AWR Engineering, LLC
Alaska Water Resources

Memorandum

To: Kirsti Bischofberger, Watershed Manager, Municipality of Anchorage

From: Janie Dusel, PE

Date: February 3, 2017

Re: 2016 Low Impact Development/Green Infrastructure Performance Monitoring

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The purpose of this memorandum is to provide a summary of the 2016 Low Impact Development (LID) /Green Infrastructure (GI) performance monitoring completed by AWR Engineering for the Municipality of Anchorage (MOA).

Background and Purpose. The MOA and the Alaska Department of Transportation and Public Facilities have been completing LID/GI projects since approximately 2010, as required per their shared Alaska Pollution Discharge Elimination System (APDES) permit. The MOA has also been completing performance monitoring of these and other private LID/GI projects since approximately 2012. The performance monitoring program provides valuable information regarding what types of LID/GI techniques work under various local site constraints. For 2016, LID/GI monitoring was not mandated by the APDES permit, but the MOA opted to continue visual monitoring of previously completed projects to continue to increase the length of record of facility performance data. Required monitoring of new LID/GI demonstration projects is expected to begin in 2017.

The 2016 monitoring program included five sites that were visited on September 22. Data from the National Climatic Data Center shows that Anchorage International Airport received 0.66 inches of rainfall that day. Monitoring was limited to visual observations. No instrumentation was used. Four of the sites visited had been previously monitored by the MOA, and one site was new to the monitoring program. The five sites and their associated LID/GI features are listed below.

1. Russian Jack Springs Park Parking Lot – Porous Asphalt and Subsurface Infiltration Chambers
2. New Seward Highway Improvements: Dowling to Tudor – Infiltration Pond
3. West Dowling Road Phase 1 – Bioswale
4. Taku Lake Park – Rain Garden
5. South Restaurant – Detention/Infiltration Pond

Observations from each of the sites are presented in the following sections of this memorandum.

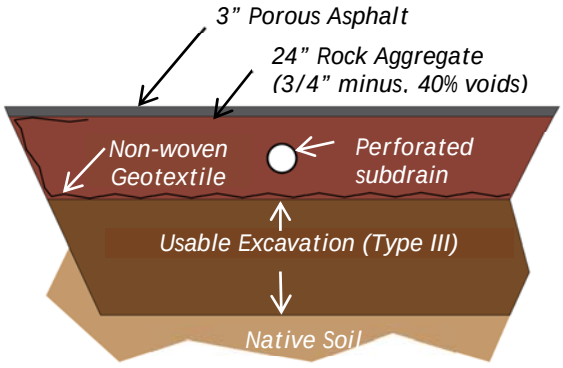
Russian Jack Springs Park. The Russian Jack Spring Park (RJSP) parking lot has been included in the MOA monitoring program since the project construction in 2012. The parking lot is located at 821 Pine Street in Anchorage, which is south of 6th Avenue, and north of Debar Road. As a joint effort between the MOA Watershed and Parks departments, the approximately one acre parking lot was retrofitted to provide improved parking and safer pedestrian facilities for park users. The RJSP parking lot is used in the summer months for access to the softball fields located north and south of the parking lot and the soccer fields to the east. It is also used year-round for access to the park's popular

trail system. The parking lot LID features include porous asphalt and an underground infiltration gallery made of chambers. The parking lot layout is shown in Figure 1.

Figure 1: RJSP Parking Lot Layout

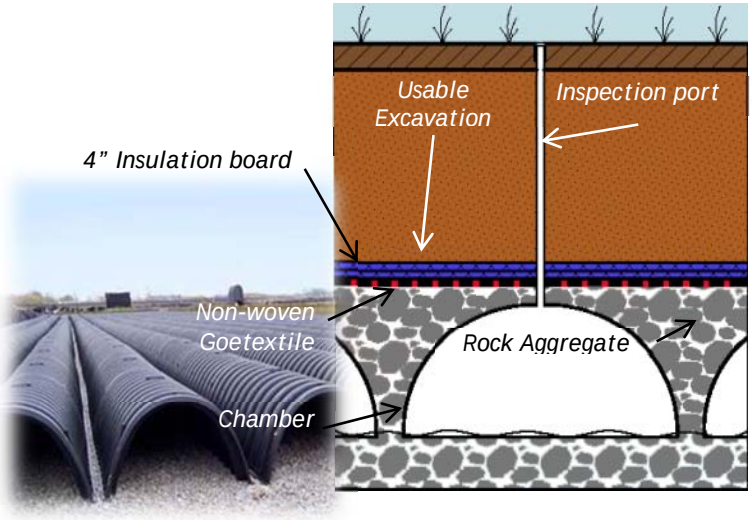
Porous Asphalt. Portions of the RJSP parking lot are constructed with porous asphalt. Rain water that falls on these areas flows through the asphalt into a subsurface rock storage area. Water is stored there and slowly infiltrated as soil capacity becomes available. The porous asphalt was designed to store and infiltrate up to the 10-year, 24-hour rainfall event. Two of the three porous asphalt sections were installed with a perforated subdrain near the top of the asphalt's structural section. In the event that the asphalt's structural section should become filled with water in excess of the design volume, water would be collected in the subdrain pipe and directed away from the asphalt. Figure 2 shows a schematic of a typical porous asphalt section. One section was installed without the subdrain in order to compare the performance of the two types. The subdrain pipes are routed to the subsurface infiltration gallery via an on-site storm drain system.

