Alcott Field of Dreams
IEPA IGIG Grant

Final Report for Alcott Elementary
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SUMMARY

The Alcott Field of Dreams is a public space used by thousands of people every week. Currently, only 35 percent of Alcott's total land area is permeable; the goal is to increase that to 60 percent permeability. FOA volunteers see the schoolyard project as a model for green infrastructure as a foundation for healthy public spaces that will be visited by architects, educators and neighbors. All BMPs were designed as iconic elements incorporating student/community artwork, and will be integrated into educational experiences, functioning as outdoor classrooms with educational signage identifying sustainable practices. Thousands of students will play in this space for at least a generation.

INTRODUCTION

PRE-CONSTRUCTION CONDITIONS

Alcott Elementary School is located at 2625 N Orchard Street, Chicago, IL 60614 which is at the corner of N Orchard Street and W Wrightwood Avenue. The total site area within Alcott Elementary property is 128,367 square feet, with the project area consisting of 63,731 square feet on the north side of the property. The site is bordered on all sides by low-rise single and multi-family residences, city streets, and surface parking. A map of the approximate area in Illinois is shown in Figure 1 and an enlarged map of the pre-construction area is shown in Figure 2.

FIGURE 1. MAP OF PROJECT AREA IN ILLINOIS

FIGURE 2. MAP OF ALCOTT ELEMENTARY SCHOOL

The Alcott Field of Dreams project was initially proposed by the Friends of Alcott School (FOA); a school based community group. The project addresses the impairment of waterways from urban runoff, the dangers of standing water in a children's sports field, and Combined Sewer Overflow (CSO) events. The objective of the Alcott Field of Dreams project is to use green infrastructure BMPs to maximize storm water retention and diversion from the combined storm and sanitary sewer system.

In the short term:

1. Reduce storm water runoff quantity and improve quality by using BMPs.
2. Prevent CSO events by infiltrating surface runoff.
3. Maximize the impact of existing green infrastructure projects in the immediate area, including the Green Alleys project in the 43rd Ward.

Over the long term:

1. Foster a culture of awareness and involvement for green infrastructure projects in the larger school community.

2. Support the neighboring efforts of CDOT's Green Alley programs which seek to achieve similar storm water mitigation goals.
3. Create a sustainable play and educational space for Alcott students and school neighbors that addresses storm water retention and infiltration.

The proposed improvements will reduce the burden on the combined sewers as well as provide phosphorous, nitrogen, and Total Suspended Solids (TSS) reductions. The porous asphalt, pervious playground areas, and enhanced artificial turf area, and plantings provide a variety of beneficial sustainable BMP's for this site, along with meeting the Chicago Stormwater Ordinance for detention requirements. The original projected improvements are detailed in Table 1 below.

Table 1.Original Projected Environmental Benefits

Outcomes: Projected environmental benefits*

BMP	Amount/Area	Flow reduction gallon/yr**	Phosphorus Reduction lbs/yr	Nitrogen reduction lbs/yr	TSS reduction lbs/yr
Permeable pavement	16,194 SF	489,059	0	6	376
Permeable Rubber Play area	5,113 SF	154,413	0	2	139
Permeable Rubber Running track	5,340 SF	161,268	0	2	122
Synthetic field***	27,981 SF	845,026	0	4	218
Planting areas and trees	Estimated	5,000	0	1	129
Totals		**1,654,766**	**1**	**15**	**984**

*Pollutant load reduction totals are from the EPA Region 5 Load Reduction worksheet. Synthetic field, running track, and play surfaces are based on porous pavement calculation within that worksheet.
**Flow reduction calculations are from the Center for Neighborhood Technology's Green Values National Stormwater Management Calculator and additional runoff calculations based upon 2011 Chicago rainfall data.
***Synthetic field includes surface, infill, drainage system, aggregate detention system. Artificial turf fields with aggregate detention storage are a BMP, according to the City of Chicago Stormwater Ordinance and, therefore, a BMP followed by CPS.

DISCUSSION

POST-CONSTRUCTION CONDITIONS

With the construction of the site improvements, the stormwater runoff will be significantly reduced, as will the impervious area of the site. The water quality leaving the site will also improve because of the filtering through the porous asphalt, permeable rubber surfacing, artificial turf and CA-7 stone in the detention areas. The underground detention facility detains 0.89 million gallons of water per year and releases it into the combined sewer system during each rain event at a controlled rate. The existing pre-project site conditions allowed this water to flow directly off-site into the combined sewer system causing an over burden on these sewers and in some instances flooding local residences. The construction of this facility will greatly reduce these instances.

