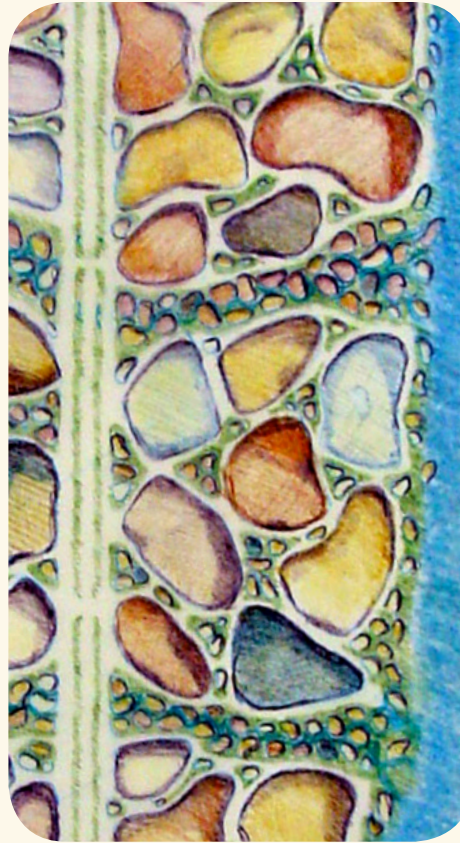




LIGHT IMPRINT

An Introduction to the
Methodology for Integrating
Ecology and Community Design

LIGHT IMPRINT

An Introduction to the Methodology for Integrating
Ecology and Community Design

More information about Light Imprint

www.lightimprint.org

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PHASE I - CARLTON LANDING LIGHT IMPRINT TOOL CALIBRATION AND ILLUSTRATIVE DETAIL



CATCHMENT AND DRAINAGE DIAGRAM - LADYFIELD

Areas of Application

The Region, Neighborhood, the District, the Corridor, the Block, the Street, and the Building

Methodology Characteristics

The following can apply techniques of Light Imprint:

- » Public Policy Program: Green Infrastructure and Stormwater Management
- » Regional/town planning
- » Transit oriented development
- » Greenfield/previously undeveloped site
- » Placemaking plan (exclusively public space, civic building, or infrastructure)
- » Qualifies for LEED-ND certification (as part of rating system)
- » Infill/previously developed site
- » Incorporates universal design principles
- » Affordable/subsidized/social housing

General Information

- » Light Imprint is an initiative that includes:
 - » The [Light Imprint Handbook](#)
 - » the toolbox matrix
 - » an interactive website
 - » a web-based project calibration tool
- » Included are three Case Studies showing a range of applications:
 - » Brownfield site - East Fraserlands - Vancouver, BC
 - » Infill site - Ladyfield - Dumfries, Scotland
 - » Greenfield site - Carlton Landing - Lake Eufaula, OK
- » A range of projects are in the process of approvals and implementation. The [Light Imprint Handbook](#) is currently being used to provide guidelines, as a reference source for manuals, and as a module for form-based codes.
- » Project Cost: Light Imprint research and development was established in 2006 with a substantial investment of time and resources.
- » Transect Zones: Light Imprint is correlated with all Transect Zones.



Light Imprint ~ Integrating Ecological Performance and Placemaking

Light Imprint is a design methodology and operating system for consideration and incorporation of ecological performance with human placemaking. The basic premise of Light Imprint is to recover and maintain the pre-development natural hydrology of the site when land is developed or redeveloped.

Established in 2006, the Light Imprint methodology expanded its educational outreach and produced professional contributions becoming a recognized rainwater mitigation practice.

Three case studies are included in this overview to demonstrate the Light Imprint methodology. They include a Brownfield Case Study - East Fraserlands, in Vancouver, British Columbia; an Infill Case Study - Ladyfield, in Dumfries, Scotland; and a Greenfield Case Study - Carlton Landing, Oklahoma.

Technical advantages of Light Imprint include:

- » Integration and advancement of engineering and natural systems into physical urban form;
- » A simple operating system, aided by the toolbox matrix and calibration tools, making it an accessible and a user-friendly methodology for all;
- » Resolving the conflicts between policy and actual implementation, and the "one size fits all" approach to water management and land use;
- » A context-sensitive infrastructure toolset that is calibrated and customized for site specific variables including soil hydrology, slope condition, climate, urban-to-rural transect zones, initial costs, and long-term maintenance factors;
- » A hydrological toolset, used collectively at the sector, neighborhood and block scale, that uses natural drainage, traditional engineering infrastructure, and infiltration practices;
- » Corrects the deficiencies found in Low Impact Development and Best Management Practices often found in conventional development; and
- » Supported by the **Light Imprint Handbook: Integrating Sustainability and Community Design** and the interactive web site, www.lightimprint.org.

Light Imprint can be used for all of the following:

- » to develop a more ecological strategy for livability and walkable, compact community standards in an economical way;
- » to reduce costs associated with conventional engineering practices;
- » to change a community's mind-set from a suburban model towards a new urban model and show the connection between the Local Food Movement and the Slow Urbanism Movement;
- » to provide an organizational framework to complement and expand the effectiveness of Leadership in Energy Efficient Design for Neighborhood Development (LEED-ND);
- » to demonstrate the effectiveness of this strategy with several well documented LI overlay case studies; and
- » to emphasize design and implementation as key factors essential to the success of every planning development project.

Overview

The Metropolis and the Natural Landscape

Light Imprint emphasizes the watershed as a geographic increment of ecological planning and design along with placemaking elements. Light Imprint charts all the physical resources of the region - especially the drainage networks - and sees what design emerges. Imperative to the design are underground formations that store drinking water, prime soils that produce food, marshes that spawn fish and wildlife, and forests that help moderate floods. Light Imprint draws on the expertise of the ecologist, biologist, and landscape architect for placemaking and prioritizes an immediate relationship to nature and agrarian practices with a methodology of laying lightly on the land. Instead of imposing a physical plan for a region, Light Imprint finds the plan that nature conceived and applies new urbanism to the design.

