MOA and DOT&PF
2023 Green Infrastructure and Low Impact Development Project Performance Monitoring Report

Prepared for:

The Municipality of Anchorage

Prepared by:

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1. Introduction and Project Description

AWR Engineering, LLC (AWR) is assisting the Municipality of Anchorage (MOA) Watershed Management Services (WMS) with performance evaluation of Low Impact Development (LID) and Green Infrastructure (GI) projects. Performance monitoring is a requirement of the current MOA and Alaska Department of Transportation and Public Facilities (DOT&PF) Alaska Pollutant Discharge Elimination System (APDES) permit. The four sites presented in this report are part of a two-year evaluation program (2023-2024) and have not been previously monitored for performance. Re-evaluation and inspection of previously monitored sites may also be included in the upcoming 2024 monitoring work.

This report presents the initial performance evaluation for the four new sites and provides recommendations for future evaluations based on the results and observations. Per the permit requirements, detailed technical evaluation including site-specific hydrographs will be developed and presented in next year's report.

Of the four projects included in this report, two are owned by DOT&PF. Each of these have drainage areas greater than five acres. The other two projects are owned by the MOA, and both have contributing drainage areas less than five acres. The sites are located in the Campbell Creek, Furrow Creek, Fish Creek, and Chester Creek watersheds.

A summary of the 2023 sites is presented in Table 1Table .

Table 1: 2023 LID/GI Project Sites Summary

Facility Owner	LID/GI Facility	Drainage Area > 5 Acres	Chester Creek, Fish Creek, Campbell Creek, or Little Campbell Creek Watershed
DOT&PF	Dowling Road and Seward Highway Interchange: Infiltration and Retention Areas	✓	✓ Campbell Creek
	AMATS: O'Malley Road Reconstruction Phase II: Infiltration and Retention Areas	✓	X Furrow Creek
MOA	Cuddy Park: Bioswale		✓ Fish Creek
	Lyons Park Improvements: Landscaped Depressions		✓ Chester Creek

1.1. APDES Reporting Requirements

The current APDES permit requires that the performance of each LID demonstration project be monitored, evaluated, and documented. The permit requires that changes in runoff quantities be calculated or modeled for each of the demonstration projects and, for new construction projects, compared to a theoretical case of the project constructed without LID practices. The analysis requirements include preparing runoff hydrographs to characterize peak runoff rates and volumes, discharge rates and volumes, and duration of discharge volumes. These computations and hydrographs will be completed in the future. The 2023 monitoring program focused on visual observations to support future computations and modeling.

2. Rainfall Data

Rainfall data for characterization of storm event magnitude, duration, and distribution was obtained online from the National Centers for Environmental Information. Hourly rainfall data were obtained from the weather station at Anchorage International Airport. Actual rainfall depths are expected to vary across the Anchorage area, but this data is expected to provide a good baseline for evaluation.

Generally, the summer and fall of 2023 was consistently rainy with above average accumulation. Visual monitoring occurred in September of 2023, and more than 3 inches of total rainfall was recorded in this month. The site visits during rainfall events that are referenced in this report occurred on September 14, 2023 and September 21, 2023.

- *September 14 Event*: Rainfall data show that 0.45 inches of rain fell on September 14. The water quality design event for Anchorage is 0.52 inches of rain preceded by 48 hours with no precipitation. While the total rainfall on September 14 was just under 0.52 inches, it was preceded by nine days of measurable precipitation, so conditions were saturated prior to the rain event.
- *September 20-21 Event*: Rainfall data show that 1.0 inches of rain fell during these two days. Visual monitoring occurred in the morning of September 21, following significant rainfall overnight. This event was preceded by 48 hours with no measurable precipitation.

3. Cuddy Park Bioswale Project (MOA)

WMS is working with Parks and Recreation to design and construct a new bioswale in Cuddy Park, located in midtown Anchorage. The bioswale will provide stormwater filtration, infiltration, and limited detention approximately 4.25 acres of contributing drainage area. The contributing drainage area is comprised of the Cuddy Park Ice Skating rink and surrounding park vicinity.

Under existing conditions, water is collected in an existing drainage channel that discharges to the Cuddy Park Pond. Fish Creek runs through the pond and continues downstream of the pond in a piped storm drain. The project will convert the existing drainage channel to a functioning bioretention swale to improve water quality prior to discharge into the Pond and ultimately into Fish Creek.

The bioswale is planned for construction in 2024, and performance monitoring will be conducted after construction is complete. To assist with development of pre-project hydrographs, the existing drainage channel was inspected on September 22 and October 10 of 2023. Channel cross-section measurements were taken to help inform future modeling efforts that will characterize the pre-project site conditions and runoff flow rates and volumes.