The project tasks will start with the removal of the existing conditions of impervious paving and flooded grass and dirt field and proceed with the installation of the project components outlined in the next section. The installation of the project components will begin with excavation to reach the designed subbase depths of storage stone and the installation of utilities. After installation of utility runs and structures, the storage stone and other subbase will be installed and all concrete work will commence to create the required edge conditions needed for installation of each project component. Lastly, all equipment and final surfacing will be installed to complete the project.

The construction of the green infrastructure has been recently completed. Below are several images of the project throughout construction.

After removal of the existing impervious paving and associated subbase, excavation for BMP subbase depths and utility runs was performed as shown in Figure 3.

FIGURE 3. CONSTRUCTION PROGRESS AS OF JULY 9, 2015

Once desired subgrades were achieved, subbase (CA-7) for BMPs was installed and formwork was erected to form curbs for the separate BMPs as shown in Figure 4.

FIGURE 4. CONSTRUCTION PROGRESS AS OF JULY 16, 2015

Playground equipment was installed and final grading of subbase achieved once all concrete curb work was complete, as shown in Figure 5.

FIGURE 5. CONSTRUCTION PROGRESS AS OF JULY 30, 2015

Final installation of pervious paving initiated after final grading of subbase was complete, as shown in Figure 6.

FIGURE 6. CONSTRUCTION PROGRESS AS OF AUGUST 20, 2015

Construction was complete in the Fall of 2015 after all pervious paving was installed and various site elements finished thereafter, as shown in Figure 7.

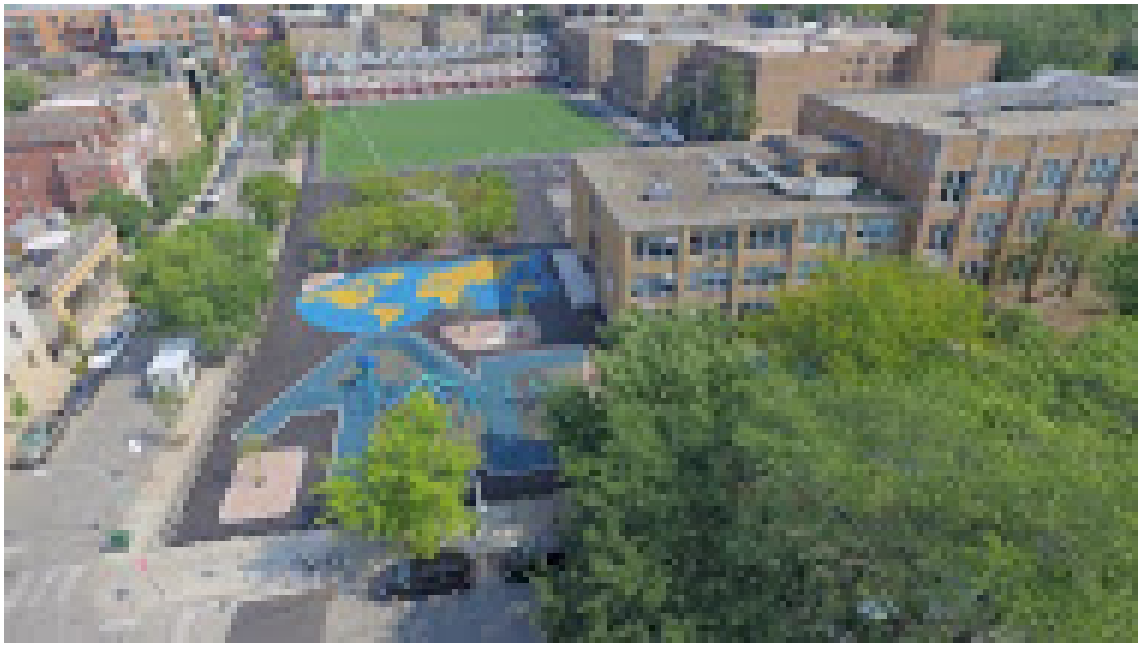


FIGURE 7. CONSTRUCTION COMPLETION AS OF SEPTEMBER 19, 2015

Project Components

Four BMPs were designed for the Alcott Field of Dreams. They include: Infiltration Basin (Synthetic Turf Area), Porous Aspahlt, Permeable Rubber Surfacing, and Other (Trees). These BMPs will maximize stormwater retention, as well as reduce runoff quantity while simultaneously increasing runoff quality.