Infill over Expansion

Light Imprint offers solutions for replacing underperforming and/or failing stormwater management systems with green infrastructure. Specific applications for infill, brownfield, grayfield, and redfield conditions use tools calibrated to improve existing infrastructure for increased rainwater collection and cleaning capacity along with complimenting and enhancing placemaking design.

The Neighborhood, the District, and the Corridor Identifiable and Walkable Neighborhoods

Light Imprint selects tools specific to the walkable scale of the neighborhood, responds to unique conditions within special districts, and corresponds to the linear character of both development corridors and natural corridors. For example, in a neighborhood center condition, tools manage rainwater but also allows for children to play and learn, while accommodating for accessibility and safety of the elderly. A transit corridor utilizes green tracks within a multimodal design. Along a green finger, the open space provides receiving zones for laminating catchment areas along with opportunities for trails, gathering places, civic spaces, and natural areas.

Housing Types and Income Ranges

Light Imprint enhances diversity within income-segregated subdivision housing pods by providing an alternative to the "inlet, pipe, and pit" approach. Light Imprint tools are dispersed throughout fine-grained, mixed-use and mixed income walkable neighborhood specifically designed as attractive public gathering spaces for surrounding residents.

Economic Health through Coding

Light Imprint integrates ecology into form-based codes and can be adopted as a stormwater management manual. It is also available as an ordinance module.

Open Spaces

Light Imprint provides a range of open spaces, both passive and active, that are distributed throughout the block, neighborhood, and district. Active spaces include a full range of urban-to-rural types such as paved basins in public squares and pocket parks that are used as rain gardens. Public plazas utilize interactive waterscapes, while sculpted watercourses attract immersive experiences for engaging public art for both adults and children. For instance, a hand-operated Archimedean screw is used to pump water for irrigation and activate playgrounds. Instead of going indoors when it rains, kids look forward to playing in the rainwater that activates the courses in public parks, squares, and plazas. Passive spaces include natural landscape for surface filtration and retention hollows as elegant park settings. Bio-retention swales are designed to incorporate landscape strips along lanes, streets, and boulevards without segregating the pedestrian from other multimodal experiences. This creates spatially appealing and sequentially connected outdoor rooms throughout the neighborhoods.

The Block, the Street, and the Building Definition of Streets, Public Space, and Squares

Light Imprint integrates tools in the design of multimodal streets and placemaking. This includes tools in appropriate locations and scale, such as, green transit tracks, vegetative swales and grated tree wells. It configures interesting and safe squares and streets with context appropriate tools. For example, streets and public plazas are designed with a broad selection of permeable paving material for stormwater performance based on the rural-to-urban condition, while also providing artistic and ecological attributes that are pleasing for pedestrians.



General Matrix

- » Calibrates rainwater management tools for climate, slope, hydrology (soils), installation costs, maintenance costs, and form-based zoning of the project.
- » Arranges tools as 'treatment trains' for paving, channeling, storage and filtration of rainwater at the point of origin. This replenishes the aquifer and maintains an overall balance in the watershed.
- » Integrates nature throughout the human habitat and highlights the celebration of our basic resource, water.
- » Calibrates tools and systems specifically along the rural-to-urban transect to acknowledge the fine-grain and appropriate differences in urban conditions.

The Building and Infrastructure Levels

- » Incorporates tools at the lot level, through channeling, storage, and filtration, and on the scale of the building, such as green roofs.
- » Designates rainwater harvesting tools for landscaping, irrigation, and filtration into the aquifer.
- » Promotes low-cost, low-tech, time-tested, context and location specific tools.

The Street, Block, and Network Levels

- » Enhances the public realm by creating multifunction streetscapes, waterscapes, plazas, and gardens which are also used to store, clean and filter stormwater. The flow of water is celebrated as an amenity instead of hidden in underground pipes.
- » Identifies paving techniques, many of which are assembled to create green streets. The integrated treatment train, which adds channeling, storage, and filtration tools, creates complete streets and livable environments.

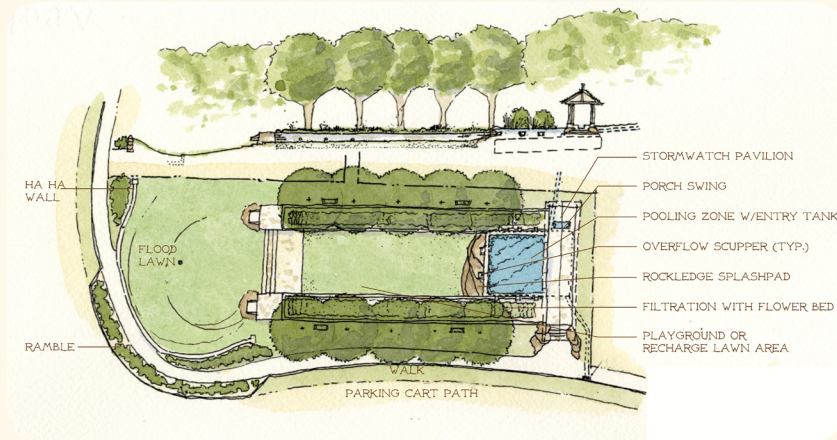
The Neighborhood, Town and City Levels

- » Lays lightly on the land, preserving natural drainage patterns and amenities with specialized tools and design techniques for enhancing the project's environmental attributes, as well as, marketability efforts.
- » Promotes active open space and passive nature throughout the rural-to-urban condition. It serves recreational means, educational needs and ecological health.
- » Integrates agriculture with water reuse for food irrigation and stormwater quality infiltration. The range of food production spans the transect from the building, lot, block, neighborhood and region.
- » Identifies the natural topography and drainage patterns, then Light Imprint guides the design of the community in terms of orientation, grading, view-sheds and location of amenities.

The Regional Level

- » Elevates the watershed as an increment of planning within a community and, with other natural factors, is used for regional analysis before placemaking design begins.
- » Prioritizes preservation of existing vegetation and land around sensitive natural environments, such as, wetlands, streams, and lakes.

