



Agenda MEMORANDUM

Streets & Stormwater Department

Natural Resources • Stormwater • Streets & Traffic

To: City Council
From: Gregg R. Strakaluse, Director
Date: March 17, 2021
Workshop Meeting Date: April 5, 2021

SUBJECT:

Presentation and discussion of the conversion of an impervious alley to a pervious one.

BACKGROUND:

During the FY 20-21 Capital Improvement Program budget workshop in May of 2020, City Council directed staff to consider a project that could integrate stormwater quality components into a public alleyway while maintaining the purpose of the alleyway for utilities, transportation, and connectivity. Most City alleyways are paved with impervious pavement and they convey stormwater through typical storm drain inlets and underground pipe. Opportunities for stormwater to be filtered through pervious areas in urban cities are few and far between. Nationally, communities are considering ways to integrate “green” concepts such as stormwater treatment components and landscaping into public alleyways, while still allowing alleyways to serve their purpose.

Considerations for Integrating Non-Traditional Green Designs into Alleyways

It's typical for any public works official to design a public project for maximum durability, effectiveness, and reliability. Of course, safety, low maintenance, and budget are also considerations. The fundamental purposes of an alleyway are to provide utility services, garbage collection, street connectivity and limited transportation for property access, deliveries, and pedestrian mobility. These uses must be evaluated when considering 'green designs' for an alley.

Utilities: From time-to-time, a utility companies upgrade services and establish service to new or rebuilt homes. This work sometimes requires excavation within an alley because the placement or connection to the utility must be made underground. This is mostly true for water and sewer connections. Even though telephone, cable and electric service can run overhead on utility poles on one side of the alley, service connections occur by dropping down the pole and running cable underground and across an alley.

Deliveries and Garbage/Recycling/Horticultural Collection Services: These services tend to require large heavy vehicles that maneuver to pick up dumpsters and other containers within an alley. The wheel loading (axel loading) over the pavement is heavy; therefore, an alley's structural cross-section (pavement) needs to be designed to accommodate this activity.

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Landscaping: Most alleys in residential neighborhoods tend to have lush landscaping that encroaches into an alley. Some plant species have deep and long root systems and can infiltrate the sub-base of an alley or a permeable pavement system.

Development: Many homes in the City are being redeveloped with larger homes with a higher demand on utilities. In other words, larger water meters and line sizes, and improved electrical power supply are required. When introducing green designs into an alley, it is important to assess the redevelopment potential of the structures that abut the alley in order to minimize damage to green investments.

Asphalt Paved Alleys: Alleys paved with 1.5 – 2-inches of asphalt have a rock base comprised of densely compacted stone and sand. The alley's cross-section is designed to support heavy loads, remain firm under stresses caused by frequent wheel turns, and resist water infiltration. Utility cuts into roads and other paved surfaces are the beginning of their demise, since this lets water infiltrate and erode the fine sands that are embedded into the road's sub-base.

Permeable Pavement Systems: A permeable pavement system is constructed with coarse stone base wrapped in a filtering fabric that is designed without sands that would otherwise fill void space between the coarse stone. This is important for allowing stormwater to fill the void space and filter through the stone and sub-base. The surface pavement can be brick, concrete, or asphalt, specifically designed to allow stormwater to penetrate to the rock base. Some permeable pavement systems have perforated pipes that can accept stormwater and direct it to a storm drain inlet. The special materials and method by which permeable pavement systems are constructed make this green design vulnerable to damage by the standard alley uses described above. Even with the best permitting and enforcement program, alley uses can substantially degrade the performance of the permeable pavement.

RECOMMENDED PUBLIC ALLEY FOR A PERMEABLE PAVEMENT SYSTEM

After several months of considering the best location for pilot project to construct a permeable pavement system that will continue to be effective within a public alley for years to come, staff has selected the alley located on the southside of 3rd Avenue North by Jasmine Cay. Please see Figure #1. The following evaluation was conducted in order to support the recommendation:

- **Risk from Utilities:** Utility lines are transmission only. In other words, there aren't any service connections from the main to the neighboring properties that might require future maintenance (water, gravity sewer, power, communications, TECO). Therefore, the risk of damage occurring to a permeable pavement system from utility maintenance is low. Other residential and commercial alleys carry many utilities with underground service connections and are significantly impacted by excavation during redevelopment. Even with the best regulatory oversight, the restoration of alleyways from utility companies and their subcontractors is difficult and time consuming and penalties are difficult to enforce. For example, withholding permits from a utility provider to do work directly affects the public's ability to receive utilities.
- **Depth to Utilities:** To construct any pervious pavement system, underground infrastructure must be assessed for size, age, connection frequency and maintenance.