Below is a detailed description of each BMP, including the reason for selecting the BMP, advantages and disadvantages, location, design considerations, maintenance, installation, materials and cost for each.

Infiltration Basin

Reason for selecting BMP

This detention, for documentation purposes, has been classified as an infiltration basin, due to the fact it will be detaining water until it infiltrates. The Infiltration Basin in this case functions as a Synthetic Turf Area. The Synthetic Turf Area is ideal for an elementary school as it provides an open space for playing and use by students, teachers, and the community. This area contains the partial bulge of the provided & required detention for the site.

Advantages/Disadvantages

The advantages of the Synthetic Turf Area include the removal of pollutants including phosphorous, nitrogen, and total suspended solids through settling and filtration. As with natural turf and rain gardens, the synthetic turf slows the flow of stormwater and allows for infiltration, thereby recharging groundwater and reducing detention needs. The primary disadvantage of synthetic turf areas is the maintenance required to groom the fibers and refill the rubber infill.

Location

The Synthetic Turf Field is located at the northeast corner of the project site.

Design

The synthetic turf field has an average of 1.65 feet of aggregate detention underneath approximately 28,000 square feet of synthetic turf. This provide approximately 46,200 cubic feet of aggregate detention (with 11,800 cubic feet of void space). Perforated underdrains will also be installed to convey water to the detention facility.

Installation & Construction

Installation will be in accordance with contract specifications.

Materials

The synthetic turf area will have two (2) inches of artificial turf fabric and infill, four (4) inches of CA-16 aggregate bedding, an average of sixteen (16) inches of CA-7 aggregate and perforated underdrains.

COST EFFECTIVENESS

The Infiltration Basin is the most costly BMP on the Alcott project site. The total cost was $424,933.06. This cost includes earthwork, perforated PVC underdrain, aggregate base, aggregate bedding, and synthetic turf. The cost breakdown of the Infiltration Basin BMP is shown below in Table 2. A typical installation and City Of Chicago standard construction would include a synthetic turf field without an infiltration basin; this would require approximately three times the amount of utility piping and would increase the total cost approximately by upwards of $30,000.

Table 2.Synthetic Turf Cost Summary

Practice Component	Unit Type	Amount	Cost Per	Total
Demolition*	Lump Sum	1.00	various	$44,836.82
Excavation	Yard (cubic)	1720.00	$11.51	$19,797.20
Catch Basin	Number	1.00	$2,449.40	$2,449.40
Utility Runs**	Lump Sum	1.00	various	$57,644.52
Stone Base (CA-7 & CA-16, various	Lump Sum	1.00	various	$68,929.24
Concrete Curb, 6" wide flush	Feet (linear)	661.00	$25.76	$17,027.36
Synthetic Field Turf	Feet	28043.00	$7.64	$214,248.5
			TOTAL	$424,933.0

*Demo includes the removal of paving and bases, utilities, and other various features.

**Utility Runs include the installation of piping and cleanouts.

POROUS ASPHALT

REASON FOR SELECTING BMP

Porous asphalt has not been previously used on CPS projects, but FOA and CPS wanted to incorporate new green technologies into the site improvements. This paved area will prevent pollution at the source, allowing runoff to infiltrate through the voids of the permeable surface which will filter and attenuate stormwater runoff flows. This area contains the partial bulge of the provided & required detention for the site.

ADVANTAGES/DISADVANTAGES

Some of the advantages of Porous Asphalt include pollutant removal and better skid resistance. Additionally, curb and storm sewers costs are reduced over traditional pavement. Permeable Pavers were included in this section because they have similar principles to that of porous asphalt. These materials allow water to infiltrate freely into underlying aggregate bases to collect water and convey to an underground aggregate detention system. The primary disadvantage associated with porous asphalt and permeable paver areas is an increase in maintenance costs.

LOCATION

There will be approximately 18,000 square feet of porous asphalt in the center of the project site. The permeable pavers are located on the west side of the project site.

DESIGN

The Porous Asphalt has has an average of 1.65 feet of aggregate detention underneath approximately 18,000 square feet of porous asphalt. This provide approximately 29,700 cubic feet of aggregate detention (with 7,100 cubic feet of void space). Perforated underdrains will also be installed to convey water to the detention facility. During rain events, water will quickly flow through the porous concrete, through the aggregate voids and into the underdrains where it will flow to the detention facility. This design element will allow for play to occur on this surface immediately after the event.