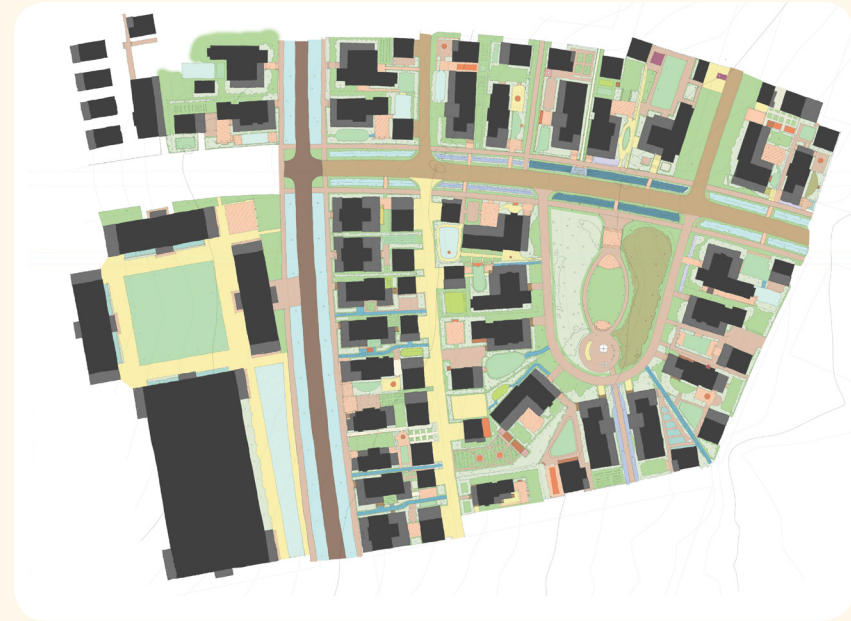
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T4 - RAIN GARDEN WEDDING PAVILION

Lessons Learned

- » Light Imprint is popular due to its user-friendly design methodology and free-ware operating system that aids in implementation and measures the ecological performance in new urbanism placemaking.
- » Light Imprint is appealing because it allows for rainwater to infiltrate at its origination point and recharge the aquifer. The conventional approach of rainwater treatment hides it in underground pipe and vaults and stores it in large, hazardous retention area. It removes the water further away from its source and ability to replenish the local water source.
- » Light Imprint is user-friendly by utilizing the toolbox organizational matrix and web-based interactive tool search to simplify the complex needs of professionals and their clients for design decisions and implementation. It especially appeals to the engineering profession currently overwhelmed with the “firehose” of technologically advanced green solutions.
- » Light Imprint is compelling due to the cost savings - an average of 25-40 percent of reduced infrastructure costs when compared with conventional engineering - and simplicity of installation and maintenance of the tools, when compared with conventional practice. This makes Light Imprint a preferred choice for development teams, designers, and municipalities, especially with the constraints and budget cuts of the current economic climate.



T4 - LIGHT IMPRINT TOOL OVERLAY WITH RAIN GARDEN PAVILION

- » The flexibility of the Light Imprint design techniques offer a broad set of contextually appropriate design solution. It calibrates for specific site conditions, including rural to urban zones, installation cost, maintenance cost, climate, slope, and hydrology (soils). In comparison, the conventional approach is limited to an “inlet, pipe, and pit” or “one-size-fits-all” stormwater management solution.
- » Light Imprint out performs and exceeds the lifespan many high-tech expensive stormwater management products because Light Imprint tools use indigenous, vernacular forms and materials.
- » Light Imprint is adaptable as the methodology is structured to easily help communities gradually adopt a form-based code approach. Municipalities and development teams can implement Light Imprint elements in incremental stages as components of a project are approved.

