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BASIN M VEGETATED INFILTRATION BASIN OPERATIONAL YEAR 2 COMPREHENSIVE REPORT

Terminal 4 Slip 1

Prepared for

Port of Portland

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1. INTRODUCTION

1.1 Purpose

This comprehensive report is provided to satisfy the requirements of the Port of Portland (Port) Terminal 4 (T4) Operation and Maintenance (O&M) Plan for the Basin M Vegetated Infiltration Basin, approved by Oregon Department of Environmental Quality (DEQ) in April 2022, and filed with the City of Portland in April 2022. Basin M is within the Slip 1 upland area, for which the Port entered into a Voluntary Cleanup Program (VCP) Agreement for Remedial Investigation, Source Control Measures, and Feasibility Study with DEQ on December 4, 2003 (LQVC-NWR-03-18) (ECSI #2356). The stormwater discharges from T4, including Basin M, are authorized under the Port's Municipal Separate Storm Sewer (MS4) Discharge Permit No. 101314.

1.2 Background

The O&M Plan requires either a comprehensive report or an annual report to be submitted to DEQ by October 1 for five years starting in October 2022. Each report will cover the preceding operating year (July 1 through June 30). The original plan stated that a comprehensive report would be created for the operating year ending in 2022, however, in an email to DEQ on 24 May 2022, the Port requested to swap the deliverable for the first two years for the following reasons:

- The construction of the stormwater source control measure (SCM) was substantially completed on 29 December 2021. The completion was delayed by over two months because of supply chain issues. As a result, a significant portion of the wet season would not have been part of the first year of reporting.
- During the initial operation of the SCM, the Port experienced difficulties in retrieving data from the instrumentation (i.e., water level sensors) and confirming the pump control operation. Therefore, the Port installed temporary instrumentation in March 2022 to provide back-up data until the issues with the permanent monitoring equipment could be resolved. As a result, representative data for much of the operating period (approximately December 29, 2021 through March 24, 2022) and the overall wet season (October 2021 through March 2022) was not available to allow meaningful analysis for some of the reporting requirements outlined for the Comprehensive Report.

DEQ approved this alternative schedule on 27 May 2022. As such, the reporting schedule now consists of annual reports for the operational years ending in 2022, 2024, and 2025, and comprehensive reports for the operational years ending in 2023 and 2026.

1.3 Location and SCM Description

T4 is located at 11040 N Lombard St, Portland, OR, on the east bank of the lower Willamette River downstream from the St. Johns Bridge in North Portland, between River Miles 4.1 and 4.6. It occupies approximately 283 acres and is within the boundaries of the Portland Harbor Superfund Site. T4 is zoned heavy industrial and is a shipping terminal whose current primary use is transportation of bulk goods by ship and rail.

Basin M, which is located within the Slip 1 Upland Facility, is approximately 26.5 acres (Figure 1). The drainage area is relatively flat and approximately 53 percent impervious. There is an above-ground tank farm in the middle of Basin M that is self-contained and does not contribute runoff¹. The vegetated bioinfiltration basin was designed to capture, treat, and infiltrate greater than 90% of the average annual runoff volume from Basin M. The main treatment components of the SCM are a sedimentation forebay to remove coarse solids, followed by a vegetated media bed which filters stormwater through engineered media prior to infiltrating into native soils (Figure 2). By infiltrating a large volume of treated runoff, the bioinfiltration basin significantly reduces the volume of runoff discharged and, therefore, the load of pollutants discharged to Slip 1 and the Willamette River.

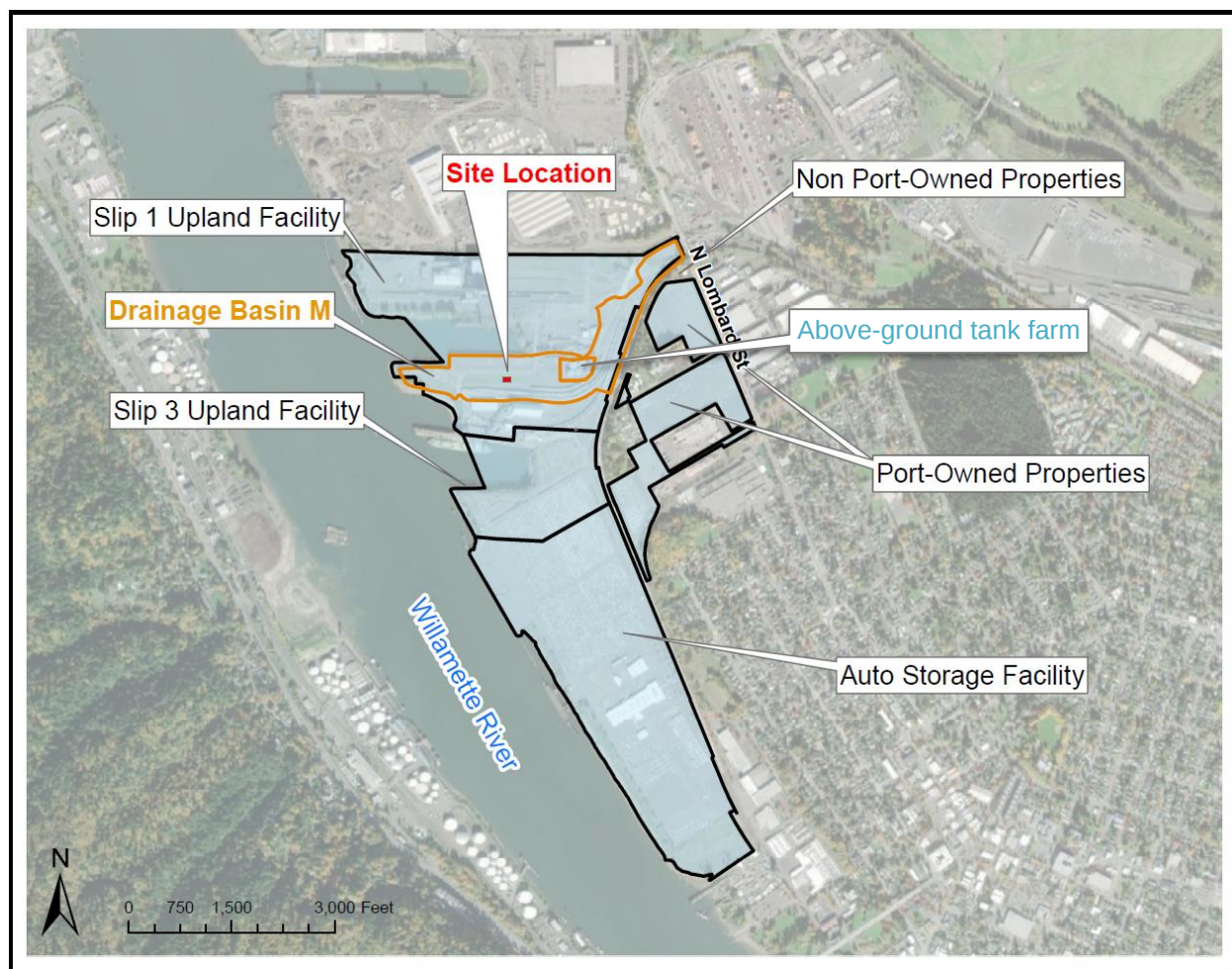


Figure 1: Site Location Map

¹ The stormwater from this area and Basin M do not interact. Infiltration and evaporation are the only available means of stormwater management for this area. Neither the Port nor its tenants have ever needed to evacuate water from the tank farm area.



