From Grey to Green

Sally O’ Halloran

12 oktober 2022

Contents

- Grey to Green Phase 1 (2016)

Pause

- Grey to Green Phase 2 (2020)
- Maintenance (skjøtsel)

Sheffield – The Steel City

Unknown artist

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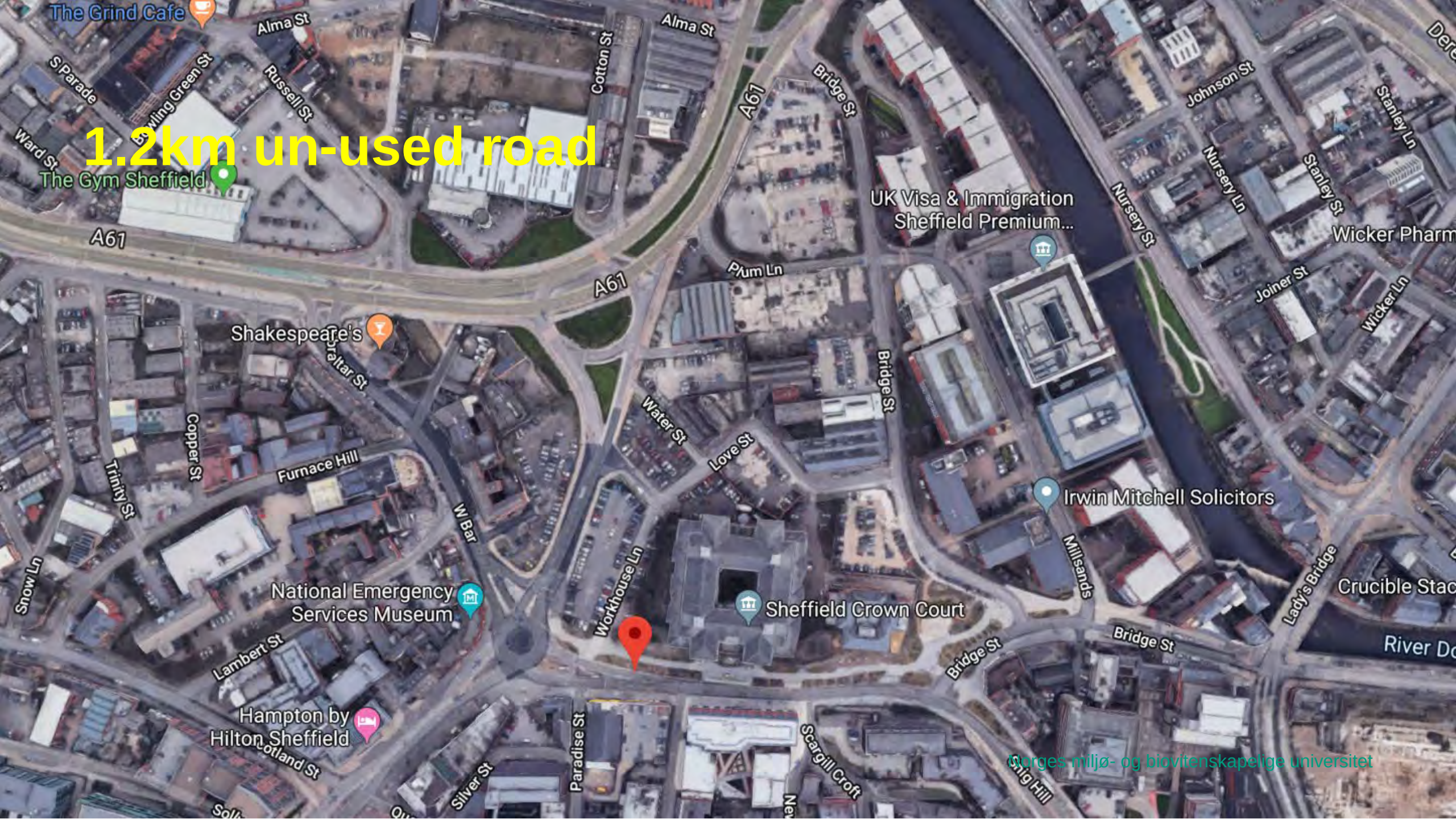
River Sheaf and River Don

25 juni 2017 Sheffield

Grey to Green - a virtual tour for Sheffield's Castlegate Festival 2020 - YouTube

Change in road layout: 4 lanes to 2



Zac Tudor-
landscape architect
Sheffield City Council (municipality)
(now with Arup)

https://www.instagram.com/zac_tudor/

Prof. Nigel Dunnett University of Sheffield

John Lewis Rain Garden, London 2015

The John Lewis Rain Garden - Landform Consultants Limited

John Lewis Rain Garden – Nigel Dunnett

Prof. James Hitchmough University of Sheffield

Designing ecological vegetation to be managed in part, with nature conservation type treatments

Application of a spring disturbance to remove winter weed cohorts

1/3 blocks cut down in April and removed, 1/3 cut and herbicided with vinegar (conc. aceti acid), 1/3 burnt as seen in this image


The London Olympic Games 2012-naturalistic planting Showing alternatives to traditional planting
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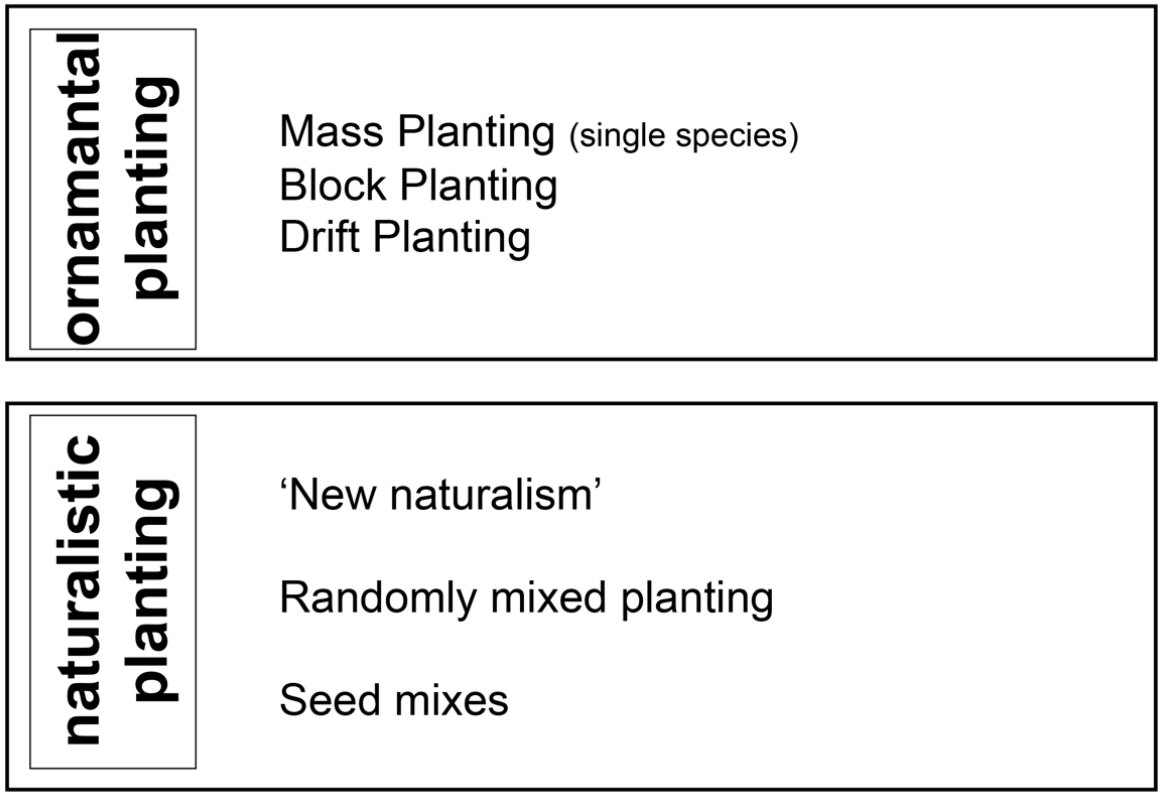
Different ways of using perennials (stauder)



1. Mass Planting (masseplantinger)

Why use perennials in a mass planting?

Design

- A simple design
- Not distracting
- Creates calm in between more dynamic spaces
- Seasonal interest
- There is a clear arrangement of the plants- formal design

Maintenance

- Easy! Very little skill involved
- Weeds are visible instantly
- Pests and disease are visible instantly
- Maintenance tasks get performed at one time as the whole planting has the same requirements

2. Block Planting (blokkplanting)


Staudene plantet i større
eller mindre grupper
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Why use perennials in a block planting?

Design

- You can create dynamic combinations
- You can repeat blocks to create rhythm and movement
- Create calm in between more dynamic spaces
- Seasonal interest
- Clear structure as every plant has a given location

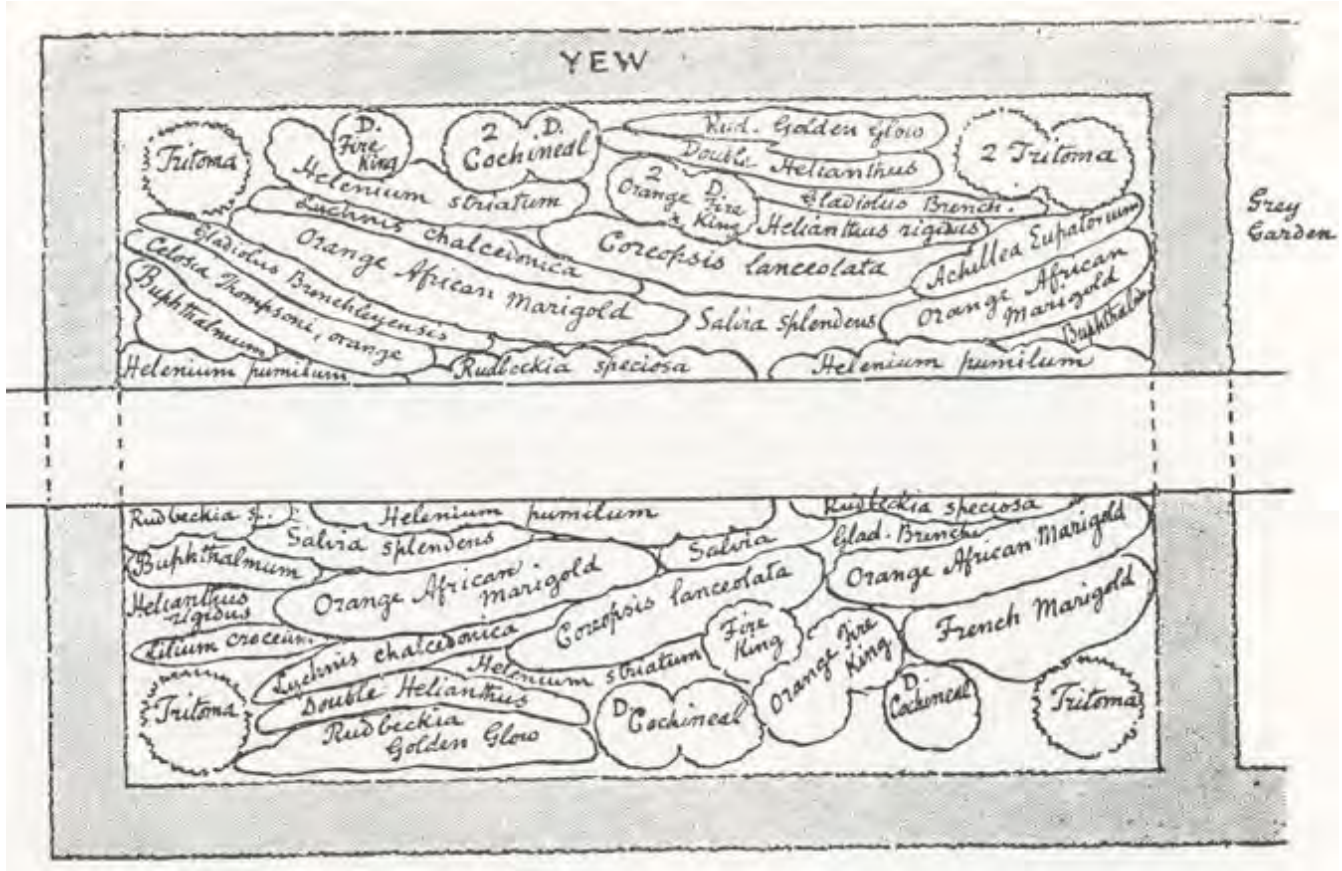
Maintenance

- If plant choices are done well it is easy- issues occur with competition if not
- Weeds are visible instantly
- Pests and disease are visible instantly
- Ideally maintenance tasks get performed at one time as the whole planting has the same requirements

Piet Oudolf- The Perennial Wave (Staudebølgen)

3. Drift Planting

Drift Planting



The English designer Gertrude Jekyll (1843-1932) stretched/**elongated the block to make a ‘drift’.**

For the first time this allowed the plants to be viewed from different angles as you passed by.

