10000071d60f89RCRD&vgnextchannel=5f51ebfc2bb31410VgnVCM10000071d60f89RCRD

Johns Hopkins Center for A Livable Future - Soil Safety Resource Guide for Urban Food Growers

www.jhsph.edu/research/centers-and-institutes/johns-hopkins-center-for-a-livable-future/_pdf/projects/urban-soil-safety/CLF%20Soil%20Safety%20Guide.pdf

Cornell Waste Management Institute – Healthy Soils, Healthy Communities

cwmi.css.cornell.edu/healthysouls.htm

Guide from Penn State Extension on Home Composting

extension.psu.edu/plants/gardening/fact-sheets/general-gardening/home-composting-a-guide-for-home-gardeners/extension_publication_file

HAVE A GARDENING QUESTION?

Call us: 215.471.2200 Option 7

Email us: PhiladelphiaExt@psu.edu
with "Hortline" as the subject line

STAY CONNECTED! VISIT OUR BLOG:

www.philadelphiacountymastergardeners.blogspot.com

For more information, visit:

www.extension.psu.edu/philadelphia/programs/mastergardener

GET COMPOST!

Fairmount Park Organic Recycling Center
free compost to pick up Location:

3850 Ford Road, Philadelphia, PA 19131
215.685.0108

Hours of Operation:

Monday - Friday 7:30 a.m. - 3:00 p.m.

Saturday: 7:30 a.m. - 11:30 a.m. (April - October)

www.phila.gov/ParksandRecreation/environment/Pages/RecyclingCenter.aspx

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Illustration & Design by Andrea Lewandowski

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