PAVING

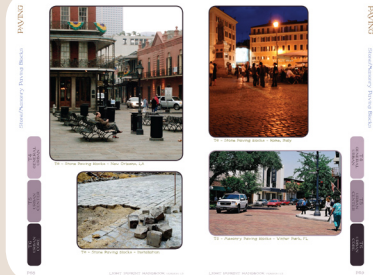


WOOD PLANKS



ASPHALT

CRUSHED STONE/GRAVEL/SHELL



STONE/MASONRY PAVING BLOCKS

CHANNELING

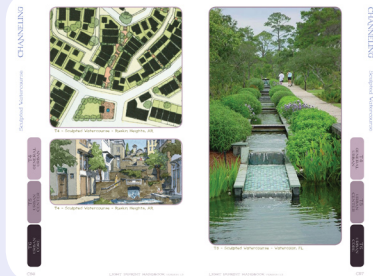


NATURAL CREEK



GUTTER/CURB

SHALLOW CHANNEL FOOTPATH



SCULPTED WATERCOURSE

STORAGE



RETENTION POND



POOL/FOUNTAIN



LANDSCAPED TREE WELL



GRATED TREE WELL

FILTRATION



FILTRATION POND



BIO-RETENTION SWALE



SURFACE LANDSCAPE

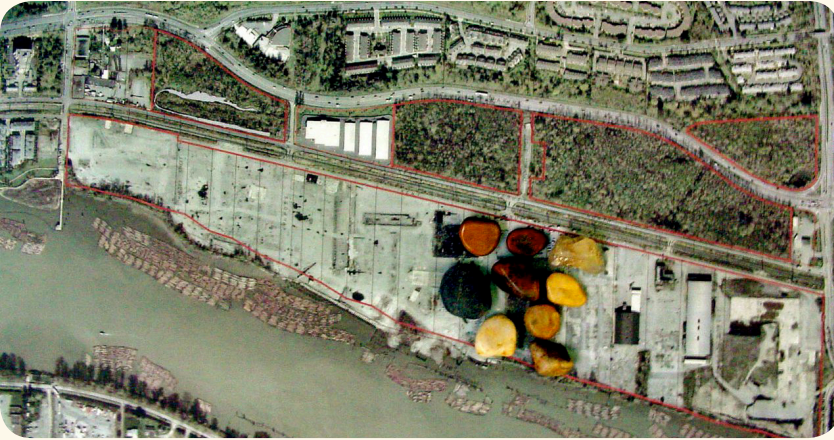


VEGETATIVE PURIFICATION BED

TOOLS CALIBRATED BY TRANSECT

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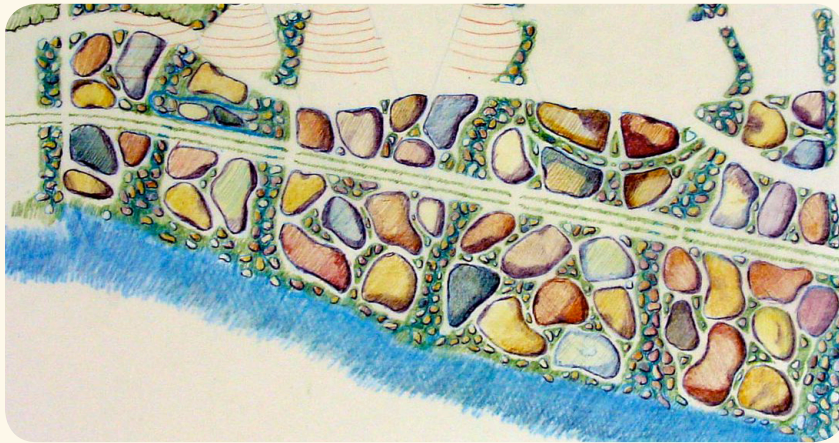
TOOLS CALIBRATED BY TRANSECT, COST, MAINTENANCE, SLOPE, SOILS & CLIMATE



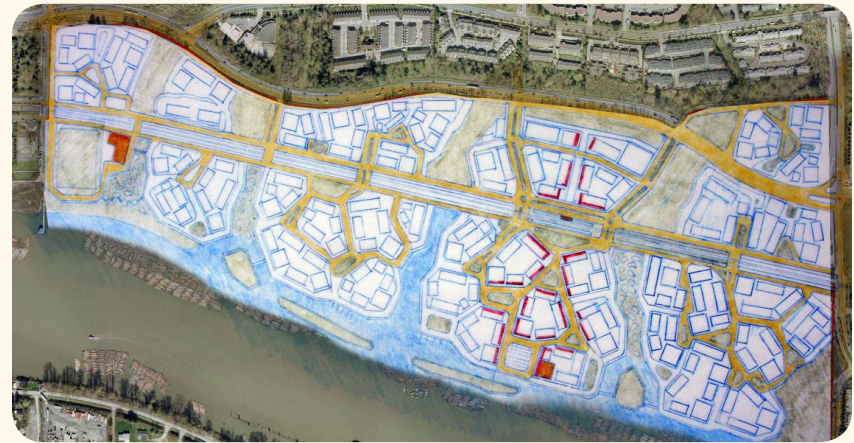
INITIAL INSPIRATION FROM SMOOTH PEBBLES



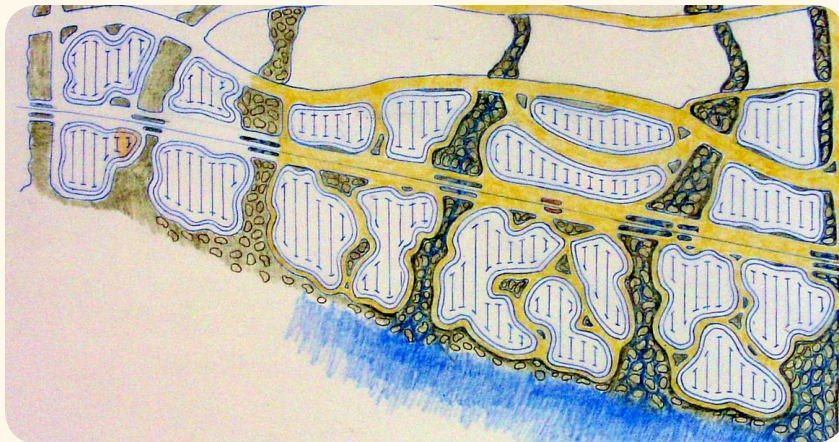
SECOND CONCEPTUAL SCHEMATIC PLAN WITH GENERAL BLOCK LAYOUTS



FIRST CONCEPTUAL SCHEMATIC PLAN



THIRD SCHEMATIC PLAN



SECOND CONCEPTUAL SCHEMATIC PLAN WITH PARKING



FINAL MASTER PLAN



MASTER PLAN DETAIL

Plan Description

The block structure incorporates catchment areas to collect rainwater through laminar flow near the origination point. This design creates attractive and functional greenways and waterscapes while also providing an opportunity to use rainwater for agricultural

purposes. Each neighborhood green and plaza integrates Light Imprint tools into its design. The plan also utilizes solar orientation of the homes and buildings to ensure maximum environmental efficiency.



BIRD'S EYE RENDERING OF MASTER PLAN DETAIL

Plan Description

The Ladyfield master plan incorporates Light Imprint strategies while maintaining a high standard of urban design. This design weaves a cross-slope pattern that both addresses solar orientating and natural drainage. This is a particularly interesting concept as it provides several advantages. Each block handles rainwater near the point that it hits the ground. This design creates attractive and functional greenways and waterscapes while also providing an opportunity to use rainwater for agricultural purposes.