Piet Oudolf- The Perennial Wave (Staudebølgen)

Why use perennials in a drift planting?

Design

- You can create dynamic combinations
- You can repeat drifts to create rhythm and movement
- Create calm in between more dynamic spaces
- Seasonal interest
- The same plant can be viewed from different angles

Maintenance

- If plant choices are done well it is easy-issues occur with competition if not
- Weeds are visible instantly
- Pests and disease are visible instantly
- Maintenance tasks get performed at one time as the whole planting has the same requirements

Mixed Perennial Plantings used in the Olympic Park London in 2012


High impact- the public loved it!
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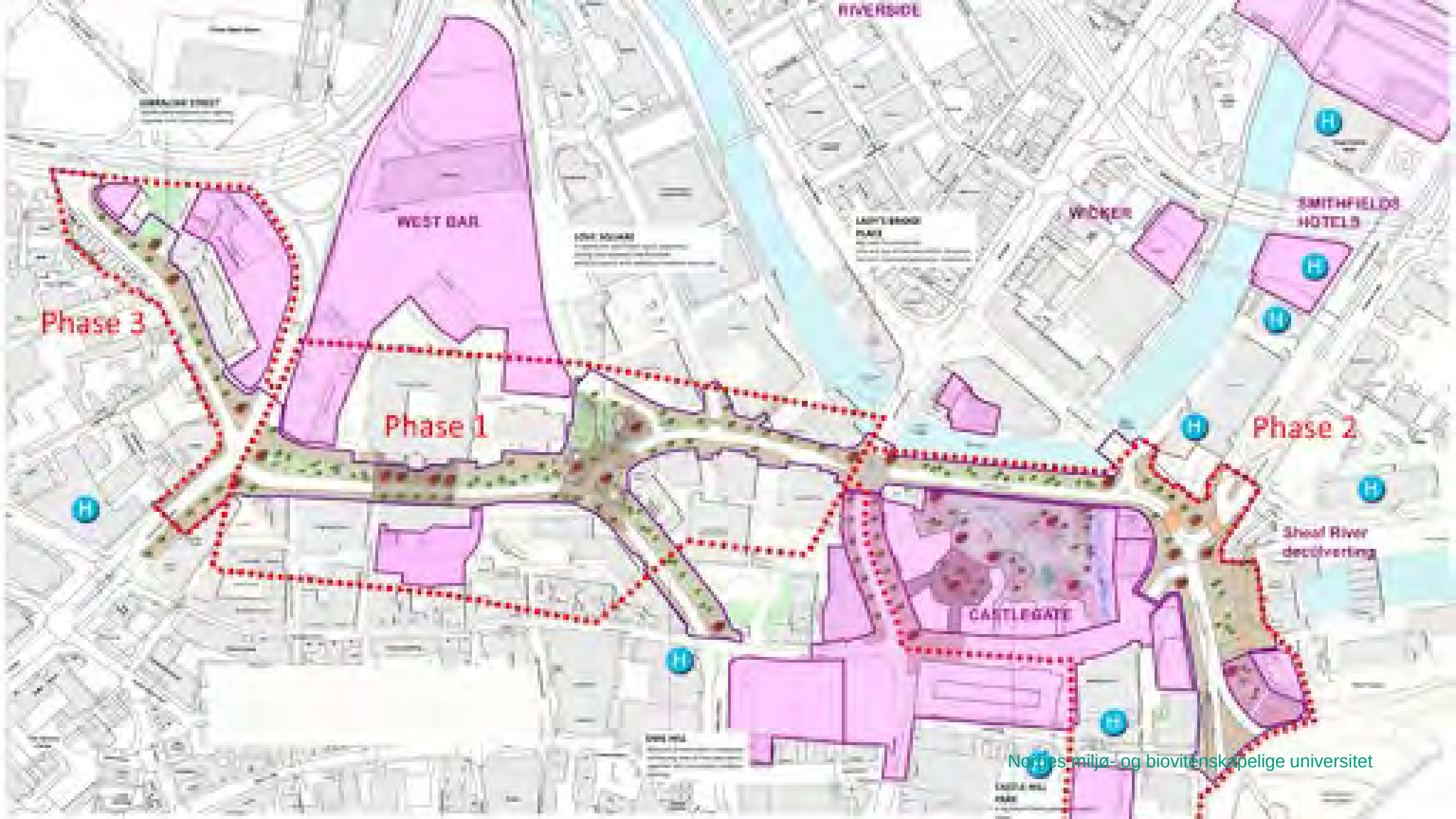
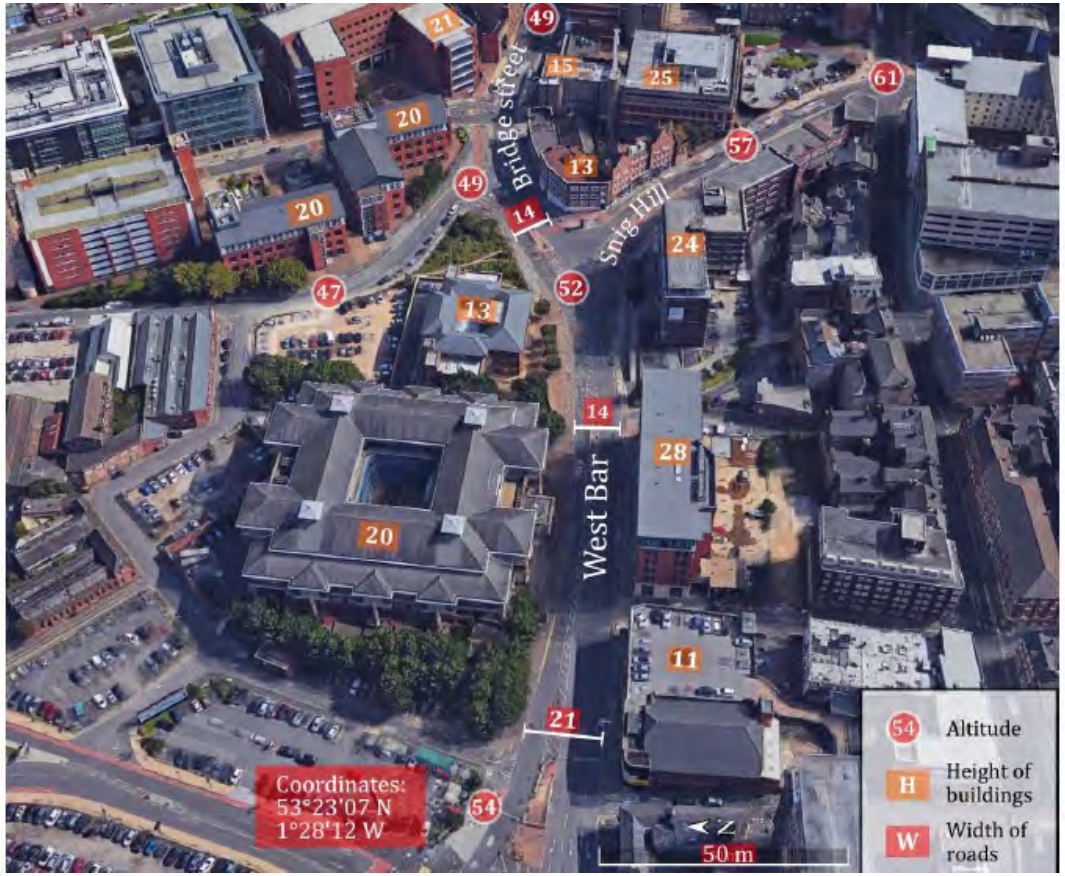
Grey to Green- Phase 1

- Sustainable Drainage System (SuDS)
  - to reduce and treat stormwater runoff
  - in a way that is closer to or mimics natural systems
    - **functional but also beautiful**
    - functional but also has **recreational value**
    - functional but also **has ecological value** (increase biodiversity, create habitats)



Grey to Green Phase 1



- Design: Nigel Dunnett and Zac Tudor Sheffield City Council
- Client: Sheffield City Council
- Planted: Spring 2016
- Cost £3.6m
- Funded by:Sheffield City Region, the European Regional Development Fund and Sheffield City Council

SuDS (Sustainable Drainage System) Capacity

- Modelling of the scheme showed the SuDS elements could contain a 60 minute, 1 in 30 year rainfall event with discharge from the whole scheme to the river reduced from 47.3l/sec to 9l/sec.
- A 1 in 100 year rainstorm, 60 minute event would start to overtop the weirs but nevertheless reduces rates from 69.6l/sec to 9.2l/sec.
- The output from the system to the river was estimated to be 12.1l/sec for a 1 in 100 year event plus 30% for climate change. (Data from SusDrain)

Proposal in 2015

Interconnecting swales-The sides are lined to promote the flow of water into the bioswales, but the bases are unlined to promote infiltration of the water back into the underlying soil.

On a steeply sloping part of the site, the check dams form a cascade, with the potential for water to flow over the top of each dam in a severe storm.

Modified green roof style substrate – free draining

Soil (jord)

- 70% crushed sandstone aggregate from a local quarry (size: 200mm to sand): this promotes drainage and gives bulk and solidity to the substrate.

- 20% composted green waste from Sheffield. The compost component is important because it contains a range of plant nutrients which are released slowly to the plants. Crucially, it retains water for plant growth, improves soil structure for good root growth, and promotes soil microbiota.

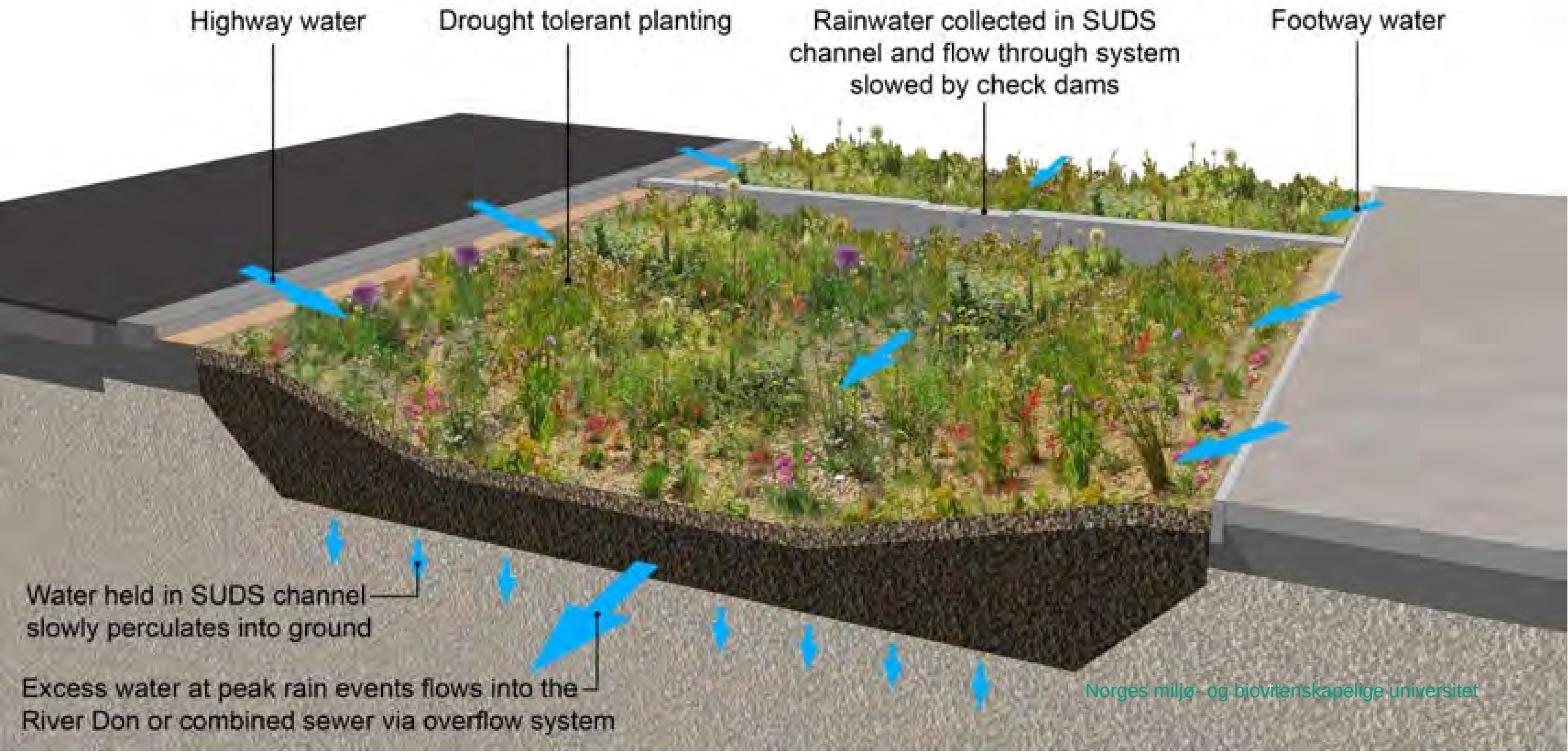
- 10% sandy silt loam. The standard soil-forming components of sand, silt and clay are essential to promote nutrient availability to plants, and to providing an optimal soil structure for plant growth.