Figure 2: T4 Basin M Bioinfiltration Basin Overview

2. OPERATION AND MAINTENANCE SUMMARY

2.1 Timeline

The following notable dates are associated with the second operational year of the Basin M stormwater SCM:

- **16 September 2022:** Quarterly inspection completed.
- **3 October 2022:** Virtual supervisory control and data acquisition (SCADA) platform becomes available for Port to monitor treatment system status and instrument readings. Flow meter for pump 2 was noted as not working properly.
- **10 October 2022:** Irrigation system was turned off for the year.
- **27 October 2022:** Permanent pressure transducer (PT) in wet well was replaced by vendor.
- **4 November 2022:** Shipyard rain gage records 2.36 inches of rainfall in 24 hours. This approximately equals the City of Portland's 2-year, 24-hour design storm.
- **7 November 2022:** Rainfall-triggered inspection.
- **16 November 2022:** Vendor fixes flow meter for pump 2.
- **1 December 2022:** Rainfall-triggered and quarterly inspection.
- **7 December 2022:** Media basin standpipe invert elevation is lowered to better capture shallow ponding events.
- **12 December 2022:** Rainfall-triggered inspection.
- **26 December 2022:** Shipyard rain gage records 2.95 in of rainfall in 24 hours, including a maximum 6-hour intensity of 1.28 in. This approximately equals the City of Portland's 5-year, 24-hour design storm.
- **27 December 2022:** Rainfall-triggered inspection.
- **4 January 2023:** Stilling well installed in wet well. Review of design drawings revealed a stilling well was included in the drawings but not specifically called out in the drawings, and so was not installed during construction. Agitation of the sensor caused by turbulence is one possible reason for the failure of this PT in October 2022. As such, the stilling well was installed, as originally intended, to better protect the PT. PT in wet well moved to stilling well. No change in datum.
- **8 February 2023:** Port shuts down power for maintenance at T4, which includes shutting power to the stormwater SCM for less than 24 hours. No rainfall occurs while power is shut down.
- **9 March 2023:** Port shuts off pumps for approximately 24 hours to test bypass elevation as part of system optimization. 0.43 inches of rain fall while pumps are shut off.

- **14 March 2023:** Rainfall-triggered and quarterly inspection.
- **23 March 2023:** Port shuts down power for maintenance at T4, which includes shutting power to the stormwater SCM for less than 12 hours. 0.13 inches of rain fall while power is shut down.
- **11 April 2023:** Rainfall-triggered inspection.
- **21 June 2023:** Quarterly inspection completed.

2.2 Maintenance Activities

Maintenance activities during the second operational year were minimal. Weed removal occurred at the beginning of the water year, but no other minor or major maintenance was necessary (Table 1). The pumps failed to start once in September 2022, following 0.20 inches of rain on September 28, 2022. This may have been related to a communication failure alarm which occurred on September 23, 2022, while the vendor was actively working on setting up the SCADA system. The communication failure alarm is thought to be the result of a failed PT, which controls the pump functions. However, the faulty PT was not discovered until after the pumps turned back on on October 4, 2022, as the SCADA system was not available to the Port until after that date. The PT in question was replaced a month later, and no subsequent issues occurred (Table 2).

Table 1: Maintenance Summary

Maintenance Type	Date	Summary of Activities Performed	Additional Documentation
Regular	10/12/2022	Fireweed and volunteer grasses removed by hand from vegetated basin	None

Table 2: Notable Equipment Issues

Equipment Issue	Date	Remedy
Suspected PT failure. PT controls pump cycling.	9/28/22 – 10/4/22	PT replaced 10/27/22
Pump 2 failed to start. Alarm occurred during a period where no flow was occurring. May be related to failed PT.	10/7/23	PT replaced 10/27/22
Pump 2 failed to start. Alarm occurred during a period where no flow was occurring. May be related to failed PT.	10/21/23	PT replaced 10/27/22
Pump station set points. When power is shut down, the pump station resets to default values which caused the pump to pump the wet well dry. Each time this was discovered it was corrected, and has been noted for future power shutdowns.	2/8/23 3/23/23	Set points adjusted 3/10/23 Set points adjusted 3/24/23
Pump flow meters. It was discovered that inaccurate flow rates were being recording from flow meters.	October 2022	Flow meters reset 3/10/23

2.3 Summary of Inspections

There were no major issues noted with the infiltration bed during routine or rainfall-triggered inspections. No erosion was observed in the basin during inspections. The plantings were healthy and appeared to be thriving. Some minor notes included:

- During the September quarterly inspection, it was noted the rope anchoring the infiltration basin temporary PT had stretched, resulting in the PT touching the bottom of the standpipe. The rope was re-tied and the offset remeasured a week later.
- Some erosion was noted in the swale draining the western edge of Basin M, and vegetation growth was minimal in this swale despite hydroseeding.
- During the June quarterly inspection it was noted the standpipe for the PT in the infiltration basin had algal growth. The plan is to evacuate and clean the standpipe before the rainy season.

3. QUANTITATIVE RESULTS

3.1 Summary of Available Data

Continuous hourly rainfall data was retrieved from the City's HYDRA network at the nearby Shipyard tipping bucket rain gage. Water surface levels were measured continuously for the entire reporting year using permanent PTs in the wet well and media bed (Figure 3 and Figure 4, respectively), and temporary PTs in the intercept manhole and media bed (Figure 5 and Figure 4, respectively). Pump data were recorded continuously by the MultiSmart™ system, although flow data was unavailable for pump 2 prior to 16 November 2022, and flow data for both pumps are inaccurate prior to 10 March 2023. As a result, pump flow data was estimated by multiplying the recorded feedback from each pump's variable frequency drive (VFD) by the estimated maximum flow rate of the pumps (2.5 cfs; Figure 6). This method of estimation was confirmed by comparing estimated flow rates to the actual flow rates recorded by the flow meters after accurate data became available starting on 10 March 2023. The total pumped volumes calculated by the two methods were within two percent of each other.