The 2024 annual report will include performance evaluation details including pre- and post-project runoff hydrographs along with visual inspection results and recommendations.

Figure 1 shows the existing drainage channel.

Figure 1: Existing Drainage Channel at Cuddy Park

Existing drainage channel looking northeast toward Cuddy Park Pond

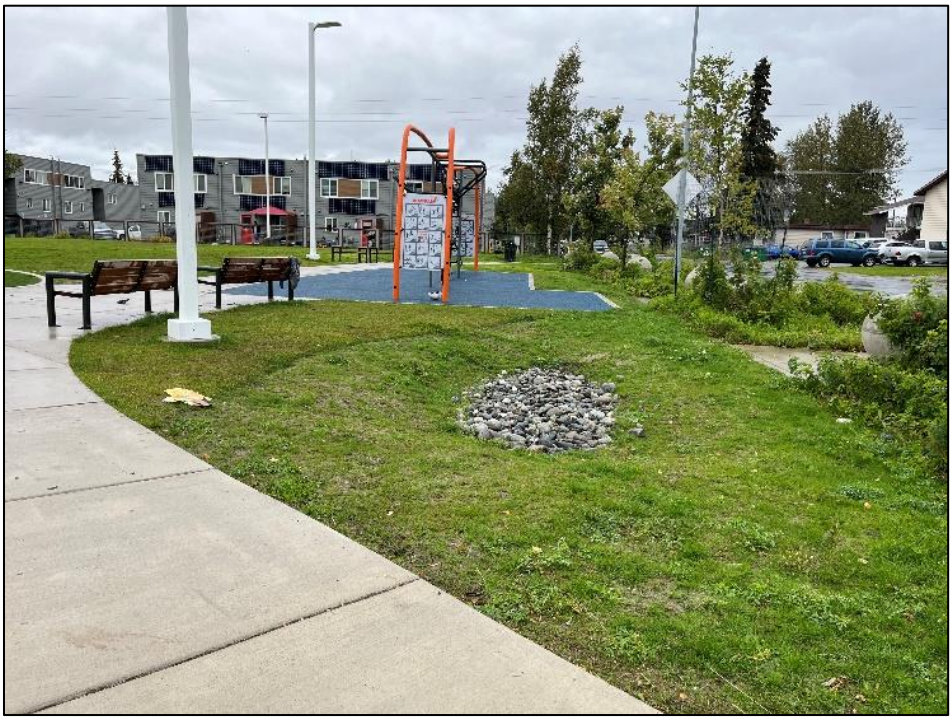
Existing drainage channel looking west toward 40th Avenue

4. Lyons Park Landscaped Depressions (MOA)

William B Lyons (Lyons) Park is located in north Anchorage on the west side of Irwin Street, between Thompson Avenue and Peterkin Avenue. MOA Parks and Recreation reconstructed the park in 2021 to add play features, walkways, and landscaping. As part of this work, two landscaped depressions were designed to capture stormwater and provide onsite detention and infiltration prior to overland flow to adjacent Irwin Street. The project's design plans show small swales were intended to collect excess stormwater runoff and direct it into the landscaped depressions. However, it was noted during visual inspection of the site in the fall of 2023 that the local swales did not appear to have been constructed. Subsequently, runoff from the surrounding impervious areas does not appear to be reaching the landscaped depression during rainfall events. This site was visually inspected during both the September 14 event and the September 20-21 event, and the landscaped depressions did not appear to be collecting runoff. However, some runoff from impervious areas may be flowing directly to adjacent grassy areas, providing filtration and infiltration of runoff not associated with the landscaped depressions. Directing runoff from impervious surfaces to pervious surfaces is a good low impact development site design practice that can significantly reduce the quantities of runoff from the site.

Figure 2 shows the landscaped depressions.

Figure 2: Landscaped Depressions at Lyons Park



Northern landscaped depression, looking north.

Southern landscaped depression, looking northeast.

5. Dowling Road & Seward Highway Interchange: Infiltration Areas (DOT&PF)

DOT&PF is currently completing construction of improvements at the intersection of Dowling Road and the Seward Highway. The project included a new bridge over Dowling Road, larger roundabouts, and safety improvements. The project installed a new drainage system at the intersection to safely convey water from the proposed improvements. The project included five stormwater infiltration areas to provide treatment and infiltration of runoff from the roadways and surrounding areas during the water quality event. The areas upstream of the infiltration areas include sections of vegetated swales and filter strip areas to help reduce the amount of sediment entering the infiltration areas. The project also installed a traditional oil and grit separator to provide treatment for runoff that could not be directed into the infiltration areas.