A 50mm mulch layer of sandstone aggregate

Interconnected swales

- The SuDS scheme of the Grey to Green was planned as a series of interconnected swale cells.
- The palisade fencing along the centre of the beds was a temporary feature to prevent dogs and children crossing the newly establishing plantings.

Sustainable Drainage System (SuDS) - 'Grey to Green Phase 1'

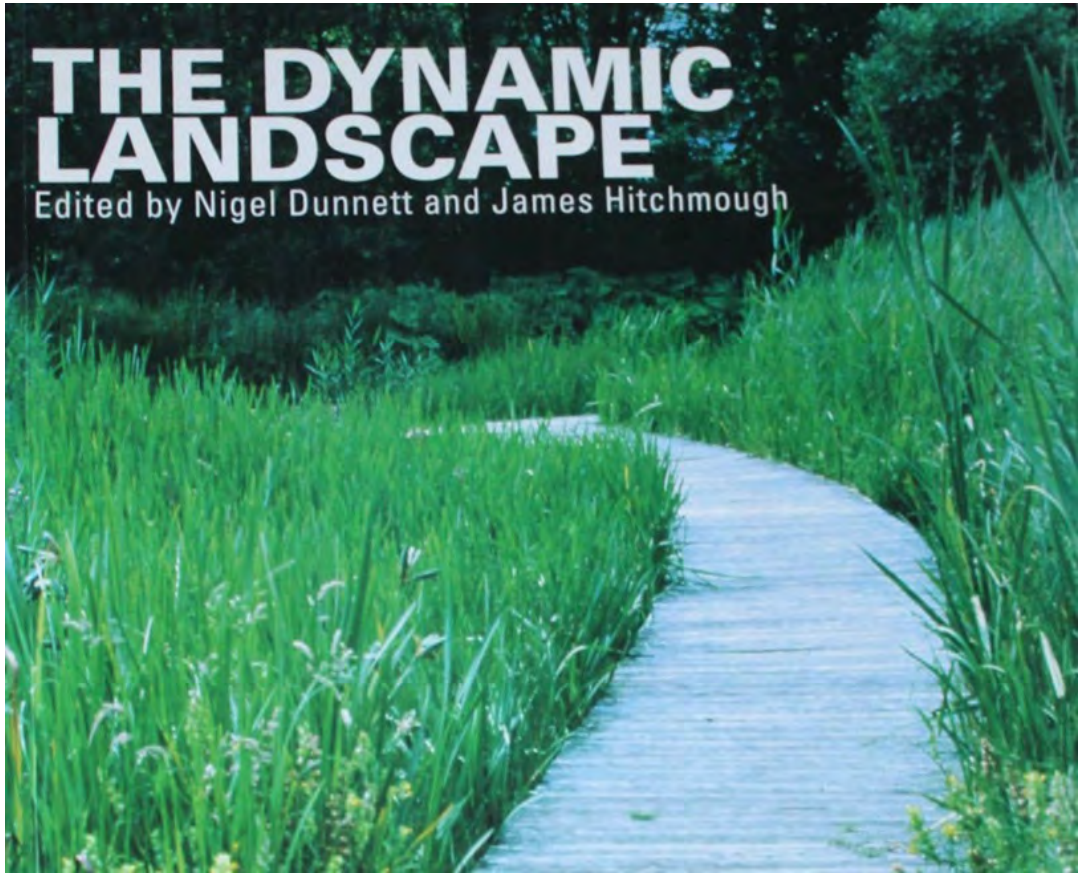


Site conditions for planting

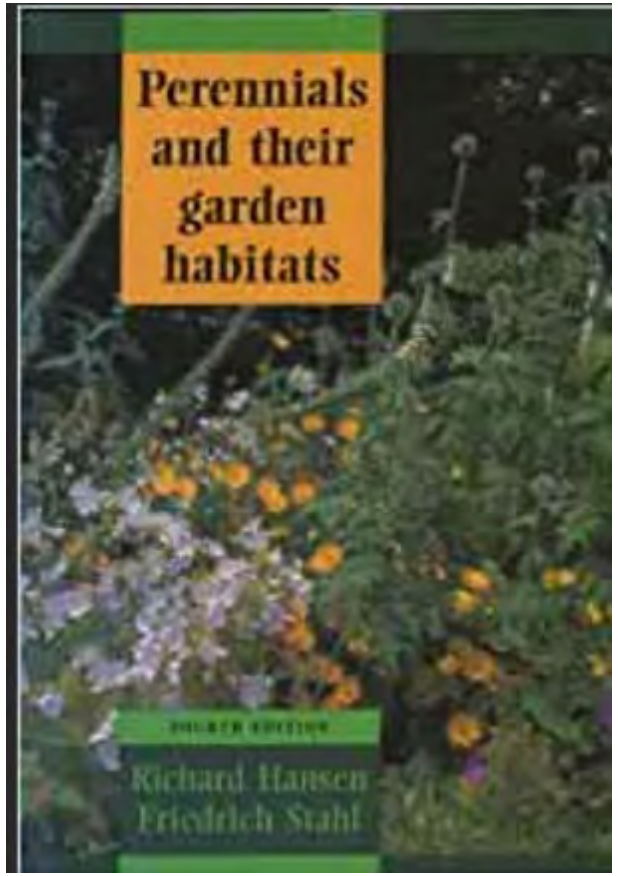
1. Rain gardens and bioswales that directly received the shed rainwater runoff.The average amount of annual precipitation in Sheffield is: 845 mm (33.3 inch) but monthly averages can be as low as 57mm (2.2 inch).
2. Areas that did not receive the runoff: these planting beds are higher than all the others in terms of levels and water does not flow into them.

Naturalistic Planting

- Naturalistic herbaceous vegetation differs from conventional herbaceous vegetation in that it mimics the spatial and structural form of semi-natural vegetation
- There will sometimes be distinct canopy layers; shade tolerant near the ground with spring interest
- The decline of early flowering species is masked by the growth of the next ‘layer’
- Individual species are generally not planted in clearly defined groups or blocks



Ideas originating in Germany



Published in English in 1993

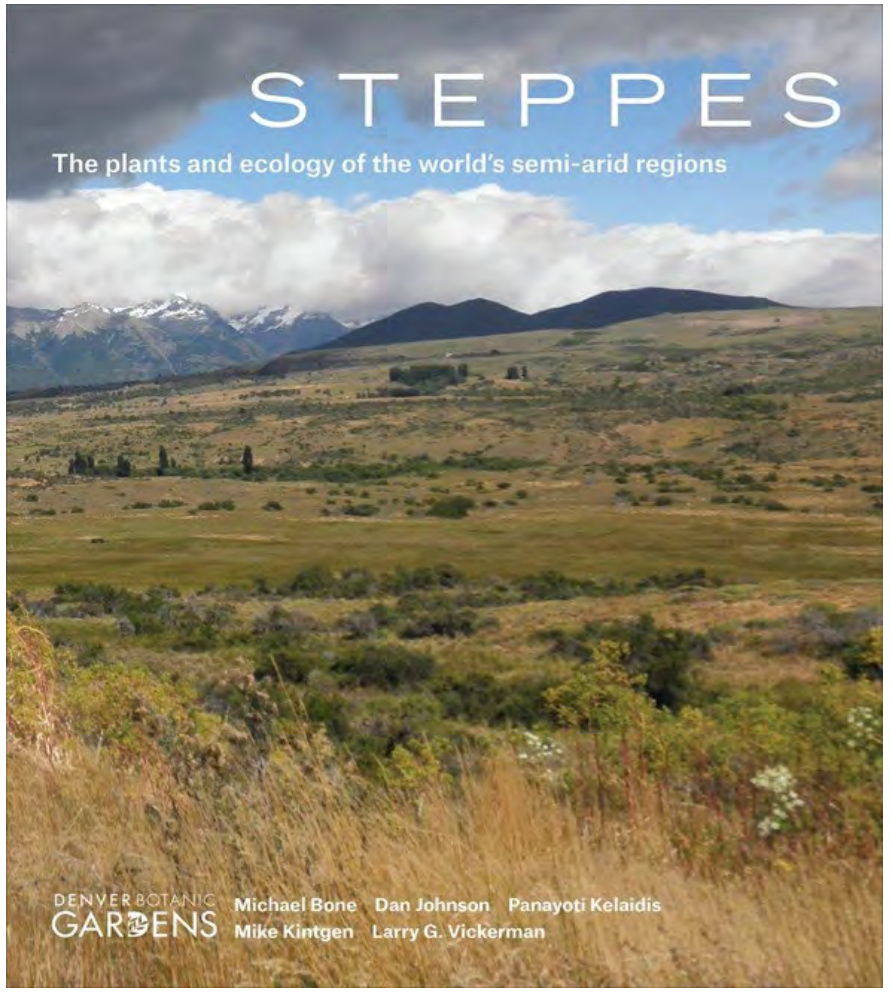
- Prof. Richard Hansen classified plants according to their habitats and plant sociology –how they co-exisit in the wild
- Sichtungsgarten Hermannshof was established in the 1980s to establish new directions in German planting design, especially in naturalistic planting styles
- Experimental Garden -it uses academic research to inform design
- Schau- und Sichtungsgarten Hermannshof (sichtungsgarten-hermannshof.de)

Woodland plant community for moist soils- Hermannshof

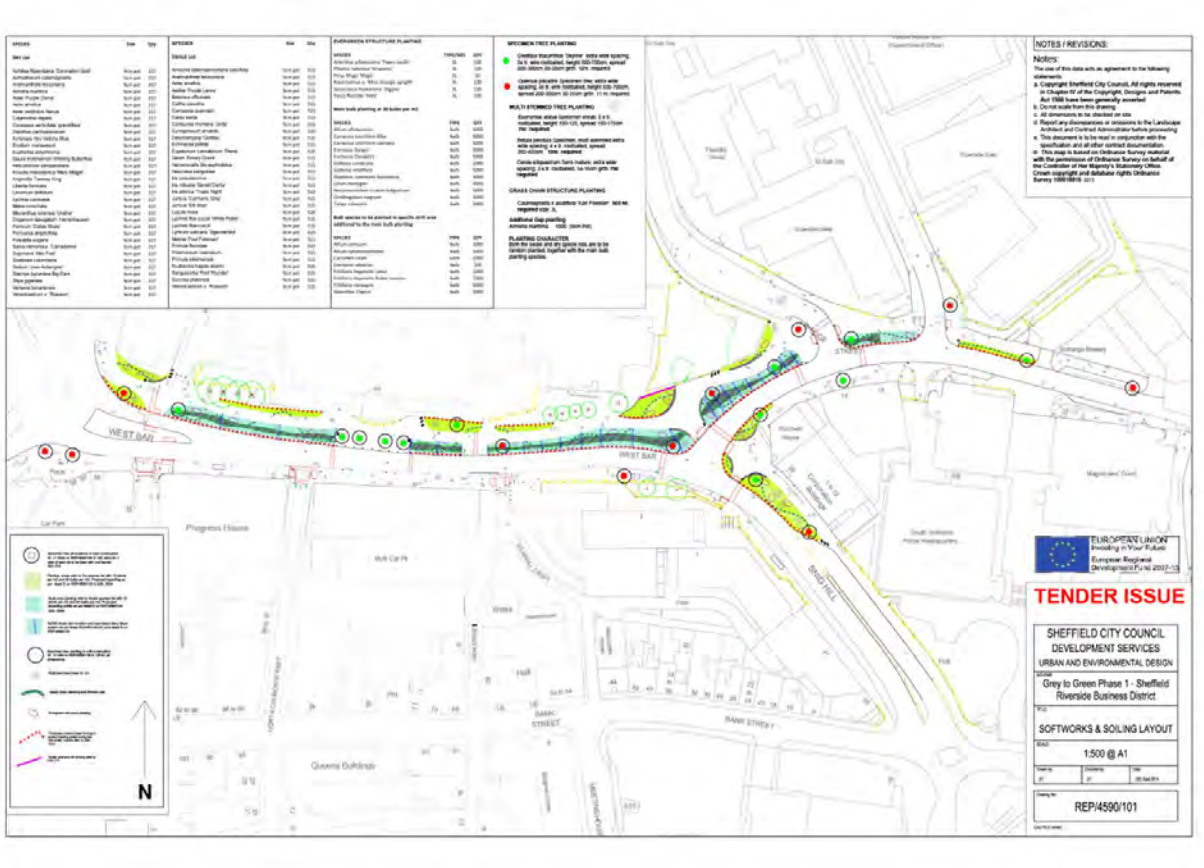
Plants arranged from similar habitats

Steppe planting in the Weihenstephan viewing garden with yucca varieties from the Richard Hansen period.