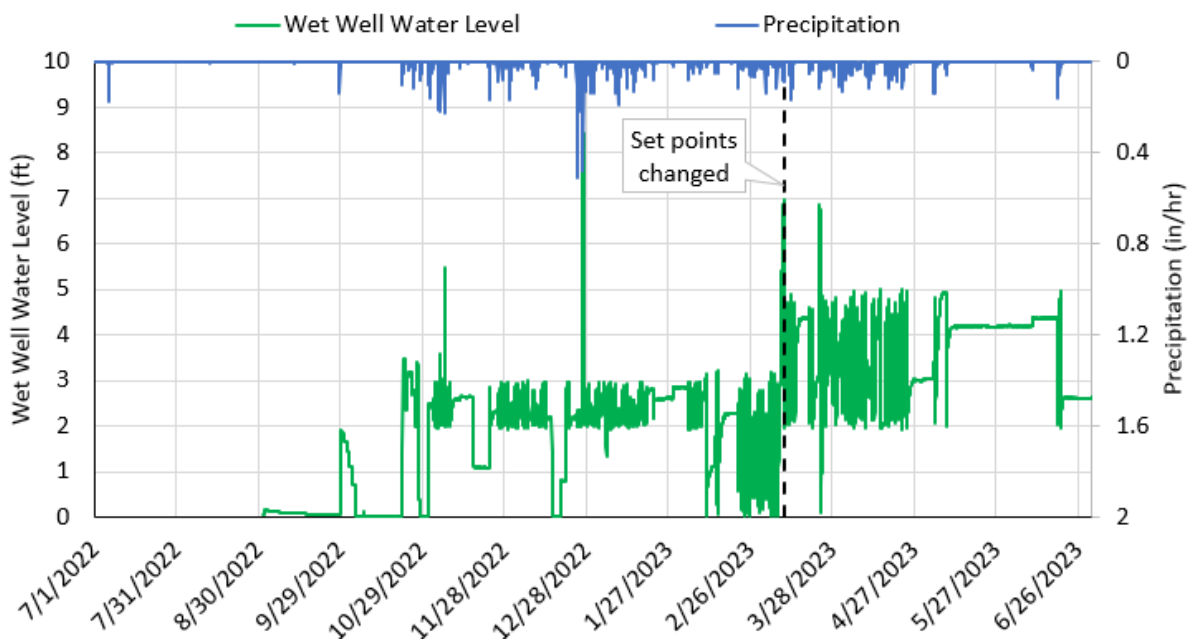


Figure 3: Wet Well Time Series

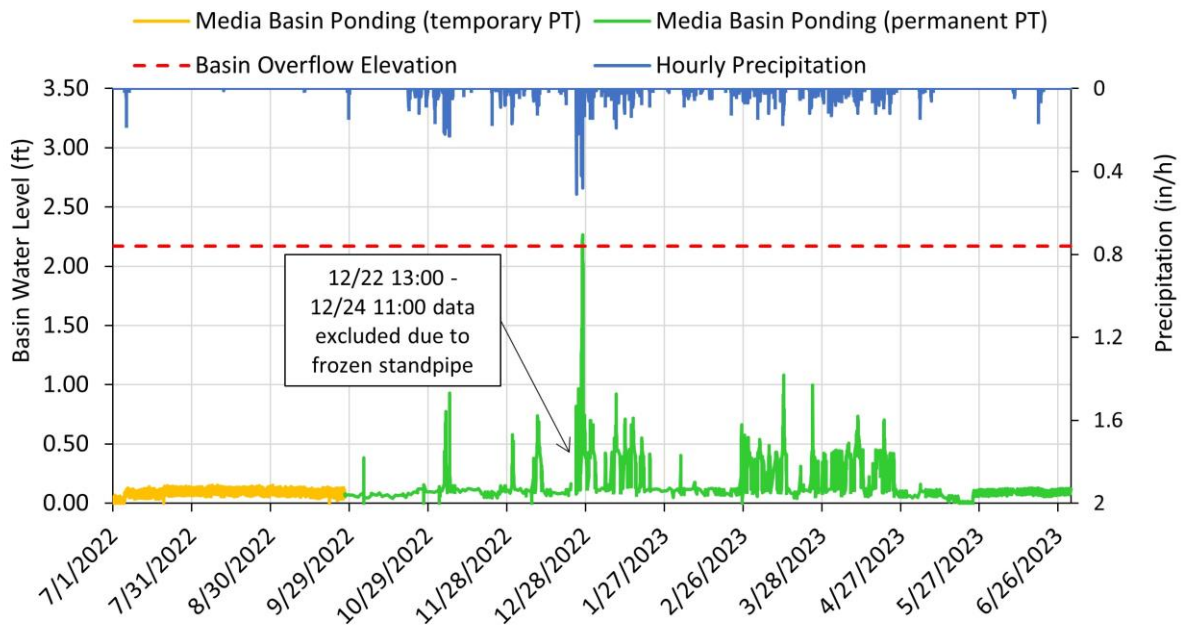


Figure 4: Basin Ponding Depth Time Series

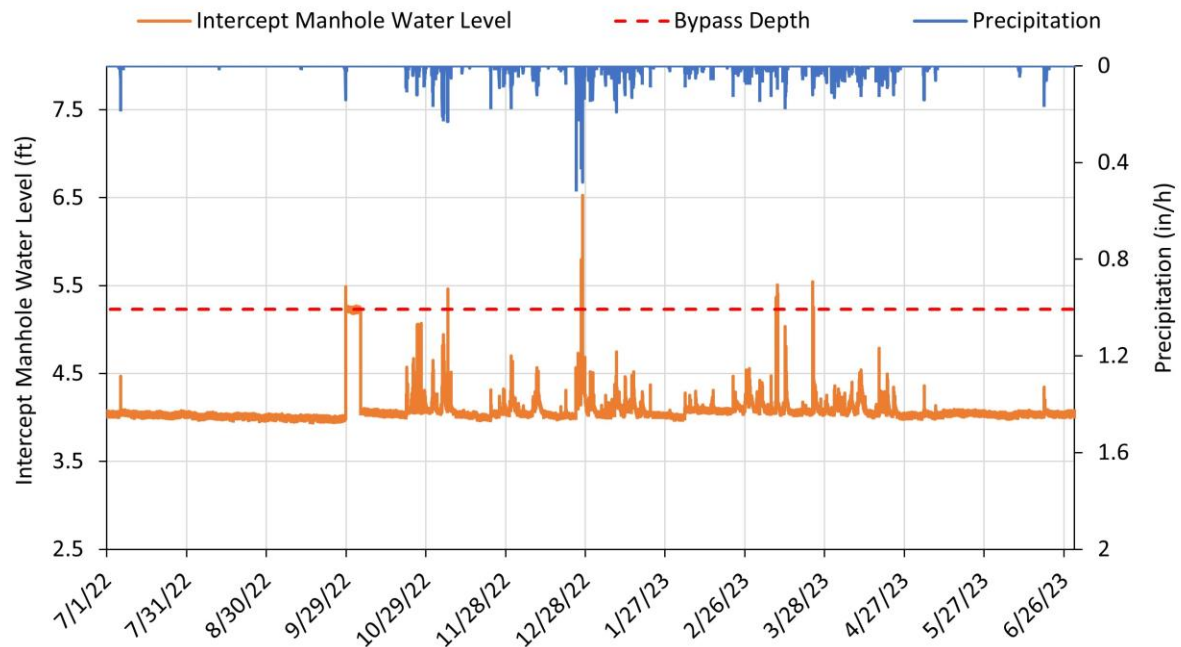


Figure 5: Intercept Manhole Time Series

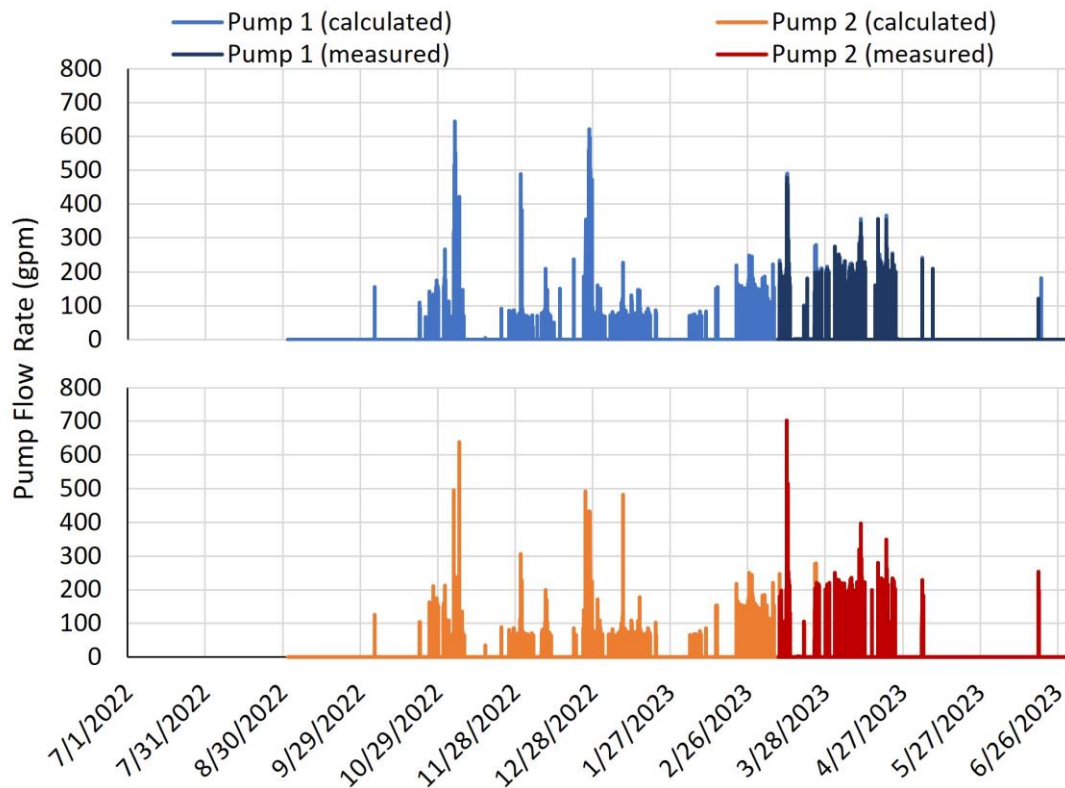


Figure 6: Pump Flow Rates Time Series, Calculated Using VFD Feedback

3.2 Uncertainty Due to Equipment Issues

Uncertainty due to equipment issues during the second year of operation were relatively minor. Table 3 presents a summary of encountered equipment issues, their resolution or work-around, and, where possible, an estimate of the potential error resulting from the issue.

Table 3: Uncertainty Resulting From Equipment Issues

Equipment Issue	Resolution or Work-Around	Potential Error Introduced
Lack of accurate pump flow data prior to mid-March 2023	Used VFD percentage and estimated maximum pump flow rates to back calculate flow rates where missing	As stated in Section 3.1, a comparison was performed for the period of record where both VFD and accurate flow data are available. Results are within 2%. The error may be somewhat higher during times when both pumps were pumping, but this cannot be determined as the lag pump did not turn on after flow meter values were corrected.
Replaced and repositioned PT in wet well	Replaced PT in October 2022 – no issues have occurred since.	None – results from the wet well PT are not used in capture analysis.
Stretched PT cord on temporary PT in media basin	Re-tied and re-measured temporary PT in media basin	None – the temporary PT in the media basin is entirely redundant. As such, data from the permanent PT was used instead of the temporary PT data. The permanent PT is wired and not subject to stretching.
Frozen PT standpipe in Media Basin in December 2022	Excluded data for period during which media basin standpipe was frozen	None – if there was water ponded in the media basin, the standpipe would not be frozen.

3.3 Data Interpretation

As required by the O&M Plan, annual rainfall data, capture analysis, infiltration rates, and drawdown times were examined and compared to previous years' metrics.

3.3.1 Total Annual Rainfall Depth

The second year of BMP operations saw a rainfall total of 34.95 inches. Based on the average rainfall recorded at the Shipyard rain gage over the past 10 years for the same annual period (Q3 previous year through Q2 named year), this is below the average annual rainfall total of 41.50 inches, and is only 70% of the previous year's rainfall total of 50.05 inches.

Despite the dry year overall, there were two significant rainfall events which occurred on each of 4 November 2022 and 26 December 2022. The 4 November storm resulted in a maximum 24 hour storm depth of 2.36 inches, which is approximately equal to the City of Portland's 2-year, 24-hour design storm. The 26 December 2022 storm resulted in a maximum 24 hour storm depth of 2.95 inches, including a maximum 6-hour intensity of 1.28 in. This approximately equals the