Key elements of the plan include:

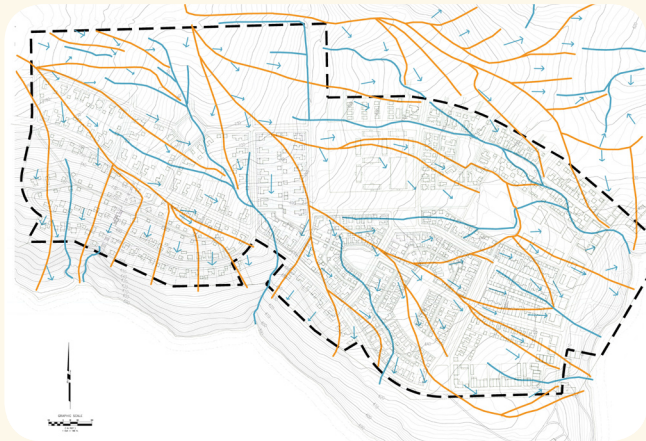
- » A connected town center that responds to the drainage routes and connects to a neighborhood plaza and school. Retail and restaurants within the center also catering to those working nearby.
- » Access to at least two types of open space including plazas, squares, greens, tot lots, and green fingers are within a half-block of each residential unit.
- » A school located to the northern edge of the village center is designed to be set within a walled garden, with agricultural resources available for student learning.
- » The southwestern orientation block structure, combined with a western sloping site, offers ideal natural drainage. It allows rainwater to slowly sheet flow down the natural slope and be directed through a treatment train of Light Imprint tools such as slope avenues, rain gardens, green fingers and shallow channel footpath rainwater conveyors. These green fingers are designed to connect nature with the developed areas and act as living lungs, play spaces, and gathering areas. The nearly four-dozen Light Imprint tools are arranged specifically in the context of their urban to rural character from the urban town center core to the agrarian community edge as a continuous treatment train of rainwater mitigation.