Figure 2: Typical Porous Asphalt Section



Infiltration Chambers. Water that falls on the traditional asphalt is directed to a subsurface infiltration chamber facility via traditional stormwater conveyance piping. The chambers are designed to store and infiltration up to the 100-year, 24-hour event. Figure 3 shows a schematic of a chamber system typical section.

Figure 3: Typical Infiltration Gallery Section



2016 Observations. In addition to the September 22 site visit, this site was visited on July 17, when no precipitation was occurring. Previous monitoring reports (2013 through 2015) have noted positive performance of this parking lot despite ongoing maintenance concerns, particularly with the porous asphalt. The 2016 observations continue this general trend. When the parking lot was visited on July 17, it was observed to be scattered with clumps of dirt and debris which were believed to be tracked onto the parking lot during construction of the Park's new skate park, just north of the parking lot. The parking lot also appeared to have been sanded during the winter and had not been swept. Sanding of the porous asphalt portions of the parking lot is not recommended unless frequent vacuum sweeping is completed. It appeared that sand had been placed on the two smaller portions of porous asphalt, and had been tracked throughout the parking lot. Sand, dirt, and organic debris on the porous asphalt can result in clogging of the asphalt pores, particularly without frequent vacuum sweeping.

One area of the parking lot was also observed to be deeply rutted, potentially from construction support trucks accessing the skate park. Based on the expected parking lot use provided by the MOA Parks Department, the porous asphalt was not designed for heavy truck loading. The heaviest expected vehicle to utilize the parking lot was the truck that services the onsite porta potty.

Light surface raveling of the asphalt was noted in last year's monitoring report, and was observed to be continuing, though not significantly worsened from last year. As discussed in the 2015 report, the absence of frequent sweeping of the parking lot is expected to compound this issue because the unraveled rocks remain on the surface and are then ground into the remaining asphalt under vehicular traffic. Photos from the July 17 site visit are shown in Figure 4.

Figure 4: RJSP Parking Lot July 17, 2016

Sand in the Porous Asphalt Pores

Dirt and Debris on the Porous Asphalt and in the Gutters

During the September 22 site visit, it was raining and the parking lot observed to be well-drained, despite the above-listed concerns. Some light ponding on the porous asphalt areas was observed, indicating that water is either not flowing freely through the asphalt pores, or the asphalt infiltration rate is slower than the rate of incoming runoff. These areas were few and were typically limited to locations near seams where the asphalt transitions to traditional non-porous asphalt, or to areas that were previously noted to be clogged with organic debris. Areas nears the seams receive runoff from the non-porous asphalt surface, resulting in more concentrated runoff.

The three monitoring wells in the porous asphalt were checked and water levels were observed to be very consistent with previous years' levels, indicating that the parking lot subgrade continues to drain well. The subdrain was not flowing.

The subsurface infiltration system was inspected via the chamber inspection ports, and standing water was not observed. This system is out-performing design expectations even with the addition of incoming flows from the east, which was not included in the design. Photos of the site from the September 22 site visit are presented in Figure 5.

Figure 5: RJSP Parking Lot September 22, 2016

The MOA Parks Department indicated that this parking is swept regularly and that they have made efforts to keep organic materials such as mulch and dirt off of the porous asphalt. They also noted that the surface raveling tends to worsen during warm summer days due to tires turning on the surface when the heat has loosened the asphalt binder. This is consistent with observations presented in previous years' monitoring reports. Parks noted they were happy to support LID demonstration project efforts, but that other LID techniques that utilize park green space may have provided a similar benefit with less maintenance.