City of Portland's 5-year, 24-hour design storm. By contrast, the largest storm that occurred during the first year of basin operation had a maximum 24 hour storm depth of 2.16 inches.

3.3.2 Capture Analysis

Approximately 4,000,000 gallons of stormwater runoff were pumped to the Basin M SCM during the second operational year. Of this, approximately 3,922,300 gallons were infiltrated and therefore not discharged through the outfall to the Willamette River.

The outfall did see discharge on a total of seven days during the second operational year. Bypass, defined as flow to the outfall as a result of diversion at the intercept manhole, occurred on seven days during the 2022-2023 reporting year. One of these events was due to an equipment failure, two were due to high-flow events, two were due to facility maintenance, and one was due to planned system optimization. Overflow, defined as flow to the outfall as a result of overtopping of the outlet structure within the media basin itself, occurred on one day during the 2022-2023 reporting year, which was due to cumulative volume received during a large storm event. By far, the largest amount of flow to the outfall occurred on 26 December 2022, which was during the 5-year, 24-hour storm, during which both bypass and overflow occurred. A storm of this magnitude has a recurrence interval of approximately once every five years, on average, or a 20% chance of occurring any given year based on historical rainfall data. Notably, the basin fully infiltrated the 2-year, 24-hour storm which occurred on 4 November 2022.

The volume of water discharged during each event was calculated using pressure transducer data and Manning's equation for bypass events, and a weir equation for overflow events. However, it should be noted that the Manning's equation calculations are very approximate and likely biased high. This is because Manning's equation assumes free and uniform flow, but the bypass pipe which conveys flow from the intercept manhole to the high flow manhole is always at least slightly backwatered due to the outlet pipe from the high flow manhole to the outfall being slightly higher (invert of 25.19 ft) than the inlet pipe from the intercept manhole (invert of 25.11 ft). Because this difference in elevation is small, the bias is likely minimal when the volume of bypass is small. On the other hand, when the volume of bypass is large, or when bypass and overflow occur at the same time, the discharge calculation could be biased significantly high. The flow path in question is reproduced from the design drawings as Figure 7.

Calculations are further complicated by the presence of an oil control tee (essentially a down-turned elbow) on the pipe between the intercept manhole and the high flow manhole to prevent floatable materials from being discharged to the river. This means the entrance to the pipe will act as an orifice when the water level in the intercept manhole rises quickly, creating a head differential between the area outside the down-turned pipe and that inside the down-turned pipe.