The project's hydrologic and hydraulic (H&H) report notes that that total contributing drainage area is 45.1 acres, which is comprised of a mix of roadway surfaces, pedestrian facilities, grassy areas, and commercial development.

At the time of the inspection period, only two of the five infiltration areas had been constructed and could be visually monitored. In the project design documents, these ponds are called "D02" and "D03", and that naming convention has been utilized in this report as well. Observations from those facilities are presented in this report. Monitoring of this site will continue in 2024, including monitoring of the additional infiltration areas.

5.1. Infiltration Facility Descriptions

Each infiltration area is a graded, shallow basin with grassed bottom and side slopes. The basins are receiving runoff from in-flowing storm drain pipes and from the surrounding ground surfaces. Water that enters the basins is allowed to pond at shallow depths and percolate into the subgrade over time. Each basin contains a raised beehive inlet that collects excess water and directs it into the downstream storm drain system. Figure 3 shows the two infiltration areas that were available for monitoring in September of 2023.

Figure 3: Dowling & Seward Highway Interchange Infiltration Ponds

Pond D02. Photo taken from Dowling Road, looking south toward the Seward Hwy northbound off ramp.

Pond D03. Photo taken from Dowling Rood, looking south toward the Seward Hwy southbound on ramp.

5.2. Visual Observations

This site was visually inspected during both the September 14 and September 21 events. Visual observations show that the infiltration facilities are generally performing well, even given the very saturated conditions present throughout the monitoring time frame.

During the September 14 site visit, water was ponding in both infiltration areas, but no water was observed to be flowing into the beehive inlet. This is consistent with the design expectations for this facility, as it is intended to capture and store the water quality event and allow events larger than the water quality event to safely bypass.

During the September 21 site visit, water was observed to be ponding at the D02 infiltration area, but no water was flowing into the beehive outlet through the casting. A small amount of water was trickling into the outlet structure below the casting elevation, likely due to the concrete structure not being fully watertight. This indicates that pond D02 may be exceeding design expectations, as the September 20-21 event exceeded the water quality event by almost double.

At Pond D03, water was ponding, and the beehive was actively flowing, allowing excess water to flow downstream. Pond D03 also appeared to have groundwater flowing in, originating from south abutment of the overpass bridge. This water was contributing to the observed flow into the beehive, as shown in Figure 4. However, even without groundwater inflow, overflow to the downstream system would be expected for this event, as it exceeded the water quality event by nearly double.

Figure 4: Groundwater Inflow to Pond D03

Left: Groundwater pooling at the southern bridge abutment and flowing to Pond D03.
Right: Water flowing into Pond D03 from the upstream groundwater.

5.3. Preliminary Conclusions and Next Steps

Preliminary visual monitoring indicates that this project's infiltration basins are performing well and are providing infiltration for the water quality event, as designed. In some cases, such as for Pond D02, the infiltration capacity may currently be exceeding design expectations. The available project documentation does not provide field-measured infiltration rates, but some decrease in infiltration capacity is expected over time due to sediment accumulation in the basin.

As long as the project construction is completed in the early summer of 2024, performance monitoring will continue in the summer and fall of 2024, and detailed performance hydrographs will be developed for inclusion with the 2024 monitoring report.

6. AMATS: O'Malley Road Reconstruction Phase II – Infiltration Basin (DOT&PF)

O'Malley Road is an east-west roadway located in the southern part of Anchorage, connecting Hillside Drive to Minnesota Boulevard. The O'Malley Road Reconstruction Project Phase II project is providing safety enhancements to accommodate traffic demands as well as pathway, drainage, and lighting improvements. The project was constructed in 2023 with some improvements continuing into 2024.

The project included construction of an infiltration basin to provide stormwater treatment. The project's H&H report notes that the infiltration basin receives runoff from 9.1 acres of contributing area and is intended to provide infiltration and storage capacity for events up to the 100-year event.

Figure 5 shows the constructed infiltration basin.

Figure 5: O'Malley Road Infiltration Basin

O'Malley Infiltration Basin, looking east toward Elmore Road

6.1. Infiltration Basin Description

Information regarding the infiltration basin design was based on the project design documents (provided by DOT&PF) and on visual observations. The infiltration basin is approximately 350 feet long with a bottom width ranging from 5 to 9 feet giving it an infiltration bed area of approximately 2,750 square feet (0.06 acres). The sides are sloped at 3H:1V, and the bottom and sides are grassed. The max depth of the facility is 4 feet.