New Seward Highway Infiltration Pond. The New Seward Highway is located in Anchorage and serves as one of the city's primary north-south highway corridors. The New Seward Highway Improvements – Dowling to Tudor project, constructed from 2013-2014, expanded the existing highway corridor from four lanes to six lanes and reconstructed portions of the frontage roads. The majority of the project lies in the Campbell Creek watershed, and the highway crosses Campbell Creek via a bridge located north of International Airport Drive and south of Tudor Road. A small portion of the Tudor-NSH intersection lies within the Fish Creek watershed. Fish Creek crosses Tudor Road via a piped storm drain near this intersection.

This project incorporated several types of LID/GI treatment, including vegetated swales with check dams and an infiltration basin. The infiltration basin was the focus of the 2016 monitoring, and was also included in the 2013 and 2015 monitoring programs. The infiltration basin is located near the intersection of Brayton Drive and Alpenhorn Avenue, and is collecting stormwater runoff from approximately 9.4 acres, 6.7 of which is impervious surface. The retention basin is approximately 150 feet long and 45 feet wide, with gentle side slopes and an approximate average

depth of two feet. The basin is vegetated with grasses, and riprap is present near the inlet and outlet. The basin inlet is a 24-inch diameter culvert on the southwest side of the basin, and the outlet is a small earthen berm on the north side. The outlet berm is overtopped when the inflow exceeds the basin capacity. The infiltration basin was designed to capture and infiltrate the runoff generated from the water quality event (0.52 inches of rain in 24 hours). Larger events were designed to overflow from the pond to a vegetated ditch that discharges to Campbell Creek. An overview of the infiltration basin site is shown in Figure 6.

Figure 6: NSH Infiltration Basin Site Overview

2016 Observations. The September 22 observations indicate that this infiltration pond continues to perform very well. The inlet was flowing and standing water was observed in the pond, but the water surface elevations were well below the pond outlet elevation. Water is being captured, infiltrated, and treated for small and mid-size rain events, and the facility is exceeding its design capacity of 0.52 inches of rain. The inlet and outlet weirs that were placed during the 2013 monitoring program were still in place. Photos from the September 2016 site visit is provided in Figure 7 below.

Figure 7: NSH Infiltration Basin September 22, 2016

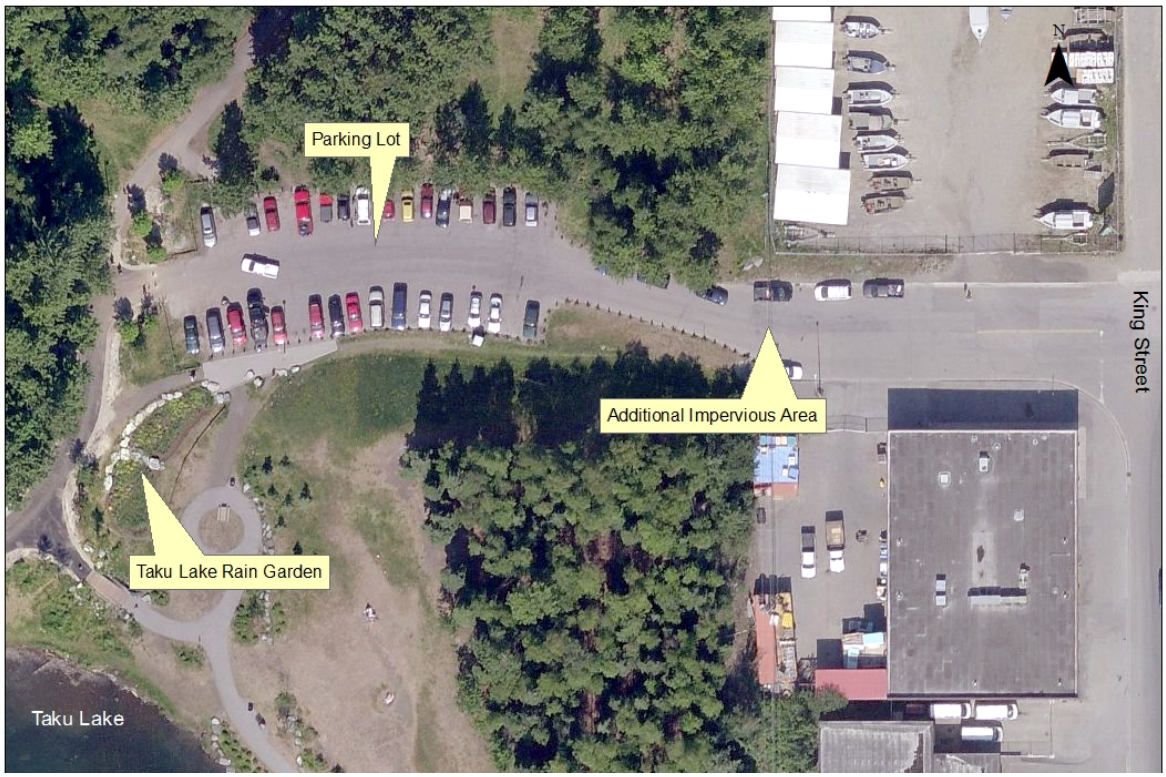
Taku Lake Rain Garden. The Taku Lake Rain Garden project was completed by the MOA in 2007 as part of an effort to improve a localized drainage and flooding problem at the Taku Lake parking lot. Taku Lake is located in Anchorage, north of Dimond Boulevard and west of King Street. The Campbell Creek trail is adjacent to the lake, and the area is popular year-round for recreational activities including walking, running, skiing, biking, and remote-control boats. The paved parking lot is approximately 12,150 square feet. The rain garden accepts runoff from the parking lot, a portion of the grassy area around the parking lot, and a portion of the roadway surface that provides access to the park.