INSTALLATION & CONSTRUCTION

Installation of the porous concrete will be in accordance with the manufacturers' specifications.

MATERIALS

The porous concrete areas consist of three (3) inch thick porous asphalt, one and a half (1-1/2) inches of CA-16 aggregate bedding, an average of sixteen (16) inches of CA-7 aggregate and perforated underdrains.

COST EFFECTIVENESS

The total cost for the Porous Asphalt BMP was $214,488.70. This cost includes earthwork, perforated PVC underdrain, aggregate base, aggregate bedding, and porous asphalt. The cost breakdown of the Porous Asphalt BMP is shown below in Table 3. A typical installation and City Of Chicago standard construction would include either a non-permeable asphalt install or permeable pavers in lieu of permeable asphalt; this would require approximately 18,000 SF of pavers increasing the total cost by approximately $102,000.

Table 3. Porous Asphalt Cost Summary

Practice Component	Unit Type	Amount	Cost Per	Total
Demolition*	Lump Sum		various	$38,463.11
Excavation	Yard (cubic)		$11.51	$13,248.01
Catch basin	Number		$2,449.40	$4,898.80
Utility Runs**	Lump Sum		various	$47,079.86
Stone Base (CA-7 & CA-16, various	Lump Sum		various	$49,259.88
Concrete curb, 6" wide flush	Feet (linear)		$25.76	$16,589.44
Porous Asphalt	Feet		$2.31	$41,025.60
Permeable Pavers	Feet		$9.00	$3,924.00
			TOTAL	**$214,488.7**

*Demolition includes the removal of paving and bases, utilities, and other various site features.

**Utility Runs include installation of piping, connection to existing sewer, and repairing of existing pavement at sewer connection.

PERMEABLE RUBBER SURFACING

REASON FOR SELECTING BMP

Permeable Rubber Surfacing Areas will prevent pollution at the source, allowing runoff to infiltrate through the voids of the permeable surface which will filter and attenuate stormwater runoff flows.

ADVANTAGES/DISADVANTAGES

Poured rubber is very pervious, which will allow rainwater to freely flow through to an aggregate layer & perforated pipes to be collected and stored in the detention area. It is also an advantage since it is safer than other playground materials to play on.

LOCATION

The Permeable Rubber Surfacing play areas are located on the west side of the project site.

DESIGN

The Permeable Rubber Surfacing has has an average of 1.33 feet of aggregate detention underneath approximately 5,300 square feet of permeable rubber surfacing. This provide approximately 7,050 cubic feet of aggregate detention (with 900 cubic feet of void space). Perforated underdrains will also be installed to convey water to the detention facility. During rain events, water will quickly flow through the permeable rubber surfacing, through the aggregate voids and into the underdrains where it will flow to the detention facility. This design element will allow for play to occur on this surface immediately after the event.

INSTALLATION & CONSTRUCTION

Installation of the permeable rubber surfacing will be in accordance with the manufacturers' specifications.

MATERIALS

The permeable rubber surfacing areas consist of various depths of rubber surfacing based on safety fall heights, two (2) inches of CA-16 aggregate bedding, and fourteen (14) inches of CA-7 aggregate.

COST EFFECTIVENESS

The total cost for the Permeable Rubber Surfacing BMP was $141,521.70. This cost includes earthwork, perforated PVC underdrain, aggregate base, aggregate bedding, and permeable rubber surfacing. The cost breakdown of the Permeable Rubber Surfacing BMP is shown below in Table 4. A typical installation and City Of Chicago standard construction would include a rubber surfacing without stormwater storage beneath. This would require additional utility piping and would increase the total cost by approximately $15,000.

Table 4. Permeable Rubber Surfacing Cost Summary

Practice Component	Unit Type	Amount	Cost Per	Total
Demolition*	Lump Sum		various	$10,775.20
Excavation	Yard (cubic)		$11.51	$3,683.20
Catch basin	Number		$2,449.40	$2,449.40
Utility Runs**	Lump Sum		various	$13,871.20
CA-7, 12" depth	Yard (cubic)		$35.20	$6,688.00
Concrete curb, 6" wide flush	Feet (linear)		$25.76	$12,442.08
Permeable Rubber Surfacing	Feet		$17.82	$91,612.62
			TOTAL	**$141,521.7**

*Demolition includes the removal of paving and bases, utilities, and other various features.