Water enters the infiltration basin from the piped storm drain system to the south as well as from ditch flow from the east and west. The facility overflows to the north of the basin, toward the Anchorage Golf Course.

The project's H&H report notes that the average field-measured infiltration rate for the facility was 1.36 inches per hour. Design sizing assumed an infiltration of 0.94 inches/hour. Assuming an empty basin at the start of the design event, the basin was expected to drain within 72 hours.

6.2. Visual Observations

This site was visually inspected during both the September 14 and September 21 events.

During the September 14 site visit, the basin was fairly full, but was not overtopping. The storm drain pipe entering the facility from the south was mostly submerged, and backwater was observed in the upstream storm drain catch basin on the south side of O'Malley Road. A small amount of water was overflowing at a low point in the berm on the north side of the basin. A follow-up visit was completed on September 15 to determine if the facility was draining. Water levels had receded, but the facility was still holding water.

During the September 21 site visit, the infiltration basin looked similar to the previous site visit. The basin was full with small amounts of water flowing out at the low point in the north berm. A follow-up visit was completed on September 25, as no measurable quantities of rain occurred September 22-25. The water surface elevation had dropped 0.25 feet from the previous site visit. Most of the inflow storm drain was still submerged, but water was not overflowing to the north.

6.3. Preliminary Conclusions and Next Steps

Preliminary visual monitoring indicates that this project's infiltration basin may not be performing as designed. Because the September 14 event was not preceded by 48-hours of no precipitation, the site observations for this event are not fully reflective of the facility performance during the water quality event. However, the notable volume of water in the pond following four days of no precipitation indicates that the facility is likely not draining within the intended time frames. While the facility appears to have sufficient volume to store the water quality event, it may not be able to drain down within sufficient time to allow for storage of subsequent events.

Localized groundwater data at this location were not available for inspection. However, groundwater levels across Anchorage were high at the time of monitoring. If there is relatively shallow groundwater at this location, elevated groundwater levels could be impacting the facility performance. If this is the case, performance may improve during years when groundwater levels recede.

It is also possible that in-situ infiltration rates after construction of the basin were lower than the field percolation rates. This could be due to a variety of possible factors such as the facility floor being at a different elevation than the percolation tests, sediment inflow to the facility during or after construction, high groundwater as discussed above, and/or accidental compaction of the infiltration bed during construction.

The DOT&PF is currently planning site modifications focused on improving the performance of this facility. Depending on the timing of that work, additional performance monitoring may continue in 2024 after modifications are complete, or DOT&PF may choose to focus future monitoring efforts on a different location.

Appendix A

Rainfall Daily Summary – September 2023

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Local Climatological Data
Daily Summary
September 2023

Generated on 01/18/2024

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 125 ft. Lat: 61.1692° N Lon: 150.0277° W