The rain garden is approximately 1,400 square feet, and is located approximately 60 feet from the normal edge of water of Taku Lake. The rain garden consists of approximately 1.3 feet of amended topsoil on top of 2.3 feet of large drain rock. The drain rock is surrounded by geotextile separation fabric. A four-inch diameter perforated drain pipe was installed one foot from the bottom of the rain garden to collect excess water that is not infiltrated into the native subgrade. The perforated drain pipe discharges at the west end of the rain garden near the edge of Taku Lake. The MOA planted a variety of native vegetation in the rain garden including wildflowers, ferns, and grasses.

The rain garden was designed to accept and infiltrate runoff from small, frequent rainfall events. Water beyond the design capacity is either collected in the subdrain or is allowed to overflow from the rain garden and flow into the lake via overland flow. Figure 8 shows the rain garden and its contributing area.

The rain garden was monitored as part of the 2013, 2014, and 2015 MOA monitoring programs and was found to be performing very well. The rain garden was consistently infiltrating small, frequent rain events with no flow out the subdrain. For larger rain events, the rain garden provided water quality treatment as well as some attenuation of peak flows by infiltrating water through the rain garden soils prior to discharge. During larger events, excess water was observed to flow out the subdrain to Taku Lake.

Figure 8: Taku Lake Rain Garden Site



2016 Observations. The September 22 observations continue to show that the rain garden is performing well. Water was observed to be flowing into the rain garden from the upstream impervious areas and a small amount of ponding was observed near the surface flow inlet. There was no standing water observed in the rain garden. The outlet pipe was flowing slowing, with water pooling downstream of the outlet and slowing the outlet flow velocities. The observations indicate that the rain garden is still providing successful retention of small rain events, and detention and water quality treatment for larger rain events. Vegetation in the rain garden is well established, and native vegetation is present in addition to planted species. Photos from the September 22 site visit are provided in Figure 9.

Figure 9: Taku Lake Rain Garden September 22, 2016

West Dowling Bioswale. Dowling Road is an east-west road in Anchorage, connecting Elmore Road to Minnesota Drive. The West Dowling Road Extension Phase I project was constructed in 2012 and widened the Dowling Road corridor from the Old Seward Highway (OSH) to C Street from a two-lane road to a four-lane road with a center median. The project also constructed new pedestrian facilities and drainage improvements. The project lies in the Campbell Creek Watershed and crosses Campbell Creek via a bridge between Potter Drive and the OSH.

The West Dowling Road Phase I project included several LID/GI features, but the focus of the 2016 monitoring was the project's large bioswale located on the north side of the road, east of the OSH. Stormwater runoff from approximately 17.4 acres of residential and industrial areas is directed to the swale via a series of storm drain collection pipes that outfall at various locations along the length of the swale. This bioswale was also included in the MOA's 2013 and 2015 monitoring programs and was found to be performing well. The primary purpose of the bioswale is to improve water

quality before the runoff enters Campbell Creek. Treatment is achieved via infiltration, transpiration, and filtration to remove sediment and associated pollutants. The 2013 monitoring results indicated that the swale is also providing attenuation of peak flows for lower rainfall events, generally less than the 10-year event. An overview of the swale site is presented in Figure 10.