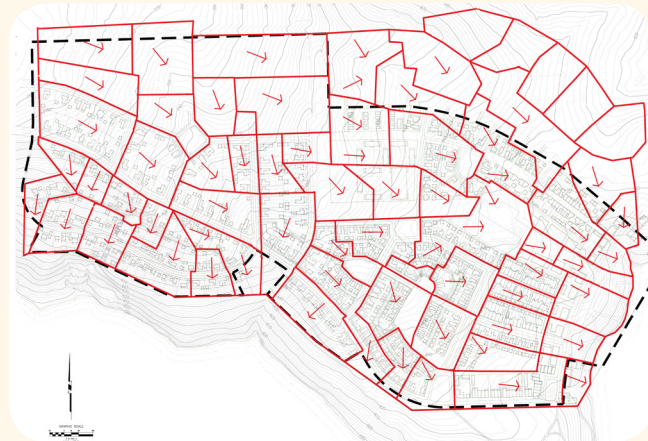
FINAL ILLUSTRATIVE MASTER PLAN



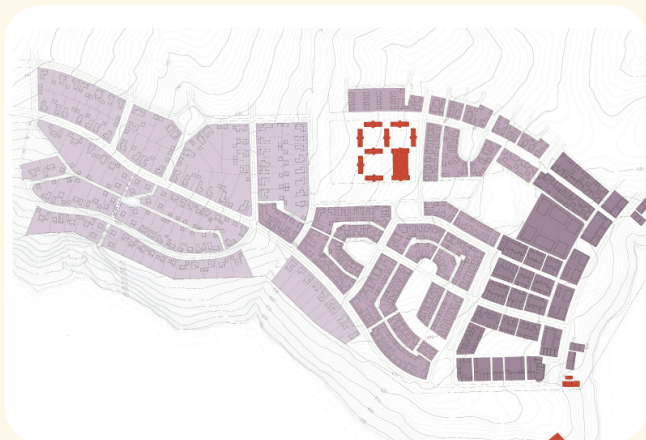
LIGHT IMPRINT OVERLAY



NATURAL DRAINAGE

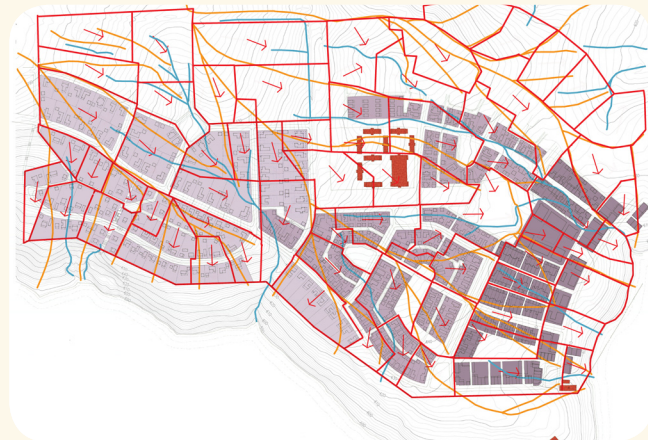


CATCHMENT AREAS

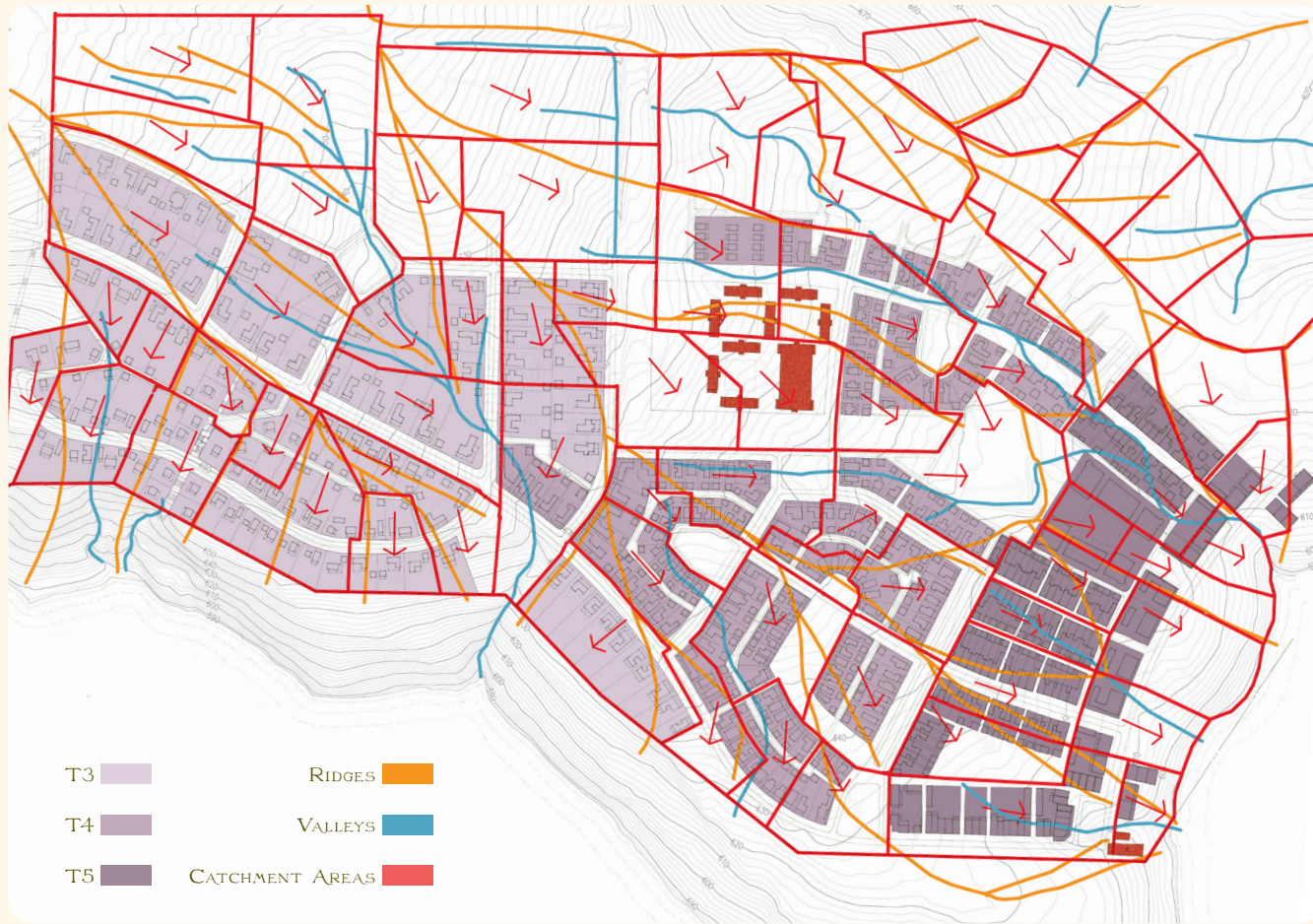


- T2
- T3
- T4
- T5

REGULATING PLAN



REGULATING PLAN WITH DRAINAGE AND CATCHMENT AREAS



SITE ANALYSIS WITH THE REGULATING PLAN, DRAINAGE AND CATCHMENT AREAS

Plan Description

The Carlton Landing Master Plan incorporates Light Imprint strategies throughout the project site, on all levels of the rural-to-urban transect. Carlton Landing offers an urban and vibrant town center, large estate lots with an agrarian edge, and all other living options in between. Among the many amenities is a large farm area, allotment lots and a farmers' market pavilion. The initial Light Imprint overlay of the first phase identified a stream (streams are highlighted in blue above) located where a road is proposed. The client and design team decided to pursue the implementation of a 'blue' street, featuring fountains, pools and open troughs. The 'blue'

street connects Lake Eufaula directly to the Middle School, allowing for play and educational opportunities.

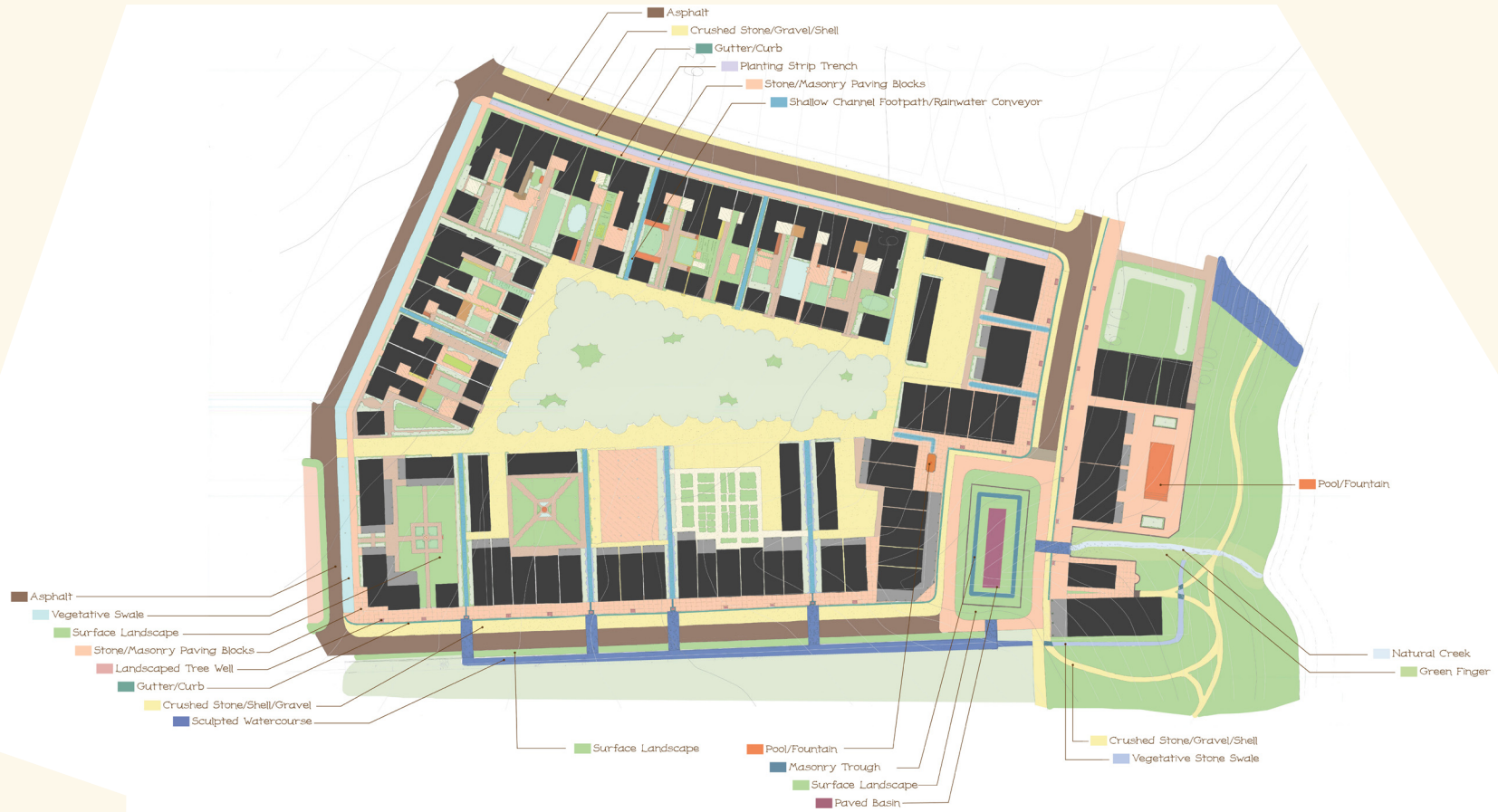
Shown above is a diagram of the Site Analysis that outlines the transect zones, with the catchment areas and existing valleys and ridges. This diagram is used in conjunction with the master plan shown on the previous plan to identify Light Imprint tools used on the project. During this stage, tools are color coded and aligned in treatment trains that are displayed on the following pages.