Because the potential error in the bypass volume calculation is greatest during large bypass events, it most significantly affects the calculation of bypass volume for the late December 2022 storm. The magnitude of uncertainty caused by this condition is difficult to quantify, as the flow conditions in the system are difficult to accurately predict. The pipe between the intercept manhole and high flow manhole may have surcharged at the downstream end, or free flow may have continued throughout the storm. One way to estimate the magnitude of uncertainty is by calculating the total bypass volume using the currently assumed conservative slope of the

hydraulic grade line (HGL) that matches the pipe slope exiting the intercept manhole (3.54%) and comparing it to the same volume calculated using a less conservative HGL that matches the slope of the theoretical line connecting the invert of the overflow pipe exiting the intercept manhole to that of the outfall pipe exiting the high flow manhole (1.85%). The difference between the bypass volumes for these two slope values can be used to approximate the uncertainty in this calculation. The relative percent difference of bypass volumes calculated for these two methods is 32%.

Table 4 summarizes the cause and estimated volume of each bypass and overflow event that occurred during the second operational year. The bypass volume from the late December 2022 storm is presented as a range based on the two slope values mentioned in the previous paragraph. It is important to note that the estimated uncertainty is unidirectional: in this application Manning's equation provides the maximum possible discharged volume (upper bound), but not the minimum possible discharged volume (minimum bound). As such, it is possible the discharged volume is lower than the lower end of the range presented in the table, but it is highly likely the discharged volume is not greater than the upper end of the range presented in the table.

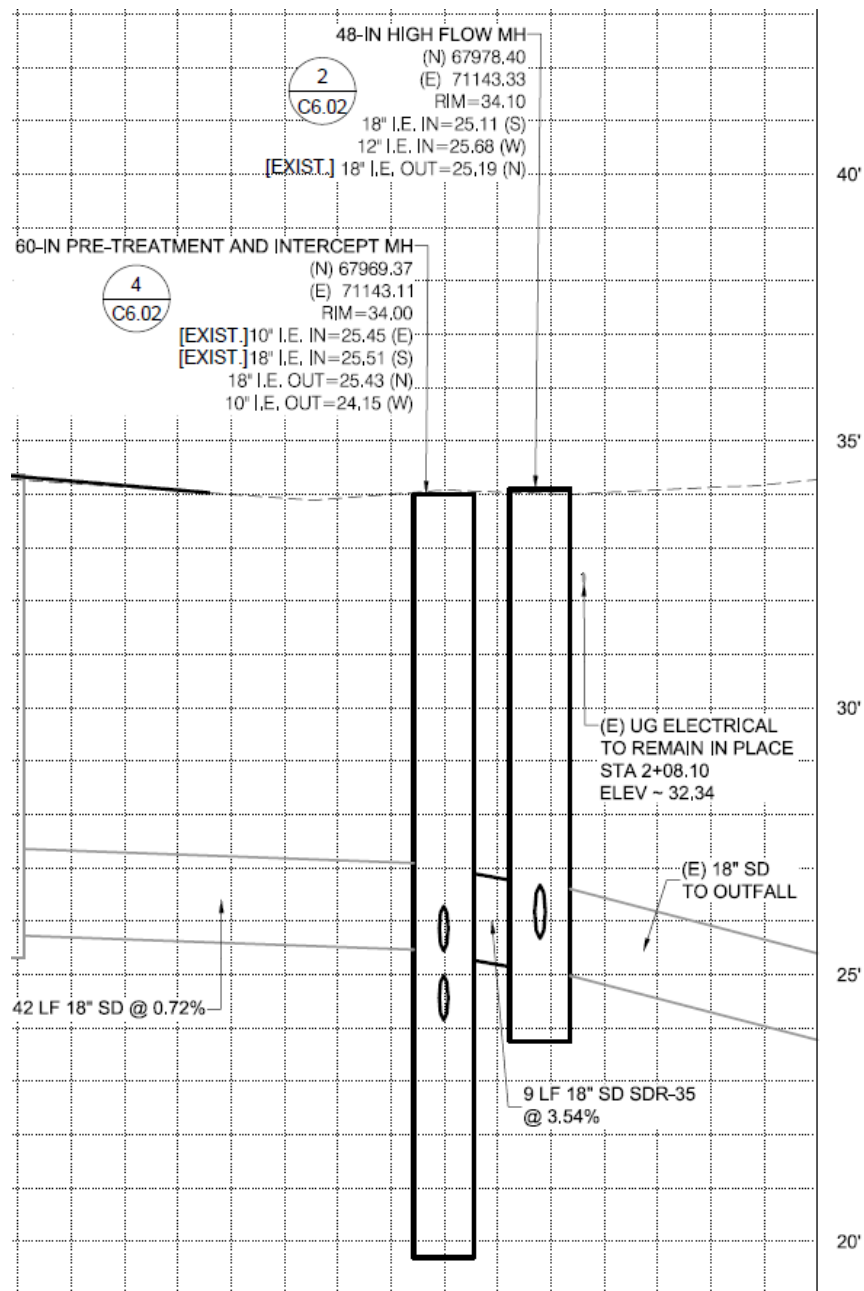


Figure 7: Flow Path and Invert Elevations From Intercept Manhole to Outfall

Table 4: Year 2 Bypass and Overflow Events

Event Date(s)	Bypass or Overflow	Cause	Estimated Volume to Outfall (gal) ¹	24h Rainfall Total (in) ²	Approximate Bypass Duration (h)
9/28/2022	Bypass	Equipment Failure	6,100	0.23	16.25 ³
11/6/2022	Bypass	High flows	2,900	0.82	0.25
12/26/2022	Bypass	High flows	418,100 - 578,900 ⁴	2.95	2, 1.5, 0.25, and 1.5
12/27/2022	Overflow	Large volume / high flows	77,700	2.95	4.25
03/09/2023 – 3/10/2023	Bypass	Facility maintenance	89,600	0.43	16.25
3/23/2023	Bypass	System optimization	8,900	0.16	2.00

¹Calculated using design drawings, pressure transducers, Manning's equation for bypass, and a weir equation for overflow.

²For high flow events, this is the maximum 24 h rainfall depth of the storm during which bypass or overflow occurred; for operational events, this is either the maximum 24 h rainfall depth during which pumps were off (long-duration events), or the rainfall depth for the 24 h preceding pumps turning back on (short-duration events).

³As the intercept manhole stayed full for many hours following this event, the exact end of bypass is unknown, so this number is approximate.

⁴This number is uncertain due to violation of the Manning's equation assumption of free and uniform flow; backwater from the high flow manhole was likely significant. The larger number represents the maximum possible discharged volume, however, the smaller number does not represent the minimum possible discharged volume. Calculation of a minimum possible discharged volume is not possible using available data.

In total, between approximately 600,000 and 760,000 gallons of stormwater were discharged through the Basin M outfall during the second operational year. While this is notably more flow to the outfall than was recorded in the first year of basin operation, the first year of operation only included approximately four months of data, and all storms were smaller than the 2-year, 24-hour event. In contrast, between 82 and 86 percent of the volume received by the outfall during this second year of operation occurred during a single large storm event (26 December 2022).

Table 5 summarizes total captured, bypassed, and overflow volumes, as well as capture efficiencies, for the second operational year, and compares them to the same values for the first operational year.