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Pervious pavement systems required anywhere from 6 to 24-inches of thickness (cross-section). Therefore, utilities need to be located at sufficient depth to allow for an effective permeable pavement system. The transmission utilities under the recommended alleyway have sufficient depth to support a permeable pavement system.

- **Construction of a Permeable Pavement System:** The construction time for a permeable pavement system is significantly longer than typical asphalt pavement. This is mainly due to the numerous layers and careful placement of different materials for the reservoir bed and interlocking surface brick. Construction requires a complete closure of the alley. For the proposed alley, a closure would not prohibit access to private property since other means of access exist for the abutting properties. The City's garbage truck is the only vehicle that requires access to the dumpster. Other vehicles can be detoured. Garbage truck access can be accommodated from 2nd Avenue North, through the Jade Apartments parking lot.
- **Drainage:** Permeable pavement systems can be designed with a perforated pipe overflow when the reservoir bed is full. The proposed alley has an existing catch basin that connects to a 60-inch stormwater trunk line. The permeable pavement system for this proposed alley would have an overflow connection to the existing stormwater system.
- **Vegetation:** The recommended alley is used frequently by pedestrians and bicyclists from the neighborhood. There were large trees with large roots that caused an upheaval of asphalt, which may be considered a tripping hazard. The large root system would have presented an issue with the permeable pavement system; however, the trees were removed in 2020. This project would correct any tripping hazards and the limited vegetation that remains is no risk to the permeable pavement reservoir. Construction of the permeable pavement system would require any remaining roots to be removed.
- **Potential Redevelopment:** Staff does not foresee any redevelopment in this alley and the City owns the parcels on both sides (Jasmine Cay - 50-year land lease and RPCC Playground).
- **Monitoring:** The RPCC Playground receive weekly landscape maintenance, therefore, the alley can be monitored closely for surface debris and unauthorized or emergency utility activity that might impact the system.
- **Water Quality Volume:** For the proposed alley, a permeable pavement system would provide 2,778 cubic feet of volume to treat up to 20,784 gallons of stormwater per storm event.
- **Estimated Pollutant Removal Potential:**

The pounds of pollutants removed by the permeable pavement system is estimated at:

POLLUTANT	POUNDS REMOVED/YEAR
Total Phosphorus	3.62
Total Nitrogen	24.95
Total Suspended Solids	955.80
Total Copper	0.31
Total Zinc	1.36
Total Lead	1.28

METHOD OF CALCULATION: The baseline pollutants for urban stormwater runoff are as follows:

POLLUTANT	UNITS	RESIDENTIAL RUNOFF
Total Phosphorus	ug/l	383
Total Nitrogen	ug/l	2636
Total Suspended Solids	mg/l	101
Total Copper	ug/l	33
Total Zinc	ug/l	144
Total Lead	ug/l	135

Source: USEPA 1983

Assuming 120 system cycling events in the course of one year, approximately 2,500,000 gallons of stormwater will be treated (or 9,463,529 liters).

The pollutant removal efficiency of a permeable pavement system that is based on exfiltration is:

POLLUTANT	REMOVAL EFFICIENCY
Total Phosphorus	40 – 60 %
Total Nitrogen	40 – 60 %
Total Suspended Solids	80 – 100 %
Total Copper	80 – 100 %
Total Zinc	80 – 100 %
Total Lead	80 – 100 %

Source: Schueler 1987

- Cost Estimate:** Formal quotes have not yet been obtained from pre-qualified contractors; but staff has used unit prices to develop an engineer’s opinion of cost for the installation of the permeable pavement system. Please See Attachment #1: Engineers Opinion of Cost. The estimated cost as of March 26, 2021 is \$145,773.
- Cost Benefit:** It is estimated that a properly maintain permeable pavement system will have a life cycle between 30 – 50 years. A system within an alleyway would likely have a life cycle closer to the lower end of 30-years. Therefore, the cost benefit for the pilot program is estimated to be \$4.92/pound of total pollutants removed.

STAFF RECOMMENDATIONS

- Proceed with a permeable pavement system comprised of brick exfiltration within the 250-foot segment of alleyway south of 3rd Avenue North.
- When completed, sign the alleyway as a ‘Green Alley’ and provide written notice and warning to utility companies regarding the permeable pavement system and ‘Special Restoration Requirements’.
- Inform and Educate permit review techs about ‘Special Restoration Requirements’ that Utility Companies must follow when impacting the permeable pavement system.
- Inspect the alleyway annually and provide City Council with a summary of any utility impacts and the overall function of the permeable pavement system.