Station: **ANCHORAGE TED STEVENS INTERNATIONAL AIRPORT, AK US WBAN:26451 (ICAO:PANC)**

Date	Temperature (F)							Degree Days (base 65F)		Sun (LST)		Weather	Precipitation (in)			Pressure (inHg)		Wind	Maximum Wind Speed = MPH / Direction = Degrees			
	Max	Min	Avg	Dep	ARH	ADP	AWB	Heat	Cool	Rise	Set	Weather Type	TLC	Snow Fall	Snow Depth	Avg Stn	Avg SL	Avg Speed	Peak Speed	Peak Dir	Sust. Speed	Sust. Dir
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
01	62	54	58	4.4	64	46	51	7	0	0552	2007		0.02	0.0	0	29.51	29.67	18.0	37	180	26	180
02	62*	53	58	4.7	70	47	51	7	0	0554	2004	RA	T	0.0	0	29.79	29.92	8.9	25	180	17	190
03	56	50	53	0.0	83	48	50	12	0	0557	2001	RA	0.38	0.0	0	29.62	29.76	7.7	35	160	20	150
04	61	48	55	2.3	84	49	52	10	0	0559	1957	RA	T	0.0	0	29.74	29.90	4.9	18	140	13	150
05	61	46	54	1.6	82	48	50	11	0	0602	1954	RA BR	0.11	0.0	0	29.72	29.86	8.2	37	140	23	140
06	58	49	54	1.9	69	44	49	11	0	0604	1951	RA	0.09	0.0	0	29.49	29.65	9.9	37	170	21	200
07	54	41	48	-3.8	84	44	46	17	0	0607	1948	RA BR	0.15	0.0	0	29.54	29.69	4.2	28	180	16	190
08	54	41	48	-3.5	88	44	46	17	0	0609	1945	RA BR	0.06	0.0	0	29.61	29.75	4.7	13	350	10	350
09	58	47	53	1.8	81	45	48	12	0	0612	1942	RA	0.37	0.0	0	29.49	29.65	7.3	33	150	21	160
10	53	44	49	-1.9	83	44	46	16	0	0614	1938	RA	0.10	0.0	0	29.46	29.60	6.6	29	160	16	150
11	57	45	51	0.4	80	43	47	14	0	0617	1935	RA	0.06	0.0	0	29.37	29.53	4.7	11	170	8	320
12	55	44	50	-0.3	78	42	46	15	0	0619	1932	RA	0.02	0.0	0	29.48	29.62	5.6	31	170	14	150
13	54	45	50	0.0	85	45	47	15	0	0622	1929	RA BR	0.10	0.0	0	29.54	29.68	3.1	14	360	10	360
14	50	46	48	-1.6	89	45	47	17	0	0624	1926	RA BR	0.45	0.0	0	29.28	29.43	5.8	24	160	13	160
15	52	44	48	-1.3	87	44	46	17	0	0627	1922	RA	0.04	0.0	0	29.27	29.41	4.4	20	140	13	020
16	53	44	49	0.0	89	45	46	16	0	0629	1919	RA	0.04	0.0	0	28.97	29.11	5.8	21	360	15	360
17	53	44	49	0.4	74	41	45	16	0	0632	1916	RA	0.04	0.0	0	29.15	29.31	6.1	20	330	16	330
18	53	37	45	-3.2	76	39	43	20	0	0634	1913	RA	T	0.0	0	29.37	29.52	4.7	16	310	12	320
19	54	32	43	-4.9	74	37	41	22	0	0637	1910		0.00	0.0	0	29.75	29.87	2.7	13	140	9	130
20	52	43	48	0.5	89	42	44	17	0	0639	1907	RA DZ BR	0.89	0.0	0	29.44	29.59	6.8	18	330	14	350
21	53	40	47	-0.1	86	42	45	18	0	0642	1903	RA	0.11	0.0	0	29.49	29.65	3.9	13	190	9	360
22	53	40	47	0.2	76	39	43	18	0	0644	1900	FG	0.00	0.0	0	29.52	29.65	2.3	12	300	8	260
23	52	40	46	-0.4	81	41	44	19	0	0646	1857	RA	T	0.0	0	29.49	29.65	3.3	9	150	7	320
24	56	37	47	1.0	81	40	43	18	0	0649	1854		0.00	0.0	0	29.61	29.76	2.0	11	040	7	300
25	53	32	43	-2.6	79	35	39	22	0	0651	1851		0.00	0.0	0	29.47	29.61	3.0	14	350	8	240
26	52	32	42	-3.2	76	34	39	23	0	0654	1847		0.00	0.0	0	29.39	29.56	3.9	17	010	13	020
27	51	40	46	1.3	52	29	38	19	0	0656	1844		0.00	0.0	0	29.60	29.76	6.6	19	010	14	360
28	55	36	46	1.7	62	28	36	19	0	0659	1841		0.00	0.0	0	29.84	29.94	4.1	14	010	12	360
29	51	34	43	-0.9	79	36	40	22	0	0701	1838		0.00	0.0	0	29.88	30.01	2.3	17	340	7	310
30	46	32*	39	-4.4	77	34	38	26	0	0704	1835	RA	T	0.0	0	29.57	29.71	4.9	15	330	12	340
	54.5	42.0	48.2							Monthly Averages | Totals			3.03			29.52	29.66	5.6				
	-0.6	0.0	-0.4	Departure from Normal (1981-2010)									0.04									

Degree Days

	Monthly		Season-to-date	
	Total	Departure	Total	Departure
Heating	503	9	909	
Cooling	0	0	0	

Number of days with...

	Temperature				Precipitation		Snow	Weather	
	Max		Min						
	>=90°	<=32°	<=32°	<=0°	>=0.01"	>=0.1"	>=1"	T-Storms	Heavy Fog
Heating									
Cooling	0	0	4	0	17	9	0		

Date of 5-sec to 3-sec wind equipment change	Sea Level Pressure			Greatest...		
		Date	Time	24-Hr...		Snow Depth
2006-06-01	Maximum 30.05	29	1504	Precip	Snowfall	
	Minimum 28.97	16	1453	0.91	0.0	0.0
				Date		
				20-21		

Station Augmentation

Name:ANCHORAGE FORECAST OFFICE, AK Lat: 61.1561 Lon: -149.9847 Elevation: N/A Distance: 1.7mi SE Elements: TEMP, PRECIP, SNOW Equipment: MMTS, SRG, SNOWBOARD, SNOWSTAKE