Table 5: Year 2 Capture Summary

Metric	Year 2 Result	Year 1 Results¹
Total volume pumped to SCM (calculated) ²	4,000,000 gal	-
Total volume infiltrated by SCM	3,922,300 gal	-
Number of days with discharge to outfall	7	≥1
Total overflow volume	77,700 gal	0 gal
Total bypass volume due to high flow ³	421,000 - 581,800 gal	-
Total bypass volume not due to high flow	104,600 gal	0 gal
Estimated total volume discharged to outfall ³	603,300 - 764,100 gal	-
Design-based capture efficiency ^{3,4}	86 - 89%	-
Overall capture efficiency	84 – 87%	-

¹Difficulties with instrumentation during the first year of operation prevents most of these values from being calculated.

²Due to issues with flow meters until March 2023, totalizer values recorded by the MultiSmart system are inaccurate for most of this operational year. However, VFD data is available for September 2022 through June 2023, and was used to calculate the total pumped volume by multiplying the VFD % by the theoretical maximum pump rate of approximately 2.5 cfs using 5-minute time steps for the entire period of record. As such, this value excludes only the volume pumped during one 0.30” storm on 6 July 2022.

³ Values given as ranges are due to uncertainty in calculated bypass volumes during the December 2022 5-year storm. See discussion at the beginning of Section 3.3 and Table 4.

⁴ Design-based capture efficiency represents capture efficiency if only bypass and overflow due to high flows had occurred. This value is calculated the same as overall capture efficiency, but counts bypass due to operational events as volume that could have been captured.

3.3.3 Average Annual Infiltration Rates

Infiltration rates were not calculated for the first operational year as very little ponding occurred, drawdown was rapid, and the maximum ponding depth was only nine inches. Since the infiltration rate is a function of ponding depth, a range of ponding depths occurring at different times of year are needed to identify any trends.

According to the O&M Plan, infiltration rates at discrete water levels should be calculated quarterly using Equation 3, where dL is the change in water level over the time period dt , A_L is the average surface area of the water in the basin over the range of water levels observed, A_i is the surface area of the basin at the infiltration surface, and i is the observed infiltration rate.

$$i = \frac{A_L * dL}{A_i * dt} \quad (3)$$

This equation is meant to be used once inflows have ceased, but while ponding still remains. However, the past year and a half of collected data have shown that the runoff hydrograph for Basin M has an extremely long tail, meaning ponding is nearly always gone by the time inflows have fully ceased. As such, Equation 3 has been modified to Equation 4, which accounts for inflow during the drawdown period in question. In this equation, V_{in} is the volume of water entering the infiltration basin during time t , and the two areas have been simplified to A_{avg} which represents the infiltration surface area at the average water level over the calculated range.

$$i = \frac{A_{avg} * dL + V_{in}}{A_{avg} * dt} \quad (4)$$

Using the surface area of infiltration at the average water level is more appropriate than using the surface area at the basin infiltration surface as it accounts for vertical infiltration at the side slopes. Using the average infiltration surface area over the calculated range does not increase or decrease uncertainty over using a different infiltration surface area. Because flow meters did not record accurate values prior to 10 March 2023, recorded VFD feedback and maximum pump design flow rate were used to calculate V_{in} . The pump design flow rate is dependent on head, which fluctuates based on the water level in both the wet well and the energy dissipation structure where water is pumped to. This introduces some uncertainty in the estimated VFD flow rate (about $\pm 2\%$, as discussed in Section 3.2).

Also, infiltration rates vary with driving head. The driving head in the basin is a function of depth of ponding, saturated hydraulic conductivity of the soils, and degree of soil saturation in the bottom and side slopes of the basin. Saturation of side slopes can vary significantly throughout a storm. As a result, infiltration rates will be higher when the water level is increasing in the basin, and they will be lower when the water level is decreasing. Due to these dynamics and the inherent uncertainties in the data, the infiltration rate calculations are approximations.

Table 6 summarizes average and maximum infiltration rates at discrete water levels by quarter for all storms where basin depths exceeded nine inches. Average and maximum infiltration rates were calculated for each time step where the average ponding depth remained above 6 inches and below 24 inches for the entire time step, whether or not the water level was increasing, decreasing, or staying the same. Infiltration values were classified into water level range based on the whole number rounded value of the average of the starting and ending water level depth for the time period, with values exactly equaling a range boundary going to the lower of the two ranges (i.e. a rounded average value of 9 would be classified into the 6 – 9 inch category, rather than the 9 – 12 inch category).

As shown, average infiltration rates ranged from 6.2 in/h to 39.0 in/h and maximum infiltration rates ranged from 18.4 in/h to 56.5 in/h. Average infiltration rates were near or above the design infiltration rate of 20 in/h at all water level ranges from 12 – 9 inches and greater, with somewhat of a decrease in infiltration rates at the 9 – 6 inch interval over time. Maximum infiltration rates remained high and well above the design infiltration rate for both 2022 and 2023. This indicates the basin is still infiltrating at a high rate, particularly at higher ponding depths.

The differences between the calculated maximum and average infiltration rates can serve as an approximation of the total uncertainty in these values. This difference ranges from 0% to 313%, with a median value of 86%. As such, the uncertainty in these calculated values is rather high. Sources of uncertainty include those mentioned above (use of VFD feedback for flow rates, differences in soil saturation, and antecedent conditions), as well as temperature, instrument accuracy, vegetation density, micro-topographic effects at the infiltration surface, hydraulic retention time in the pretreatment forebay, and the presence of the weepholes between the forebay and the infiltration area, which ensure water is conveyed to the basin for a long time after pumping ceases. These sources of uncertainty are those that are known – there are likely many more sources of uncertainty that are not included in this list.

Importantly, no overflow events occurred other than the 26 December 2022 event. Inspections did not reveal accumulated sediment, biofouling, or any other condition that would suggest the media basin's condition has been compromised. Furthermore, lower infiltration rates are expected during the more deeply saturated conditions typical of the middle of winter. Notably, infiltration rates at higher ponding depths did not show a large decrease in infiltration rate over time. With the limited number of high ponding events and the uncertainty in the calculations, it is not possible to discern any statistically significant trend in the maximum rates of infiltration. As such, the Port does not recommend performing additional maintenance at this time. Instead, because of the apparent decrease in infiltration rates at the 9 – 6 in water level range, the Port will continue to calculate infiltration rates on a quarterly basis, as described in the O&M Plan, and noted in Section 4.