** Utility Runs include the installation of piping and cleanouts.

OTHER (TREES)

REASON FOR SELECTING BMP

Trees and stabilized decomposed aggregate were selected for their versatility and the seamless application of these BMPs into the project site at Alcott Field of Dreams. Trees are the perfect addition to a play area for shade and a calming atmosphere. The stabilized decomposed aggregate easily fits with the rest of the design.

ADVANTAGES/DISADVANTAGES

The advantages of trees and stabilized decomposed aggregate relate quite closely to other advantages for this project. The trees provide shade, reduce the heat island effect and also provide oxygen rejuvenation. The stabilized decomposed aggregate has the added bonus of being a porous material that allows for water infiltration, much in the same way as the porous asphalt and permeable rubber surfacing. Once established, trees are low maintenance. There were no disadvantages incorporating trees into the project from a cost or maintenance objective. The disadvantage with the stabilized decomposed aggregate is the cost to periodically replenish the beds.

LOCATION

The trees and stabilized decomposed aggregate are distributed throughout the play areas near the west side of the project site.

DESIGN

Tree locations were selected to ultimately maximize provided shade at the play areas. Stabilized decomposed aggregate was incorporated into the play area design.

INSTALLATION & CONSTRUCTION

The saplings were planted and carefully cultivated over their first year to ensure they are established. The engineered wood fiber was installed with drainage as recommended by the manufacturer. This is done to increase the life of the engineered wood fiber by reducing mold and fungus issues and to help with cold resistence.

MATERIALS

Saplings were planted and engineered wood fiber was purchased in 12 foot lengths. Three-inch deep mulch was placed at the base of the trees. Topsoil was also used in the planting.

COST EFFECTIVENESS

The trees are a cost-effective investment as after they are established, they require very minimal maintenance. The only maintenance required would be to the stabilized decomposed aggregate at the base of the trees. Stabilized decomposed aggregate is also a cost-effective selection but requires maintenance. The cost breakdown of the Other (Trees) BMP is shown below in Table 5.

Table 5. Other (Trees)

Practice Component	Unit Type	Amount	Cost Per	Total
Shade Trees, 3" caliper	Number	3.00	$1,179.48	$3,538.44
Ornamental Trees, 8' High	Number	3.00	$905.40	$2,716.20
Planting Soil	Yard (cubic)	84.00	$37.22	$3,126.48
Stabilized Decomposed Aggregate,	Feet	757.00	$7.36	$5,571.52
			TOTAL	**$14,952.64**

RESULTS

OPERATION AND MAINTENANCE

As with most stormwater management practices, permeable pavement systems require regular maintenance to ensure a prolonged lifespan. The synthetic turf field requires regular maintenance to ensure no weeds or mold grow, the infill does not become compacted and no damage occurs due to chemicals or fire. If not properly maintained, the infill may become contaminated and could lead to the hardening of the surface and decreased drainage. Similarly care must be taken to ensure the permeability of the porous asphalt and permeable rubber surfaces remains intake. Sand must not be used during winter months and the surfaces themselves and adjacent surfaces must be maintained to ensure no sediments accumulate in the voids of the pavements. Scheduled cleanings and vacuuming/power washing will help ensure sediments do not affect drainage. See the approved Operation and Maintenance Plan in Appendix A.

STORMWATER RUNOFF

With the installation of the BMPs included in the project, the stormwater runoff will be significantly reduced. The majority of the site was previously impermeable; as such most, if not all, runoff previously fell off-site and into the City of Chicago's stormwater system. It rains approximately 27.1 inches per year in the Chicagoland area, and given the project site area approximately 0.89 million gallons of water per year will now be detained and released slowly to prevent Combined Sewer Overflow (CSO) events.

POLLUTANT REMOVAL EFFICIENCY

In order to determine pollutant reduction from the proposed improvements, the Illinois EPA's Estimating Pollutant Load Reductions for Nonpoint Source Pollution Control BMPs workbook was used. The annual pollutant load reductions are summarized in Table 6.