Steppe is a term for semi-arid grassland vegetation
Nigel was familiar with this from his Green Roof research



2 Mixed Plantings- Dry (yellow) and Swale-moist (blue)



Mixed perennial plantings

How to make a mixed perennial planting

- Choose plants that are suited to the site
- Ensure that plants are suited to each other:
  - They need to be able to live together
- Design the planting in layers:
  - ground layer
  - main foliage layer
  - taller emergent layer
- **Ensure maximum ground coverage**
- Plantings need to look good
  - don’t rely on flowers
  - exploit variety of leaf shapes, texture and colours
  - use new foliage of summer-leafing species to hide untidy spring ephemeral

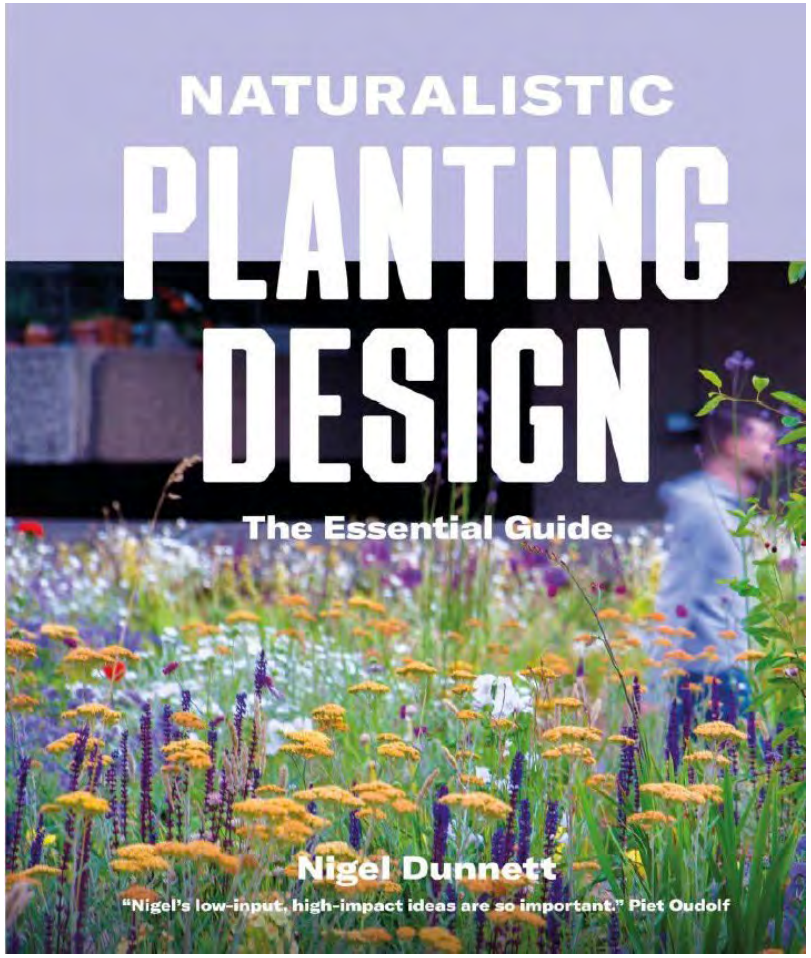
Mixed Perennial Planting

- Leddplanter (over 70 cm) (ca.1-10%)
- Støtteplanter (40-70 cm) (ca.10-40%)
- Bunndekkere (5-40cm)(ca.30-50%)
- Fyllstauder (kortvarige arter) (5-10%)
- Density 9-11/m2

Nigel Dunnett's approach

- Anchor plants + or -10%
- Satellite + or -40%
- Ground cover plants + or -45%
- Short-lived +or –5%

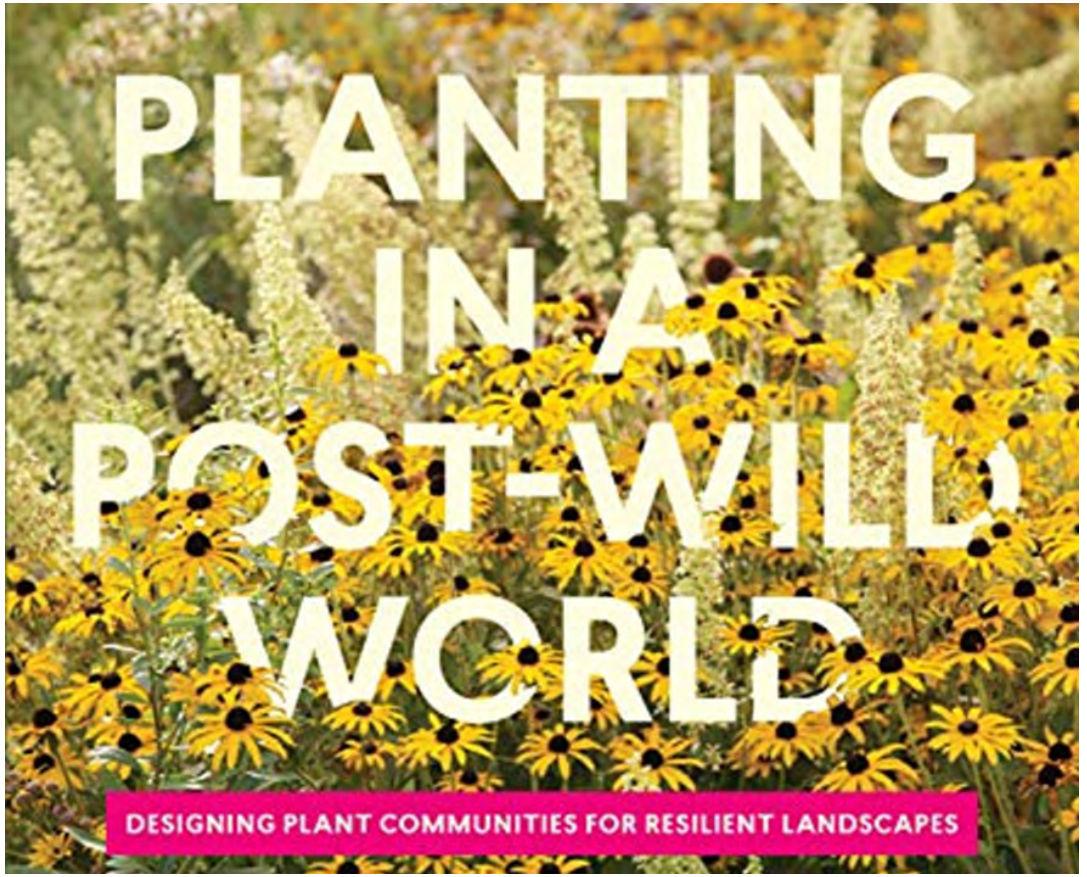
- The Ground cover plants need to tolerate shade.
- The Filler plants are short lived and just add colour for the first years.



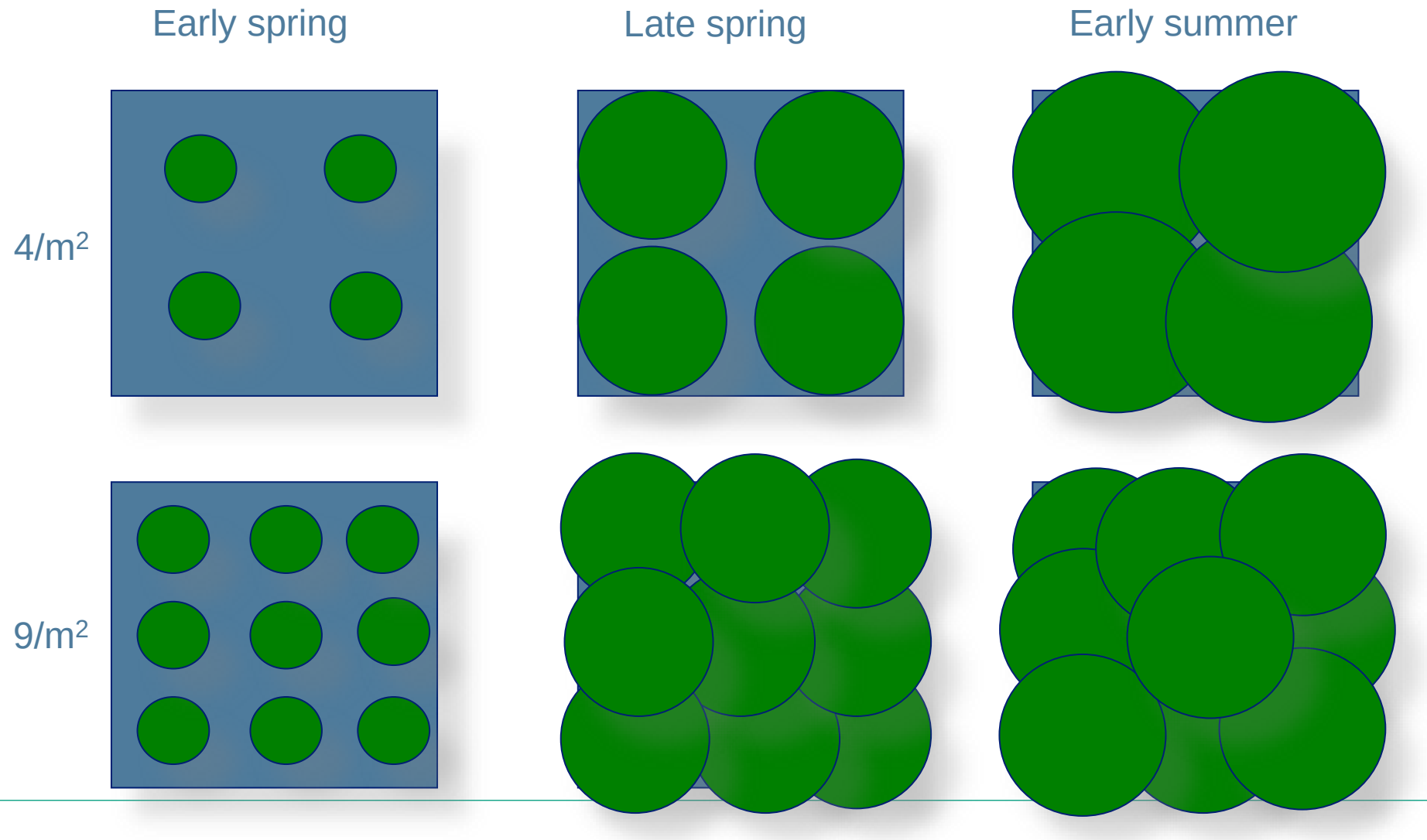
Thomas Rainer and Claudia West approach

- Structural/framework plants – 10-15%
- Seasonal theme plants – 20-40%
- Ground cover plants- 50%
- Filler plants – 5-10%

- Density 9-11/m2



Planting Density- Increasing density reduces weeding



Sarah Price

- She builds up her planting schemes in three vertical layers, starting with the lowest. Short plants (less than 12in/30cm)
- The middle layer (approximately 12in-40in/30cm-100cm, around 40 per cent of the mix) often contains plants with a long flowering season
- Two to three species are selected that will emerge through this tapestry, the taller the better (40in/100cm or more, approximately 10 per cent or less of the mix)

https://www.telegraph.co.uk/gardening/9672234/Sarah-Prices-guide-to-naturalistic-planting-for-your-garden.html

Nigel is inspired by plant communities in the wild

Liatris spicata

- Native Range: Central and Eastern United States
- Habitat: Grown in damp meadows, the edges of marshes and savannahs
- Stiff, upright stems
- Photo showing it in North-East Illinois in a mesic sand prairie in the Kankakee Sands Region. Sandy soil but does get wet.