Table 6: Infiltration Rates by Quarter

Year / Quarter	Peak Ponding Date	Water Level Range (inches)	Est. Ave. Infiltration Rate (in/h) ^{1,2}	Est. Max Infiltration Rate (in/h) ^{1,2}
2022 / Q3	No ponding ≥ 9 in observed	-	-	-
2022 / Q4	11/4/2022	9 – 6	31.9	41.4
	11/6/2022		23.9	56.5
	12/25/2022		13.5	30.4
	12/26/2022		12.7	28.7
	<i>Average</i>		27.2	39.3
	11/6/2022	12 – 9	39.0	47.2
	12/25/2022		21.3	30.6
	12/26/2022		20.9	44.5
	<i>Average</i>		27.1	40.8
	12/26/2022	15 – 12	23.3	46.8
		18 – 15	25.7	38.4
		21 – 18	23.9	37.9
		24 – 21	20.4	32.6
2023 / Q1	1/8/2023	9 – 6	6.2	25.6
		12 – 9	17.4	29.9
2023 / Q2	3/13/2023 ³	9 – 6	11.5	35.9
		12 – 9	18.3	40.3
		15 – 12	18.4	18.4

¹ Calculations were performed on 15-minute average data for all rainfall-induced events where ponding reached at least 9 inches in depth. Average and maximum infiltration rates were calculated for each time step where the average ponding depth remained above 6 inches and below 24 inches for the entire time step. Infiltration values were classified into water level range based on the whole number rounded value of the average of the starting and ending water level depth for the time period, with values exactly equaling a range boundary going to the lower of the two ranges.

² Because flow meters were not reporting accurate values prior to 10 March 2023, the V_{in} term is calculated using VFD feedback multiplied by the maximum pump rate of 2.5 cfs per pump. The maximum pump rate was calculated as the median of all pump flow rates divided by the corresponding VFD percentage for all two-minute timesteps during the 13 March 2023 storm.

³ Accurate flow data are available for this storm, so these values were calculated using flow data. The same values calculated using the VFD-based approach used for the other storms in this table are all within 7% of the flow meter-based value.

3.3.4 Maximum Drawdown Time

Drawdown time was defined as the time required for the water level in the media basin to drop below three inches after pumping ceased following a storm event. Three inches was used as the minimum threshold instead of zero to reduce the effects of sump water in the standpipe and noise in the data. Data from the permanent pressure transducer with a five-minute timestep was used for this calculation. The maximum drawdown time for the second operational year was 4 hours and 15 minutes, which occurred following rainfall on 21 January 2023. This is well below the maintenance trigger defined in the O&M Plan of 24 hours. Maximum drawdown times by quarter are provided in Table 7.

Table 7: Maximum Drawdown Time by Quarter

Year / Quarter	End Date of Maximum Drawdown	Maximum Drawdown Time
2022 / Q3	-	N/A: ponding never remained after pumping ceased
2022 / Q4	12/8/2022	1 h 25 min
2023 / Q1	1/21/2023	4 h 15 min
2023 / Q2	4/12/2023	3 h 50 min

4. SUMMARY AND RECOMMENDATIONS

Based on the information collected in year 2, the Basin M stormwater SCM is operating as designed. Recommendations for the next reporting period, from 1 July 2023 to 30 June 2024, are to continue monitoring and maintaining the Basin M stormwater SCM as outlined in the O&M Plan, with submission of an Annual Report on or before 1 October 2024. While calculated infiltration rates at the 9 to 6-inch ponding interval showed a slight decrease over time, that decrease did not result in an increase in overflow or a reduced capture of stormwater, and is likely a result of seasonal saturation conditions. Furthermore, prolonged ponding in the basin did not occur in conjunction with the lower infiltration rates, and inspections did not reveal accumulated sediment, biofouling, or any other condition that would suggest the media basin's condition has been compromised. However, as outlined in the O&M Plan on notable decreases in infiltration rates, the Port plans to calculate infiltration rates quarterly during the third year of basin operation.

In addition, because no issues have been identified with the basin during post-large storm physical inspections, the Port proposes to modify the inspection threshold from within 48 hours of storms exceeding 1.0 inches in 24 hours to the following:

- A physical inspection within 2 business days after the first storm of the season that exceeds 1.0 inches in 24 hours.
- Review of SCADA data within 2 business days of any storm exceeding 1.0 inches in depth over 24 hours. For any storm over 1.0 inches in 24 hours where overflow has occurred, a physical inspection will be conducted within 2 business days of identification that overflow occurred.
- Physical inspection within 2 business days for storms exceeding 2.0 inches in depth over 24 hours.

These proposed changes will better utilize the remote monitoring data to inform system performance and reduce unnecessary site visits.

Additionally, the Port intends to relocate the pressure transducer in the intercept manhole to the high-flow manhole so the effect of the backwater condition can be minimized for future calculations of overflow discharge volumes.

Finally, the Port will evaluate erosion control measures for the conveyance swale located south of the SCM, where regular inspections (Appendix A) have noted erosion.

Regular quarterly inspections will continue as specified in the O&M Plan.

APPENDIX A

Completed Inspection and Maintenance Forms

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Mike DuBose

Date: 09/16/2022

Location/Facility ID: Basin M

Time: 2:37 PM

Weather: Dry/Cloudy/Cool

Date of Last Rainfall: 09/06/22

Amount: 0.3 inches

Reason for Inspection (Circle): Routine

Complaint

Major Event (spill or >1" in 24hrs)

Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified

3 = Immediate repair necessary

1 = Monitor (potential for future problem)

N/A = Not applicable

2 = Routine maintenance required

FEATURES

1) Basin Inlet

- 0 Structure damaged
- 0 Structure clogged or obstructed
- 1 Other: Rocks and dirt below inflow pipe

2) Sediment Forebay

- 0 >3 inches of sediment / debris accumulation
- 0 Vectors / pests present
- 0 Structural integrity
- 0 Other:

3) Basin Divider

- 0 Sediment / debris blocking weir
- 0 Weir integrity
- 0 Erosion
- 0 Weep holes not functioning
- 0 Other:

4) Media Bed

- 0 > 2 inches of sediment / debris accumulation
- 0 Trash accumulation
- 0 Crusting of surface of media bed
- 0 Holes / loss of media / channelization / scour
- 0 Evidence of burrowing animals / vectors / pests
- 0 Standing water / saturated patches
- 0 Other:

5) Vegetation

- 0 Trimming or detritus removal needed
- 0 Loss of vegetation cover
- 2 Noxious weeds
- 0 Abnormal plant mortality
- 0 Other:

6) Side Slopes

- 0 Rill / gully erosion
- 0 Evidence of burrowing animals / pests
- 0 Slope slippage
- 0 Structural integrity
- 0 Other:

7) Outlet

- 0 Structure damaged, grate displaced
- 0 Structure clogged or obstructed
- 2 Standpipe and pressure transducer condition
- 0 Other:

8) Overflow Weir & Swale

- 0 Structure damaged
- 0 Weir / riprap integrity
- 1 Swale - erosion
- 1 Swale - noxious weeds
- 2 Other:

Inspection Summary and Comments:

Rocks & dirt below basin inlet inflow pipe.
Deliberate? Are they supposed to be there? Noxious weeds are
beginning to build up in vegetated basin. The rope attached to the
inf. basin temp PT has stretched. PT touches standpipe bottom.
Vegetation in swale never grew much - could lead to more erosion issues

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified

2 = Routine Maintenance Required

1 = Monitor (potential for future problem exists)

3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Mike DuBoise
 Location/Facility ID: _____
 Weather: Dry/cloudy/cool
 Date of Last Rainfall: 09/06/22

Date: 9/16/2022
 Time: 3:15:17

Amount: 0.30 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
 1 = Monitor (potential for future problem) N/A = Not applicable
 2 = Routine maintenance required