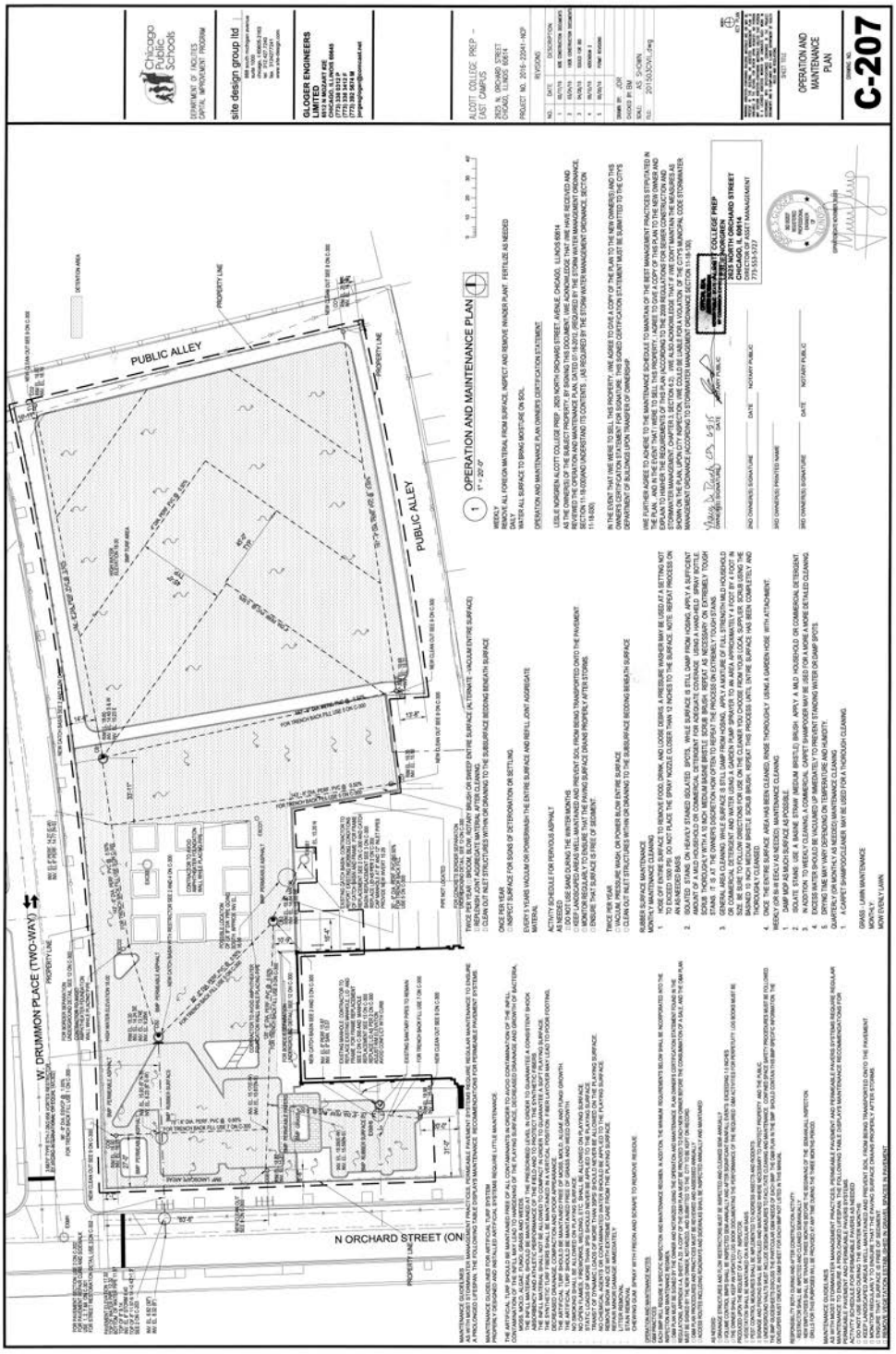
Table 6. Pollutant Reductions

BMP	Infiltration Basin	Porous Asphalt	Porous-Other	Vegetative Cover	**Total (lbs/yr)**
BOD					
COD	113	106	21	5	**245**
TSS	677	493	128	40	**1338**
Lead					
Copper					
Zinc					
TDS					
TN	2	4			**6**
TKN					
DP					
TP					
Cadmium					

This treatment train process will maximize stormwater infiltration and pollutant removal by treating stormwater runoff by several different BMPs prior to discharging downstream.

APPENDICES

Appendix A – Operation and Maintenance Plan:



Appendix B - Ribbon Cutting Media Release