Liatris spicata in the Grey to Green in Sheffield

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Example of a mixed perennial planting-Olympic Park

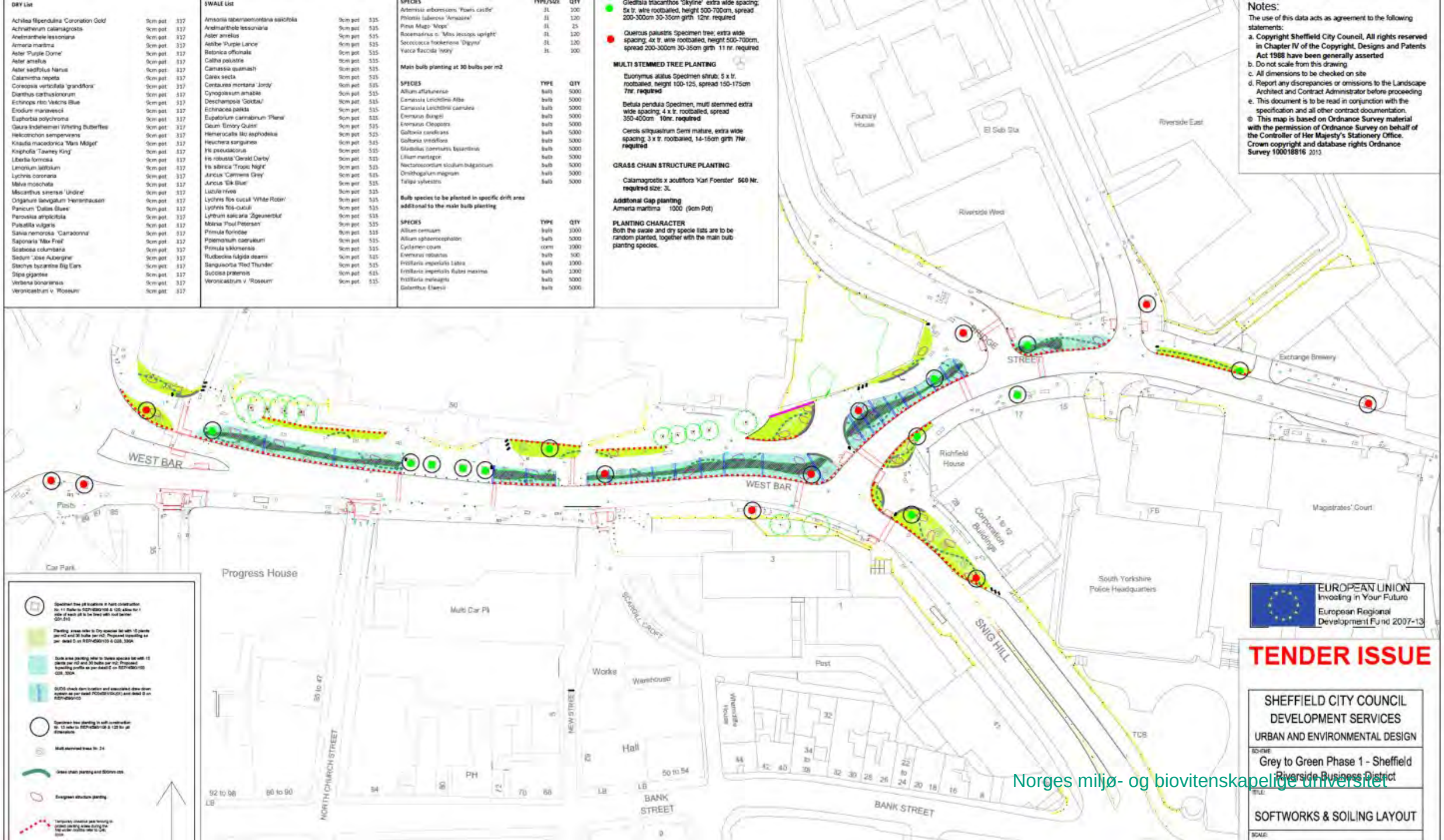
WESTERN EUROPE Tall Emergents	Mean number of plants per m²	Max flowering height (mm)
Cepheleria gigantea	0.1	2000
Telekia speciosa	0.1	1500
Molina caerulea 'Transparent'	0.1	2000
	0.3	
Medium Canopy Species		
Deschampsia cespitosa 'Gold Veil'	1	1000
Campanula lactiflora 'Pritchard's Variety'	0.2	1000
Molinia caerulea 'Moorhexe'	1	600
Lythrum virgatum 'Dropmore Purple'	1.5	1000
Trollius europaeus	0.2	500
Succisa pratensis	0.5	500
Sanguisorba officinalis	1	700
Achnatherum calamagrostis	1	600
Centaurea dealbata 'Steenbergii'	1.5	600
Euphorbia palustris	0.5	900
Geranium sylvaticum 'Mayflower'	0.2	500
Leucanthemum 'x superbum ' T E Killin	3	700
	11.6	
Lower Ground Species and Fillers		
Lychnis chalcedonica	0.2	750
Total plants/m²	11.9	

3 layers
Tall- lowest % because they are the biggest plants

Medium – plants selected for long seasonal interest. Note these plants do not all look good at the one time- but come in succession

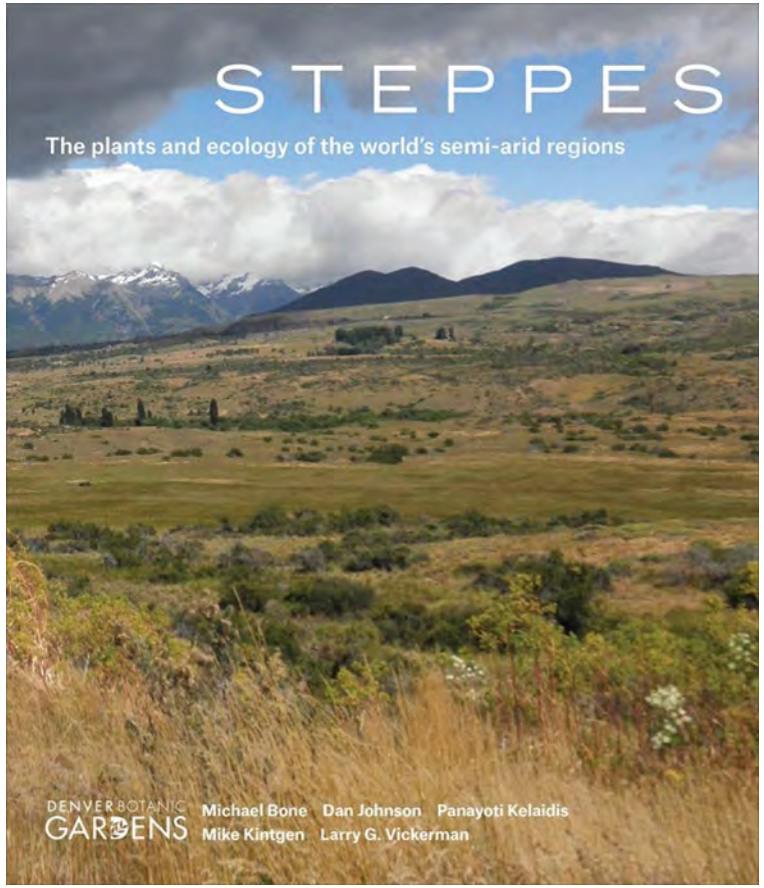
Lower- this can have a higher % but in this case the plants in the Medium layer also took this role

Medium canopy species = *Deschampsia*, *Leucanthemum* and *Sanguisorba*



Stauder – Dry List

SPECIES	Size	Qty
DRY List		
Achillea filipendulina 'Coronation Gold'	9cm pot	317
Achnatherum calamagrostis	9cm pot	317
Anelmanthele lessoniana	9cm pot	317
Armeria maritma	9cm pot	317
Aster 'Purple Dome'	9cm pot	317
Aster amellus	9cm pot	317
Aster sedifolius Nanus	9cm pot	317
Calamintha nepeta	9cm pot	317
Coreopsis verticillata 'grandiflora'	9cm pot	317
Dianthus carthusionorum	9cm pot	317
Echinops ritro Veitchs Blue	9cm pot	317
Erodium manavescii	9cm pot	317
Euphorbia polychroma	9cm pot	317
Gaura lindeheimeri Whirling Butterflies	9cm pot	317
Helicotrichon sempervirens	9cm pot	317
Knautia macedonica 'Mars Midget'	9cm pot	317
Kniphofia 'Tawney King'	9cm pot	317
Libertia formosa	9cm pot	317
Limonium latifolium	9cm pot	317
Lychnis coronaria	9cm pot	317
Malva moschata	9cm pot	317
Miscanthus sinensis 'Undine'	9cm pot	317
Origanum laevigatum 'Herrenhausen	9cm pot	317
Panicum 'Dallas Blues'	9cm pot	317
Perovskia atriplicifolia	9cm pot	317
Pulsatilla vulgaris	9cm pot	317
Salvia nemorosa 'Carradonna'	9cm pot	317
Saponaria 'Max Freil'	9cm pot	317
Scabiosa columbaria	9cm pot	317
Sedum 'Jose Aubergine'	9cm pot	317
Stachys byzantina Big Ears	9cm pot	317
Stipa gigantea	9cm pot	317
Verbena bonariensis	9cm pot	317
Veronicastrum v. 'Roseum'	9cm pot	317




Achillea filipendulina 'Coronation Gold'
Verbena bonariensis (Fyllstauder)
Lychnis coronaria
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Støtteplanter


Juli 2019
CROWN
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Swale list

Centaurea montana 'Jordy'	9cm pot	515
Cynogolssum amabile	9cm pot	515
Deschampsia 'Goldtau'	9cm pot	515
Echinacea pallida	9cm pot	515
Eupatorium cannabinum 'Plena'	9cm pot	515
Geum 'Emory Quinn'	9cm pot	515
Hemerocallis lilio asphodelus	9cm pot	515
Heuchera sanguinea	9cm pot	515
Iris pseudacorus	9cm pot	515
Iris robusta 'Gerald Darby'	9cm pot	515
Iris sibirica 'Tropic Night'	9cm pot	515
Juncus 'Carmens Grey'	9cm pot	515
Juncus 'Elk Blue'	9cm pot	515
Luzula nivea	9cm pot	515
Lychnis flos cuculi 'White Robin'	9cm pot	515
Lychnis flos-cuculi	9cm pot	515
Lyhtrum salicaria 'Zigeunerblut'	9cm pot	515
Molinia 'Poul Petersen'	9cm pot	515
Primula florindae	9cm pot	515


Lythrum salicaria 'Zigeunerblut'
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Mai 2019 *Lychnis flos-cuculi*
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Iris sibirica 'Tropic Night'
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Veronicastrum virginicum 'Album'

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Eupatorium cannabinum 'Plenum'
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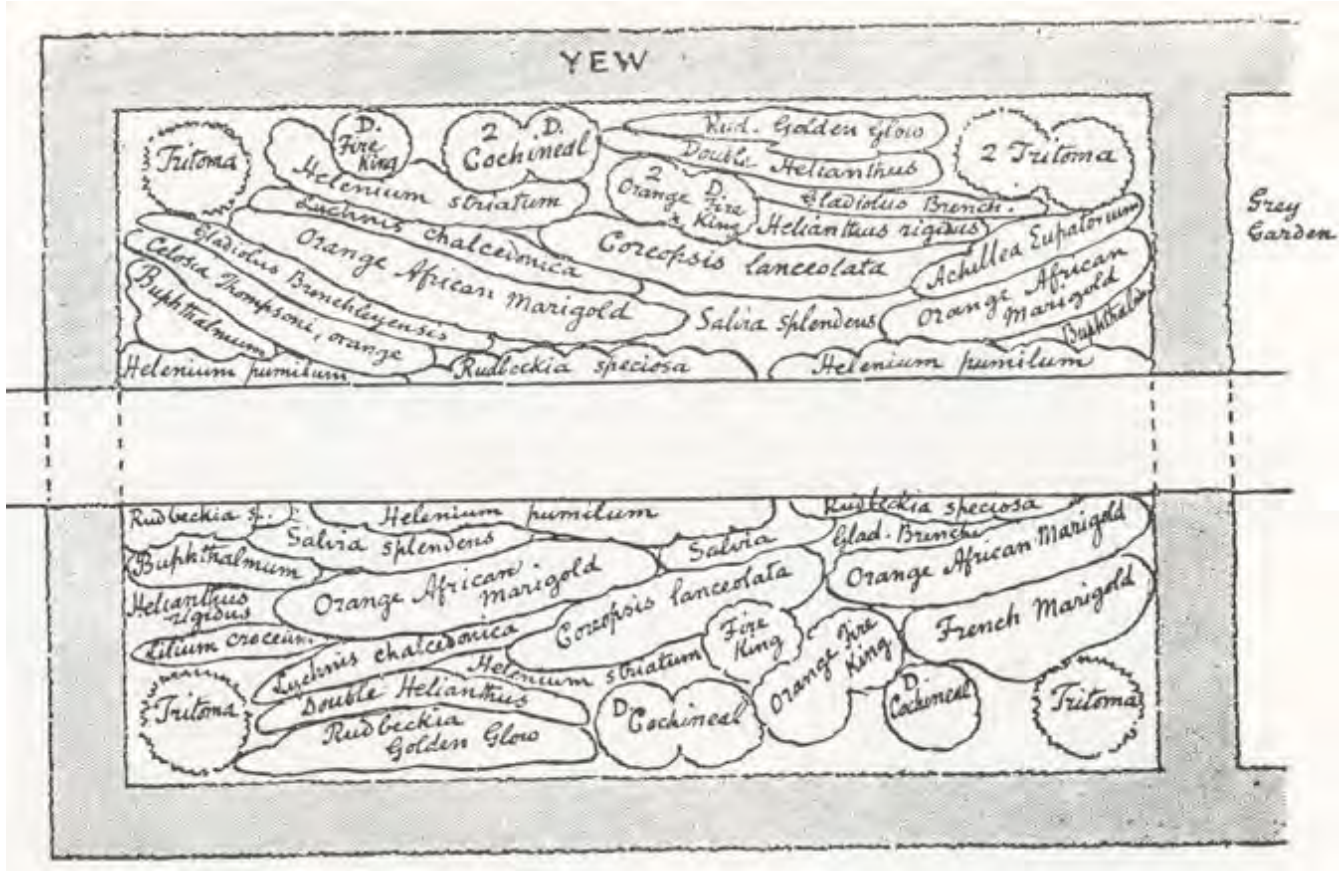
Ornamental grasses- prydgress

‘Grass chain structure planting’ of 560 *Calamagrostis* × *acutiflora* 'Karl Foerster’ in 3l pots

(Shown in juli 2016)

‘Chain planting’ = Drift Planting



The English designer Gertrude Jekyll (1843-1932) stretched/**elongated the block to make a ‘drift’.**

For the first time this allowed the plants to be viewed from different angles as you passed by.