ILLUSTRATIVE DETAIL PLAN



CATCHMENT AREAS WITH REGULATING PLAN OVERLAY



LIGHT IMPRINT TOOL CALIBRATION OVERLAY

CARLTON LANDING, OKLAHOMA T5 SAMPLE AREA TABLE		DRAINAGE AREA (ACRES)	1ST INCH RAINFALL VOLUME (CUBIC FEET)	PERCENT TOOL AREA (%)	NUMBER OF TOOLS	CUBIC AREA OF TOOL (HxWxD=CUBIC FEET)	RAINWATER STORAGE (CUBIC FEET)	RAINWATER RUNOFF (CUBIC FEET)
PRE DEVELOPMENT CONDI- TION		13.01	47,226.3	100%	1	47,227.3	40,143.2	7,083.1
T5	T5 - A	3.08						
	CRUSHED STONE/GRAVEL/SHELL	0.25	907.5	8.1%	1	1,179.8	272.3	635.2
	ASPHALT	0.45	1,633.5	14.6%	1	1,633.6	0.1	1,633.4
	STONE/MASONRY PAVING BLOCKS	0.78	2,831.4	25.3%	1	3,397.9	566.5	2,264.9
	SHALLOW CHANNEL FOOTPATH	0.70	2,541.0	22.7%	2	3,811.7	2,541.5	-0.5
	GUTTER/CURB	0.25	907.5	8.1%	1	907.6	0.1	907.4
	PLANTING STRIP TRENCH	0.65	2,359.5	21.1%	1	3,539.5	1,180.0	1,179.5
	TOTAL	3.08	11,180.4	100.0%			4,560.5	6,619.9
	T5 - B	2.30						
	CRUSHED STONE/GRAVEL/SHELL	0.25	907.5	10.9%	1	3,733.3	2,825.8	-1,918.3
	ASPHALT	0.35	1,270.5	15.2%	1	1,270.7	0.2	1,270.3
	STONE/MASONRY PAVING BLOCKS	0.10	363.0	4.3%	1	435.6	72.6	290.4
	VEGETATIVE SWALE	1.20	4,356.0	52.2%	1	6,098.9	1,742.9	2,613.1
	SURFACE LANDSCAPE	0.40	1,452.0	17.4%	1	2,178.2	726.2	725.8
	TOTAL	2.30	8,349.0	100.0%			5,367.7	2,981.3
	T5 - C	4.75						
	CRUSHED STONE/GRAVEL/SHELL	1.10	3,993.0	23.2%	1	4,392.5	399.5	3,593.5
	ASPHALT	0.55	1,996.5	11.6%	1	1,996.6	0.1	1,996.4
	STONE/MASONRY PAVING BLOCKS	0.50	1,815.0	10.5%	1	2,178.1	363.1	1,451.9
	VEGETATIVE SWALE	0.35	1,270.5	7.4%	1	1,778.8	508.3	762.2
	SHALLOW CHANNEL FOOTPATH	0.40	1,452.0	8.4%	4	2,178.1	726.1	725.9
	GUTTER/CURB	0.40	1,452.0	8.4%	1	1,452.1	0.1	1,451.9
	SCULPTED WATERCOURSE	0.20	726.0	4.2%	1	1,370.0	644.0	82.0
	LANDSCAPED TREE WELL	0.10	363.0	2.1%	23	399.3	36.3	326.7
	POOL/FOUNTAIN	0.00	7.3	0.0%	1	12.0	4.7	2.5
	PAVED BASIN	0.05	181.5	1.1%	1	1,875.0	1693.5	-1,512.0
	SURFACE LANDSCAPE	1.10	3,993.0	23.2%	1	5,989.7	1,996.7	1,996.3
	TOTAL	4.75	17,249.8	100.0%			6,372.5	10,877.3
	T5 - D	2.09						
	ASPHALT	0.25	907.5	12.0%	1	907.6	0.1	907.4
	STONE/MASONRY PAVING BLOCKS	0.35	1,270.5	16.7%	1	1,524.8	254.3	1,016.2
	SHALLOW CHANNEL FOOTPATH	0.34	1,234.2	16.3%	1	1,851.5	617.3	616.9
	GUTTER/CURB	0.10	363.0	4.8%	1	363.0	0.0	363.0
	PLANTING STRIP TRENCH	0.15	544.5	7.2%	1	816.8	272.3	272.2
	SURFACE LANDSCAPE	0.90	3,267.0	43.1%	1	4,900.9	1,633.9	1,633.1
	TOTAL	2.09	7,886.7	100.0%			2,778.0	4,808.8
	T5 - E	0.79						
	NATURAL CREEK	0.10	363.0	12.7%	1	671.7	308.7	54.3
	MASONRY TROUGH	0.10	363.0	12.7%	1	617.2	254.2	108.8
	POOL/FOUNTAIN	0.18	653.4	22.8%	1	1,111.0	457.6	195.8
	SURFACE LANDSCAPE	0.05	181.5	6.3%	1	272.3	90.8	90.7
	GREEN FINGER	0.36	1,306.8	45.6%	1	2,418.0	1,111.2	195.6
	TOTAL	0.79	2,867.7	100.0%			2,222.6	645.1
POST DEVELOPMENT TOTAL		13.01	47,233.6	100.0%			21,301.2	25,932.3
PRE VS. POST CONDITION RUNOFF							38%	18,649.2