Figure 10: West Dowling Bioswale Site Overview

2016 Observations. The September 22 observations show that this swale is still performing well. During the site visit, water was entering the swale from most of the incoming storm drain pipes and trickling slowly toward the facility outlet. Previous years' monitoring reports have noted that vegetation in the swale was mowed fairly short, and it was noted that performance of the swale would likely be enhanced by letting the vegetation become more established. This year, the vegetation along the swale bottom was not mowed. The longer branches of grass provided additional slowing of the flow through the swale, and it is expected that improved treatment and peak flow attenuation were achieved. Photos from the September 22 site visit are provided in Figure 11.

Figure 11: West Dowling Bioswale September 22, 2016

South Restaurant Infiltration/Detention Pond. A new commercial development in South Anchorage utilized onsite stormwater management techniques for management of site runoff. The site is located southwest of the intersection of the Old Seward Highway and O'Malley road, immediately south of Lowes. The commercial building is utilized for several retail establishments, and the largest occupant is South Restaurant and the associated South Café. The site elevation is significantly lower than that of Old Seward Highway, making the storm drain system on the Old Seward Highway inaccessible. The 2016 monitoring included visual observations. This site had not been previously monitored by the MOA, and the site drainage design documents were not available for review. However, based on visual observations, the pond appears to be collecting water from approximately 1.3 acres of mostly impervious parking lot and access road areas.

This site was visited on July 30 during dry conditions, and again on September 22 during the rainfall event discussed previously. During dry conditions, the pond was observed to be approximately five or six feet deep, with gently sloping sides. The pond is vegetated with unmowed grass and the perimeter is landscaped with shrubs and mulch. Riprap is placed at the pond entrances for erosion control. There is a beehive style outlet located near the top elevation of the pond. It is expected that the beehive provides overflow for events higher than the design event of the pond, but the design information was not available to confirm this intent. The downstream outlet of the pond is not known. Photos of the pond from the July 30 site visit are provided in Figure 12.

Figure 12: South Restaurant Pond July 30, 2016

During the September 22 site visit, the pond was observed to be full with the beehive flowing. Water was observed to be actively flowing into the pond from both of the pond inlets. Based on the recorded rainfall of 0.66 inches of rain on September 22, this pond may be intended to provide storage/infiltration of events up to the water quality event of 0.52 inches of rain, with larger events overflowing to separate system via the beehive outlet. (The water level of the pond at the start of this rain event is not known.)

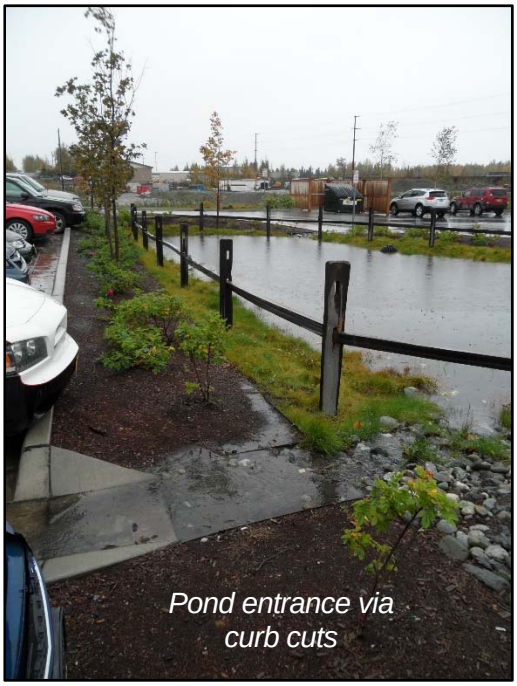
Performance of the pond relative to the intended design performance is not known. The MOA plans to incorporate this site into future monitoring programs to gain additional information. However, the site provides an excellent example of integrating Green Infrastructure into a commercial development. The facility is both aesthetic and functional.

Features such as depressed curbs and sidewalks provide dual functionality as both site features and stormwater management assets. Photos of the site form the September 22 site visit are provided in Figure 13.

Figure 13: South Restaurant Pond September 22, 2016


Pond Overview


Pond entrance


Pond entrance via curb cuts