Oktober 2017
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August 2019
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Echinops ritro ‘Veitch’s Blue’
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Trees- Trær

- 40 trees
- 30 semi mature trees:
  - –12 *Gleditsia triacanthos* ‘Skyline’
  - –11 *Quercus palustris*
  - – 7 *Cercis siliquastrum*
- 10 multi-stemmed *Betula pendula*

SPECIMEN TREE PLANTING

Gleditsia triacanthos 'Skyline' extra wide spacing; 5x tr. wire rootballed, height 500-700cm, spread 200-300cm 30-35cm girth 12nr. required

Quercus palustris Specimen tree; extra wide spacing; 4x tr. wire rootballed, height 500-700cm, spread 200-300cm 30-35cm girth 11 nr. required

MULTI STEMMED TREE PLANTING

Euonymus alatus Specimen shrub; 5 x tr. rootballed, height 100-125, spread 150-175cm **7nr. required**

Betula pendula Specimen, multi stemmed extra wide spacing; 4 x tr. rootballed, spread 350-400cm **10nr. required**

Cercis siliquastrum Semi mature, extra wide spacing; 3 x tr. rootballed, 14-16cm girth **7Nr. required**

Cercis siliquastrum- tolerates drought

Quercus palustris- tolerates flooding

Eastern and Central USA


Betula pendula
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Shrubs- busker

EVERGREEN STRUCTURE PLANTING

SPECIES	TYPE/SIZE	QTY
Artemisia arborescens 'Powis castle'	3L	100
Phlomis tuberosa 'Amazone'	3L	120
Pinus Mugo 'Mops'	3L	25
Rosemarinus o. 'Miss Jessops upright'	3L	120
Sacoccocca hookeriana 'Digyna'	3L	120
Yucca flaccida 'Ivory'	3L	100


Phlomis fruticosa
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Rosmarinus officinalis
'Miss Jessopp's Upright'
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Bulbs- Løker og knoller

Main bulb planting at 30 bulbs per m2

SPECIES	TYPE	QTY
Allium aflatunense	bulb	5000
Camassia Leichtlinii Alba	bulb	5000
Camassia Leichtlinii caerulea	bulb	5000
Eremurus Bungei	bulb	5000
Eremurus Cleopatra	bulb	5000
Galtonia candicans	bulb	5000
Galtonia viridiflora	bulb	5000
Gladiolus communis byzantinus	bulb	5000
Lilium martagon	bulb	5000
Nectaroscordum siculum bulgaricum	bulb	5000
Ornithogalum magnum	bulb	5000
Tulipa sylvestris	bulb	5000

Bulb species to be planted in specific drift area additonal to the main bulb planting

SPECIES	TYPE	QTY
Allium cernuum	bulb	1000
Allium sphaerocephalon	bulb	5000
Cyclamen coum	corm	1000
Eremurus robustus	bulb	500
Fritillaria imperialis Lutea	bulb	1000
Fritillaria imperialis Rubra maxima	bulb	1000
Fritillaria meleagris	bulb	5000
Galanthus Elwesii	bulb	5000

Maintenance-cutting and removing

- Cutting or mowing the above ground shoots of grasses and herbaceous plants yes or no?
- Generates large amounts of biomass
- Increases light in the community, more likelihood of seedling establishment within
- Gradually reduces productivity of the system (this is very beneficial)

The public prefer it cut back

The longer you can wait to cut back the better as this reduces weed establishment

North American prairie, Sheffield botanical gardens

The public do not want to look at bare soil for months

Bulbs- Løker og knoller

Spring Bulb Display | Lurie Garden

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Interesting foliage helps

Extensive bulb planting

- 45,000 bulbs including: *Allium, Camassia, Cyclamen, Eremurus, Fritillaria, Galanthus, Galtonia, Gladiolus, Lilium, Nectaroscordum, Nerine, Ornithogalum* and *Tulipa*

Eremurus robusta


Allium cvs

Art work

- Throughout the scheme are a number of 4.2m totem-like structures filled with sculptures and carvings.
- The sculptures are made from stone and metal and incorporate stories of the area together with eye-catching mirror and lighting efects

Matching art and seating

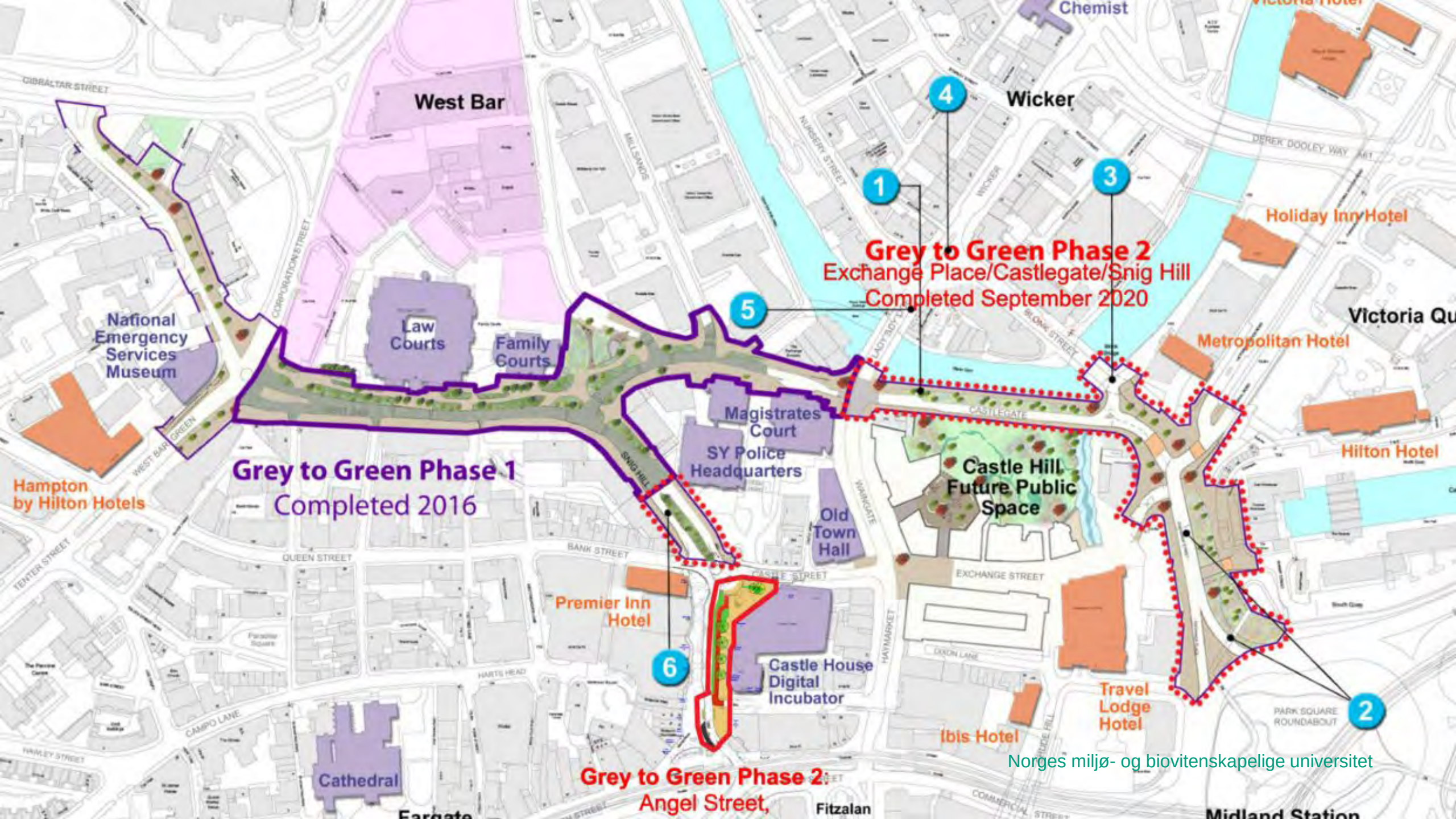
The public barely notice the art now

Grey to Green – Phase 1 success

- The project has improved the city's resilience to climate change, enhanced the public realm, and increased connectivity in the city centre
- The project is now attracting investment in new and existing jobs
- The project is a template for other cities wanting to install naturalistic style planting in water management
- It is being used for research-

Grey to Green Phase 2

- Design: Nigel Dunnett and Zac Tudor Sheffield City Council
- Client: Sheffield City Council
- Planted: Summer 2020
- Cost £6.3m
- Funded by: Sheffield City Region, the European Regional Development Fund and Sheffield City Council



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Pedestrians and Cyclists


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Interconnecting swales

Soil

Imported Manufactured Top Soil

- Planting areas allow for an average depth of soil to be 600mm
- Type: semi extensive growing medium

Mix: **70% sandstone aggregate** (20mm to sand)

- 20% composted green waste
- 10% Silt Loam topsoil


October 2020
INSTANT HIRE
KX016-4
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Impacted by the pandemic

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Notes:

Generally:

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SOFTWORKS PLANTING SCHEDULE

SNIG HILL - SOFTWORKS 1:500

TOPSOIL GROWING MEDIUM

TREE SOILS

FOR CONSTRUCTION

SHEFFIELD CITY COUNCIL
DEVELOPMENT SERVICES
URBAN AND ENVIRONMENTAL DESIGN TEAM

Grey to Green Phase 2

Softworks & Soiling Layout

1:500

Trees

SPECIMEN TREE PLANTING

Liquidamber styraciflua 'Worplesdon' extra wide spacing; 5x tr. wire rootballed, height 500–700cm, spread 200–300cm 30–35cm girth 25nr. required

Quercus palustris Specimen tree; extra wide spacing; 4x tr. wire rootballed, height 500–700cm, spread 200–300cm 30–35cm girth 5nr. required

Nyssa sylvatica Specimen tree; extra wide spacing; 4x tr. wire rootballed, height 500–700cm, spread 200–300cm 30–35cm girth 3nr. required

Sorbus aucuparia Extra Heavy Standard tree; extra wide spacing; 3x tr. wire rootballed, 16–18cm girth 9nr. required

MULTI STEMMED TREE PLANTING

Betula pendula Specimen, multi stemmed extra wide spacing; 4 x tr. rootballed, spread 350–400cm 15nr. required

Additional Gap planting
Armeria maritima 750nr (9cm Pot)

PLANTING CHARACTER
Unless stated as group all planting and bulb mixes are to be randomly planted throughout there given areas

- North American species proving successful in Sheffield
  - Able to cope with flooding and drying out
  - Provide good autumn colour

Bigger trees

Trees defining boundaries-more hazards

Shrubs- busker

Phase 1

6 evergreen shrubs in 3l pots

Phase 2

10 shrubs including 7 deciduous in 5l pots

Group	Density	Shrubs to be positioned on site by Landscape Architect during planting time.			
	low				
	low	**Shrubs (Specimen Locations)**	**Structure**	**QTY**	**Size**
	low	Amelanchier lamarkii	structure	50	5L
	low	Aronia arbutifolia 'Brilliant'	structure	50	5L
		Euonymus alatus ' Compactus'	structure	50	3L
Group	**Density**	Viburnum opulus	structure	15	5L
	med	Hydrangea paniculata 'Limelight'	structure	30	5L
	high	Hydrangea petiolaris	structure	20	5L
	low	Phlomis russeliana	structure	75	3L
	med	Pinus mugo 'gnom'	structure	30	5L
		Viburnum bodnantense Dawn	structure	50	5L
		Acer tataricum ginnala	structure	20	35-45L *
			* multistem, height 1500-200, 3x transplant, container grown, min 3nr branches		
Group	**Density**				
5-7G	high				

Aronia × *prunifolia* 'Brilliant' and *Amelanchier lamarckii*

Larger plants- quicker impact

Mixed Perennial Plantings

Phase 1- Mixed Planting

2 Mixes

- Dry
- Swale
- Density- 15/m2

Phase 2 Mixed Planting

5 Mixes

- Short (pink, blue, silver, orange)
- Medium (yellow, blue and red)
- Foliage
- Tall
- Shade
- **Density is 12 plants/m2** but Mix 3 foliage is 6/m2.