LIGHT IMPRINT TOOL CALIBRATION RENDERING

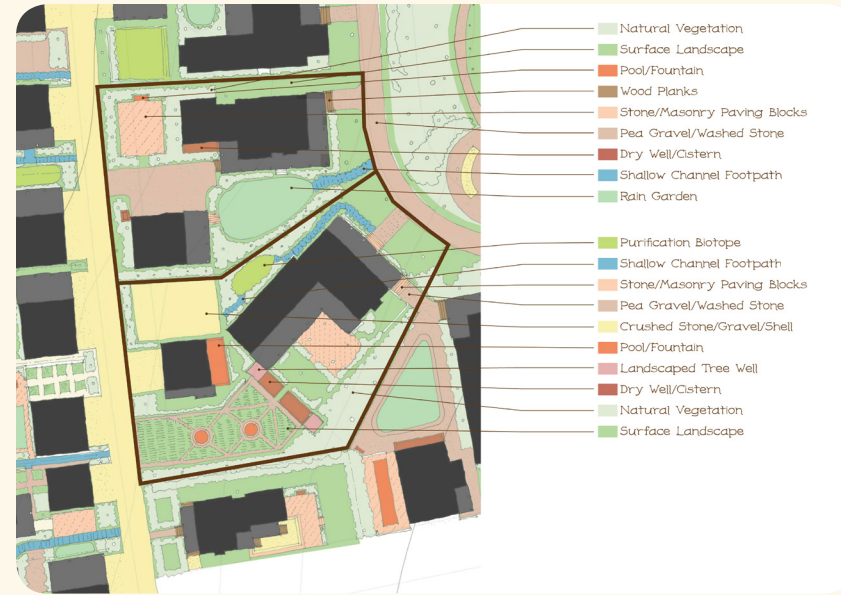
Carlton Landing ~ Catchment Area Calculations

The table at left shows the calculations of the first inch of rainwater in a storm event for each catchment area, within the T-5, Urban Center. The tools work together, as a treatment train, to provide channeling, storage, and filtration capacity to control the rainwater.

For example, Catchment Area A shows how the amount of rainwater is captured with six Light Imprint tools: Asphalt, Crushed Stone/Gravel, Gutter/Curb, Planting Strip Trench, Stone/Masonry Paving Blocks, and Shallow Channel Footpath/Rainwater Conveyor. Each tool is analyzed for its surface area, infiltration permeability and storing capabilities, in order to determine the rainwater flowing off the catchment area. The goal for the combined catchment areas is to be able to retain as much rainwater runoff in the post development condition as the volume occurred in the pre-development conditions. The T5 zone is able to retain a portion of the first one-inch of a storm. The collective assembly of the catchment areas, and the rural-to-urban transect of the development, enables the achievement of a pre-development runoff condition overall for the site.



T3 - ANNOTATED SITE PLAN WITH PHYSICAL FEATURES



T3 - ANNOTATED SITE PLAN WITH LIGHT IMPRINT TOOLS



T5 - ANNOTATED SITE PLAN WITH PHYSICAL FEATURES



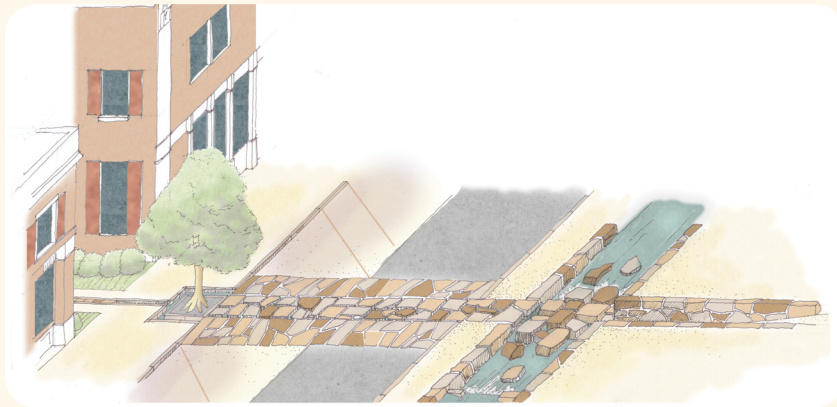
T5 - ANNOTATED SITE PLAN WITH LIGHT IMPRINT TOOLS



T3 - GREEN STREET - DETAIL



T3 - BIO-RETENTION SWALE - DETAIL



T5 - SCULPTED WATERCOURSE

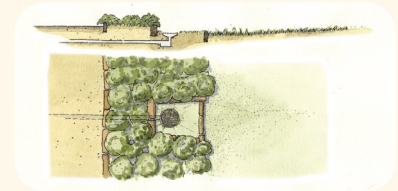
Light Imprint Tool Details are designed with the site, climate, topography, and architecture in mind. Each tool is a beautiful civic gesture, as well as a functioning stormwater management tool. Shown are tools that channel, store, and filter rainwater.



VEGETATIVE STONE SWALE - DRY AND WET



T3 - BIO-RETENTION SWALE - DETAIL



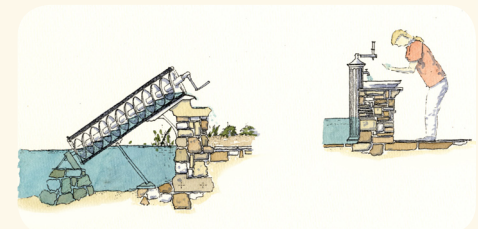
T3 - BIO-RETENTION SWALE
OVERFLOW OUTLET



T4 - BIO-RETENTION SWALE
OVERFLOW OUTLET



T4 - PLANTING STRIP TRENCH



T5 - ARCHIMEDEAN SCREW



THE
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CENTER

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2011