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SOFTWORKS PLANTING SCHEDULE

SNIG HILL - SOFTWORKS 1:500

TOPSOIL GROWING MEDIUM

TREE SOILS

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Grey to Green Phase 2

Softworks & Soiling Layout

1:500

Mix 1 – Short pink, blue, silver and orange

Mix 1 - Short - Pink, Blue, Silver and Orange

SPECIES Perennials	Structure	QTY	Size	Group	Density
Achillea Paprika	canopy	450	9cm pot	3-5G	Mid
Achillea terracotta	canopy	450	9cm pot	3-5G	Mid
Aster amellus 'King George'	canopy	450	9cm pot		Mid
Agastache rugosa Albiflora	canopy	450	9cm pot		Mid
Artemisia stelleriana 'Boughton silver'	canopy	220	9cm pot		low
Berkleya officinalis	canopy	445	9cm pot		Mid
Dianthus cruentus	semi emergent	683	9cm pot	3-5G	high
Dictamnus alba purpureus	canopy	445	9cm pot		Mid
Echincaea pallida	canopy	445	9cm pot		Mid
Echinops ritro 'Veitch's Blue'	semi emergent	240	2L Pot		low
Erigeron darkest of all	canopy	660	9cm pot		High
Eryngium yuccafolium	semi emergent	445	9cm pot		Mid
Euphorbia Fire glow	canopy	445	9cm pot		Mid
Gaura lindheimeri 'snowstorm'	canopy	445	9cm pot		Mid
Gypsophila paniculata 'Rosenschleier	canopy	445	9cm pot		Mid
Hyssopus officinalis subsp. aristatus	canopy	225	9cm pot		low
Iris x robusta Gerald Derby	semi emergent	420	9cm pot	3-5G	Mid
Juncus 'Carmens Grey'	Canopy	210	9cm pot		Low
Kniphofia 'jenny Bloom'	emergent	420	2L Pot	3G	Mid
Kniphofia Tawny King	emergent	420	2L Pot	3G	Mid
Liatris spicata	canopy	665	9cm pot	3-5G	high
Origanum rosenkupprl	canopy	440	9cm pot		Mid
Perovskia 'Lacy blue'	semi emegent	425	2L Pot		Mid
Phlomis tuberosa Amazone	semi emergent	425	9cm pot		Mid
Primula veris	canopy	665	9cm pot		high
Salvia caradonna	canopy	425	9cm pot		Mid
Sanguisorba blackthorn	emergent	425	9cm pot		Mid
Saponaria 'Max Frei'	canopy	425	9cm pot		Mid
Sedum Matrona	canpoy	425	9cm pot		Mid
Sisyrinchium striatum	canopy	225	9cm pot	3-5G	low
Veronicastrum virgatum Roseum	semi emergent	225	9cm pot		Mid
Grasses	**Structure**	**QTY**	**Size**	**Group**	**Density**
Sesleria nitida	canopy	430	9cm pot	3-5G	Mid
Sesleria autumnalis	canopy	650	9cm pot	3-5G	high
Stipa gigantea	emergent	225	9cm pot		low
Cortaderia selloana Pumila	emergent	40	2L Pot		V low
Miscanthus 'Undine'	emergent	225	9cm pot		low
Bulbs/corms	**Structure**	**QTY**	**Size**	**Group**	**Density**
Allium Pink Jewel	canopy	2200	Bulb/corm	10-15G	high
Crocosmia x crocosmiiflora 'Venus'	canopy	2850	Bulb/corm	10-15G	mid
Eremurus Cleopatra	emergent	1600	Bulb/corm	3-5G	low
Gladiola byzantinus	canopy	1900	Bulb/corm	10-15G	mid
Lilium Orange Marmalade	semi emergent	1150	Bulb/corm	10-15G	v low
Schizostylus coccinea 'Fenland Daybreak'	canopy	1900	Bulb/corm	10-15G	mid
Tulbhaghia violacea	canopy	1850	Bulb/corm	10-15G	mid

The plan outlines the role of each plant

There are perennials, grasses and bulbs within the one mix


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Mix 2- Medium Yellow, blue, and red

Mix 2 - Medium Height - Yellow, Blue and Red

Species **Perennials**	Structure	QTY	Size
Achillea filipendulina 'Coronation Gold'	semi emergent	200	9cm pot
Agastache 'Blue Fortune'	canopy	454	9cm pot
Aster amellus 'Violet Queen'	canopy	454	9cm pot
Aster novae-belgii 'Purple Dome'	canopy	454	9cm pot
Aster turbinellus	canopy	454	9cm pot
Astilbe 'Purple Lance'	canopy	454	9cm pot
Calamintha 'Blue cloud'	canopy	700	9cm pot
Coreopsis verticilata Zagreb	canopy	700	9cm pot
Echinacea paradoxa	semi emergent	454	9cm pot
Echinops ritro 'Veitch's Blue'	semi emergent	200	2L pot
Euphorbia palustris	canopy	454	9cm pot
Ferula communis	emergent	50	2L pot
Helenium 'Wyndley'	semi emergent	454	9cm pot
Hemerocallis lilioasphodelus	canopy	454	9cm pot
Iris sibirica Tropic Night	semi emergent	454	9cm pot
Juncus patens 'Carmens Grey'	canopy	200	9cm pot
Kalimeris incisa 'Charlotte'	canopy	454	9cm pot
Kniphofia Percy's Pride	emergent	454	2L pot
Kniphofia uvaria	semi emergent	50	Supplied by others
Lychnis chalcedonica	semi emegent	454	9cm pot
Lychnis coronaria	canopy	454	9cm pot
Lythrum 'zigeurnerblut'	canopy	454	9cm pot
Perovskia 'Blue Spire'	semi emergent	454	2L pot
Primula elatior	Canopy	454	9cm pot
Primula veris	canopy	700	9cm pot
Rudbeckia fulgida deammii	canopy	700	9cm pot
Rudbeckia subtomentosa	semi emergent	454	9cm pot
Solidago rugosa 'Fireworks'	semi emergent	200	9cm pot
Verbena bonariensis	emergent	700	9cm pot
Veronicastrum virgatum 'Fascination'	Emergent	454	9cm pot

Grasses	Structure	QTY	Size
Sesleria autumnalis	canopy	706	9cm pot
Calamagrostis acutiflora 'Karl Foerster'	emergent	200	9cm pot
Miscanthus sinensis Silberfelder	emergent	200	9cm pot
Panicum virgatum 'Heavy metal'	canopy	454	9cm pot

Bulbs/Corms	Structure	QTY	Size
Allium 'Molly'	Canopy	2750	Bulb/corm
Camassia leichtlinii Caerulea	Semi emergent	3500	Bulb/corm
Crocosmia george davison	Canopy	750	Bulb/corm
Eremurus stenophyllus	emergent	1500	Bulb/corm
Lilium martagon Orange Marmalade	semi emergent	1000	Bulb/corm

The plan outlines the role of each plant

There are perennials, grasses and bulbs within the one mix


30

Mix 3- Foliage and Structure Planting

- In Phase 1 *Calamagrostis x acutiflora* ‘Karl Foerster’ was planted based on 500mm centers
- Now grasses are in nearly ever mix and more dominant in some

Mix 3 - Foliage and Structure (only 6 plants per m2)

Species			
Grasses	**Structure**	**QTY**	**Size**
Carex secta	canopy	490	9cm pot
Calamagrostis 'Karl Foerster'	emergent	490	9cm pot
Calamagrostis brachytricha	semi emergent	2000	9cm pot
Perennials	**Structure**	**QTY**	**Size**
Anemone japonica 'White'	semi emergent	690	9cm pot
Echinacea 'White Swan'	semi emergent	690	9cm pot
Libertia formosa	canopy	690	9cm pot
Verbena bonariensis	Emergent	690	9cm pot
Bulbs /Corms	**Structure**	**QTY**	**Size**
Allium Mount Everest	semi emergent	2000	Bulb/corn
Allium sphaerocephalus	semi emergent	4300	Bulb/corn
Eremurus White Beauty	Emergent	600	Bulb/corn
Leucojum Aestivum	Canopy	2000	Bulb/corn


Mix 3- mai 2021
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September 2021
Norges miljø- og biovitenskapelige universitet


Desember 2021
THE ALEXANDRA
Restricted parking ZONE
No loading
Restricted parking ZONE
No loading
Norges miljø- og biovitenskapelige universitet

Mix 4- Tall Mix

Mix 4. Tall Mix			
Perennials & Grasses	**Structure**	**QTY**	**Size**
Aster turbinellus	understorey	300	9cm pot
Aster tataricus 'Jindai'	canopy	200	9cm pot
Astilbe 'Purple Lance'	understorey	200	9cm pot
Campanula 'loddon anna'	canopy	200	9cm pot
Coreopsis tripteris	canopy	200	9cm pot
Echinops bannaticus 'Taplow Blue'	canopy	200	9cm pot
Eupatorium 'Ivory Towers'	canopy	200	9cm pot
Eupatorium 'Purple Bush'	canopy	200	9cm pot
Euphorbia palustris	understorey	190	9cm pot
Vernonia fasciculata	understorey	190	9cm pot
Helianthus lemon queen	Canopy	200	9cm pot
Juncus patens 'Carmens Grey'	understorey	200	9cm pot
Miscanthus giganteus	emergent	190	9cm pot
Miscanthus 'Silberfeder'	emergent	190	9cm pot
Persicaria amplexicaulis 'Firetail'	understorey	200	9cm pot
Thalictrum elin	Canopy	200	9cm pot
Echinacea purpurea Magnus	understorey	200	9cm pot
Geranium psilostemon	understorey	200	9cm pot
Bulbs/corms		**QTY**	**Size**
Narcissus poeticus recurvus		3060	Bulb/corm

- The plan outlines the role of each plant
- There are perennials only and one species of bulb within the one mix


Mix 4
Norges miljø- og biovitenskapelige universitet


November 2021
Norges miljø- og biovitenskapelige universitet

Mix 5- Shade

Mix 5 - Shade	structure	QTY	Size	Group	Density
Anemone japonica 'Honorine Jobert'	canopy	55	9cm pot		Mid
Aster divaricatus	canopy	55	9cm pot		Mid
Astrantia claret	canopy	55	9cm pot	5-7G	Mid
Brunnera macrophylla	canopy	55	9cm pot		Mid
Deschampsia cespitosa	canopy	55	9cm pot		Mid
Dryopteris filix femina	canopy	55	9cm pot	5-7G	Mid
Euphorbia polychroma	canopy	55	9cm pot		Mid
Francoa sonchifolia 'Pink Giant'	canopy	55	9cm pot		Mid
Geranium Phaeum alba	canopy	55	9cm pot		Mid
Geranium sylvaticum Mayflower	canopy	55	9cm pot		Mid
Heuchera maxima	canopy	55	9cm pot	5-7G	Mid
Libertia Formosa	canopy	55	9cm pot		Mid
Luzula nivea	canopy	55	9cm pot		Mid
Pulmonaria saccharata 'Cotton Cool'	canopy	55	9cm pot		Mid
Bulb/corm	**Structure**	**QTY**	**Size**	**Group**	**Density**
Polygonatum multiflorum	canopy	75	Bulb/corm	5-7G	Mid
Muscari Blue magic	understorey	435	Bulb/corm	20-30G	Mid

- In Phase 1 none of the planting was in ‘deep shade’
- In Phase 2 there is a huge wall bordering part of the site

Mix 5- shade planting

Volunteers november 2020 bulb planting

Art- same 4.2m totem-like structures

In phase two the artworks are made from wood and are designed to create habitats for the wildlife that is returning to the area

Art now has an ecological focus

Signage introduced to Phase 1 and 2


Market
Norges miljø- og biovitenskapelige universitet

Multi-funcational space

Ecological versus horticultural maintenance

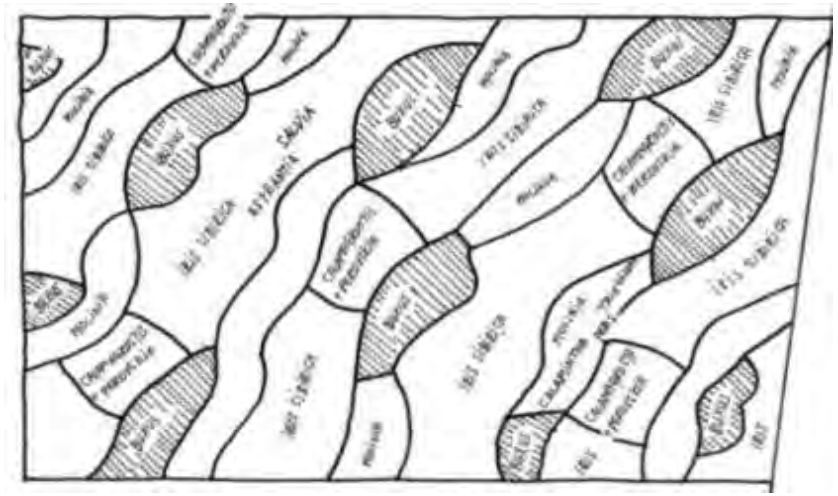
Great Dixter Garden, England (image by Nigel Dunnett)

Mixed plantings- Ecological maintenance

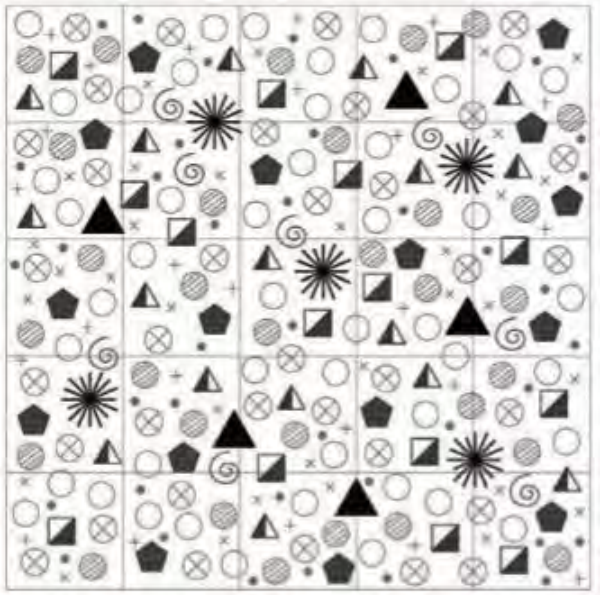
- The Ecological approach is more concerned with the bigger picture, and connections; what are the consequences for A when making changes to B?
- The landscape is dynamic therefore there are no clear rules
- The landscape is not a product therefore maintenance is a process

Different ways of arranging perennials

Block Planting



Drift Planting



Mixed planting

Grey to Green Phase 1

- It is now 6 years old
- The fyllstauder are gone i.e. *Verbena bonariensis*
- What has taken that 10% gap?
- There have been winners and losers- *Eupatorium cannabinum* has taken over and has been removed in places
- It does not matter that there are less species as the plants fill the gaps
- This is not standard maintenance

The valuable role of Green Estate

- Green Estate is a not for profit social enterprise based in Sheffield working for people, place and a fairer way of doing business- https://greenestate.org.uk/
- The plantings require specialist maintenance in the establishment phase which they have.
- Contracted for 3 years for Grey to Green Phase 1 but then continued as Amey could not manage it

Key maintenance tasks associated with perennial plantings

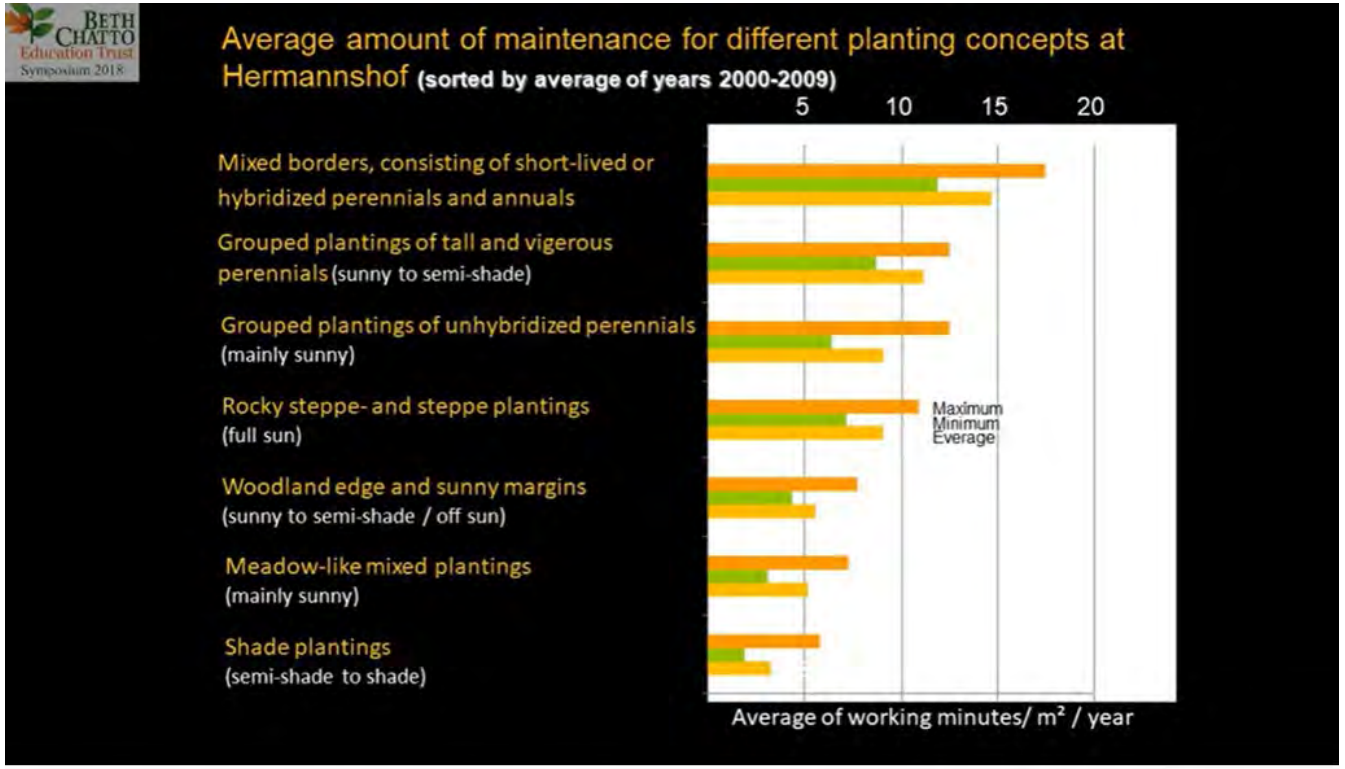
- Cutting/removal of plants by various means
- Addition of nutrients/water
- Restricting the capacity for weed seedling establishment
- Elimination of unwanted plants
- Control of pests and diseases
- Removal of debris

Staking- perennials that need support should not be used in public landscapes. This is an un-necessary expense

The cost of maintenance

Information on overall costs i.e. labour and maintenance of perennial plantings is not readily available.

The High Line in New York contacted Cassian Schmidt for this information



The Beth Chatto Symposium: Cassian Schmidt Stylized Dynamic Plantings

Watch this lecture

https://www.youutube.com/watch?v=4HyeXlNG4AY

Establishment/Maintenance- Addition of Water/Nutrients

- Increase in growth rate and standing biomass, plants may be judged to look “better”
- More biomass to remove in future?
- Decrease root: shoot ratio; plants deal less well with severe moisture stress
- Resource consumption is increased
- Increase in competition between species leading to dominance of the most vigorous species at the expense of the least dominant
- Weed invasion normally increases

Grey to Green was watered during establishment but not since then

Keeping the mulch weed free

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Establishment/Maintenance- Control of Pest and Disease

- Plant selection - avoid plants that need pest and disease control
- Plant habitat- recreate the conditions they thrive in typically in the wild
- Accept what happens and do nothing
- Remove plants
- Apply pesticides on sighting symptoms- this is not an option anymore
- There have been no issues with pest and disease in the Grey to Green

Why use perennials in mixed plantings?

Design

- It has impact!
- It looks more naturalistic
- You can create dynamic combinations
- Seasonal interest
- All the plants should be suited to the site conditions so should look healthy

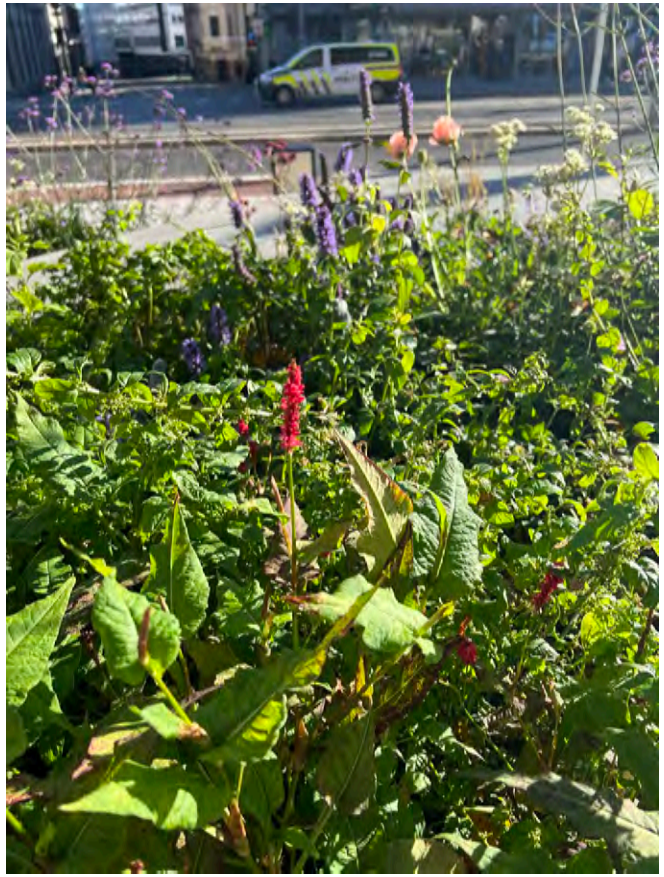
Maintenance

- It requires long term vision as it is inspired by ‘the wild’ and is ever-changing
- Weeds are not as obvious as the ground layer is covered
- If a plant dies due to pest or disease it does not need to be replaced
- Watering should be more cost-effective as plants will have similar requirements

Sommerrogata og Sommerroparken, Oslo

	T%	t%	ARTSNAVN LATIN	ARTSNAVN NORSK	VEKSTJORD CM	STØRRELSE (INNKØP)	AREA M2	ANTALL PR. M2	ANTALL TOTAL	KOMMENTARER ØKOLOG
KS. TRÆR										
-EKS			Acer platanoides	Spisslønn	-	-	-	-	6	Norsk art
-EKS			Aesculuc hippocastanum	Hestekastanje	-	-	-	-	1	Fremmed art - potensielt høy risiko.
-EKS			Tilia cordata	Småbladlind	-	-	-	-	1	Norsk art
RÆR										
1			Acer platanoides	Spisslønn	100-120	SO 18-20 cm **	-	-	~~3~~ 4	Norsk art
~~2~~			~~Tilia cordata~~	~~Småbladlind~~	~~100-120~~	~~SO 18-20 cm **~~	–	–	~~1~~	Norsk art
						* Opstammet træ, uten gjennemgående stamme. Kronen må ha min. 5 kraftige greiner				
						* Rotklumpens diameter må være min. 4 x stammens omkrets				
USKER										
1			Pinus sylvestris 'Watereri'	Dverg skogfuru	70-80	30-40 cm ***	-	-	7	Norsk art
2			Hippophae rhamnoides	Tindved	70-80	30-40 cm ***	-	-	5	Norsk art
3			Salix lanata L.	Ullpil / ullvier	70-80	25-30 cm ***	-	-	13	Norsk art
4			Prunus spinosa	Slåpetorn	70-80	30-40 cm ***	-	-	6	Norsk art
						* Bredtvoksende barplante; dyrket og leveret som klumpplante. Omplantet min. hvert tredje år.				
						* Uten gjennemgående stamme. Greinene må være jevnt fordelt i ulike retninger, og være friske/uten sviskade.				
						* Rotsystemet må være kraftig/godt forgreinet, og utviklet i forhold til antall omplantninger.				
RESS							**30**			
1			Calamagrostis x acutiflora 'Karl Foerster'	Fagerrørkvein 'Karl Foerster'	40	9 cm potte	18	4	72	Fremmed art - ukjent kultivar.
2			Molinia caerulea 'Moorhexe'	Blåtopp 'Moorhexe'	40	9 cm potte	12	6	72	Norsk art
TAUDER							**40**			
1			Agastache `Black Adder´	Hageanisisop 'Black Adder'	40	9 cm potte	10	9	90	Ukjent/ikke vurdert
2			Eupatorium maculatum 'Purple Bush'	Storhjortetrøst 'Purple Blush'	40	9 cm potte	10	9	90	Fremmed art - ingen kjent risiko.
3			Nepeta faassenii `Walkers Low´	Prydkattemynte 'Walkers Low'	40	9 cm potte	10	9	90	Fremmed art - ikke risikovurdert.
4			Persicaria amplexicaule `Firedance´	Blodslirekne 'Firedance'	40	9 cm potte	10	9	90	Ukjent/ikke vurdert
TAUDEMIX 1							**92**			
M1_01		17	Brunnera macrophylla	Forglemmegeisøster	40	9 cm potte	15,3	9	137	Fremmed art - lav risiko.
M1_02		17	Knautia mecedonica	Makedonia rødknapp	40	9 cm potte	15,3	9	137	Ukjent/ikke vurdert
M1_03	100	17	Panicum virgatum `Rehbraun´	Staudehirse `Rehbraun´	40	9 cm potte	15,3	9	137	Ukjent/ikke vurdert

Planted in July- watered once since



Takk!