FEATURES

1) Upstream Manhole / Catch Basin

- 2 Clogged catch basin grate or insert
0 Sediment / debris build-up in bottom of catch basin
0 Cracks / mechanical damage
0 Other: _____

2) Intercept Manhole

- 0 Access Problems
0 > 11 inches of sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Evidence of improper weir height (see Design Drawings)
0 Standpipe and pressure transducer condition
0 Other: _____

3) Wet Well and Pumps

- 0 Sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Access problems
0 Safety chains condition
0 Other: _____

4) Valve Box

- 0 Leaks / water present
0 Sediment / debris present
0 Cracks / mechanical damage
0 Safety chains condition
0 Other: _____

5) Swale Outlet Catch Basin

- 0 Clogged catch basin grate or insert
0 Sediment / debris build-up in bottom of catch basin
0 Cracks / mechanical damage
0 Other: _____

6) Downstream Manholes (2)

- 0 Sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Other: _____

Inspection Summary and Comments:

Catch basin (upstream) inserts have debris build up

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Jack Lisin Date: 11/07/2022
Location/Facility ID: T4 Basin M Infiltration Basin Time: 0750
Weather: Overcast
Date of Last Rainfall: 11/06/2022 Amount: 1.69 inches

Reason for Inspection (Circle): Routine Complaint **Major Event (spill or >1" in 24hrs)**

Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
1 = Monitor (potential for future problem) N/A = Not applicable
2 = Routine maintenance required

FEATURES

1) Basin Inlet

0 Structure damaged
0 Structure clogged or obstructed
0 Other: _____

2) Sediment Forebay

0 >3 inches of sediment / debris accumulation
0 Vectors / pests present
0 Structural integrity
0 Other: _____

3) Basin Divider

0 Sediment / debris blocking weir
0 Weir integrity
0 Erosion
0 Weep holes not functioning
0 Other: _____

4) Media Bed

0 > 2 inches of sediment / debris accumulation
0 Trash accumulation
0 Crusting of surface of media bed
0 Holes / loss of media / channelization / scour
0 Evidence of burrowing animals / vectors / pests
1 Standing water / saturated patches
0 Other: _____

5) Vegetation

0 Trimming or detritus removal needed
0 Loss of vegetation cover
0 Noxious weeds
0 Abnormal plant mortality
0 Other: _____

6) Side Slopes

0 Rill / gully erosion
0 Evidence of burrowing animals / pests
0 Slope slippage
0 Structural integrity
0 Other: _____

7) Outlet

0 Structure damaged, grate displaced
0 Structure clogged or obstructed
0 Standpipe and pressure transducer condition
Other: _____

8) Overflow Weir & Swale

0 Structure damaged
0 Weir / riprap integrity
1 Swale - erosion
0 Swale - noxious weeds
0 Other: _____

Inspection Summary and Comments: Couple inches of water in forebay. some sediment (but not covering entire base of forebay). Forebay was actively discharging through weep holes. Small amount of ponded water in infiltration basin. Exposed soil at west end of swale with minor signs of erosion, see photos

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Jack Lisin Date: 11/07/2022
Location/Facility ID: T4 Basin M Infiltration Basin Time: 0815
Weather: Overcast
Date of Last Rainfall: 11/06/2022 Amount: 1.69 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
1 = Monitor (potential for future problem) N/A = Not applicable
2 = Routine maintenance required

FEATURES

1) Upstream Manhole / Catch Basin

0 Clogged catch basin grate or insert
0 Sediment / debris build-up in bottom of catch basin
0 Cracks / mechanical damage
0 Other: _____

2) Intercept Manhole

0 Access Problems
0 > 11 inches of sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Evidence of improper weir height (see Design Drawings)
0 Standpipe and pressure transducer condition
0 Other: _____

3) Wet Well and Pumps

0 Sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Access problems
0 Safety chains condition
0 Other: _____

4) Valve Box

0 Leaks / water present
0 Sediment / debris present
0 Cracks / mechanical damage
0 Safety chains condition
0 Other: _____

5) Swale Outlet Catch Basin

0 Clogged catch basin grate or insert
0 Sediment / debris build-up in bottom of catch basin
0 Cracks / mechanical damage
0 Other: _____

6) Downstream Manholes (2)

0 Sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Other: _____

Inspection Summary and Comments: wet well was actively filling during inspection

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Mike DuBois Date: 12/01/2022
Location/Facility ID: T4 Basin M Time: 9:48 am
Weather: Cloudy, cold, windy, intermittent rain ~ 38°
Date of Last Rainfall: 11/30/2022 Amount: 1.04 inches

Reason for Inspection (Circle One): Routine Complaint Major Event (spill or >1" in 24hrs)

Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
1 = Monitor (potential for future problem) N/A = Not applicable
2 = Routine maintenance required

FEATURES

1) Basin Inlet

☒ Structure damaged
☒ Structure clogged or obstructed
Other: _____

2) Sediment Forebay

☒ >3 inches of sediment / debris accumulation
☒ Vectors / pests present
☒ Structural integrity
Other: _____

3) Basin Divider

☒ Sediment / debris blocking weir
☒ Weir integrity
☒ Erosion
☒ Weep holes not functioning
Other: _____

4) Media Bed

☒ > 2 inches of sediment / debris accumulation
☒ Trash accumulation
☒ Crusting of surface of media bed
☒ Holes / loss of media / channelization / scour
☒ Evidence of burrowing animals / vectors / pests
☒ Standing water / saturated patches
Other: _____

5) Vegetation

☒ Trimming or detritus removal needed
☒ Loss of vegetation cover
☒ Noxious weeds
☒ Abnormal plant mortality
Other: _____

6) Side Slopes

☒ Rill / gully erosion
☒ Evidence of burrowing animals / pests
☒ Slope slippage
☒ Structural integrity
Other: _____

7) Outlet

☒ Structure damaged, grate displaced
☒ Structure clogged or obstructed
☒ Standpipe and pressure transducer condition
Other: _____

8) Overflow Weir & Swale

☒ Structure damaged
☒ Weir / riprap integrity
☒ Swale - erosion
☒ Swale - noxious weeds
Other: _____

Inspection Summary and Comments: Some standing water in bed, weep holes still flowing ~ 0.5 in; erosion in same location as previous inspection in bioswale. Active erosion at rip rap in field - see photos

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
☒ 1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Mike DuBois Date: 12/01/2022
 Location/Facility ID: TH Basin M Time: 10:17 am
 Weather: Cloudy, some rain ~38°F
 Date of Last Rainfall: 11/30/2022 Amount: 1.04 inches

Reason for Inspection (Circle): Routine Complaint **Major Event (spill or >1" in 24hrs)**

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
 1 = Monitor (potential for future problem) N/A = Not applicable
 2 = Routine maintenance required

FEATURES
1) Upstream Manhole / Catch Basin

☒ Clogged catch basin grate or insert
☐ Sediment / debris build-up in bottom of catch basin
☐ Cracks / mechanical damage
 Other: _____

2) Intercept Manhole

☐ Access Problems
☐ > 11 inches of sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
☐ Evidence of improper weir height (see Design Drawings)
☐ Standpipe and pressure transducer condition
 Other: _____

3) Wet Well and Pumps

☐ Sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
☐ Access problems
☐ Safety chains condition
 Other: _____

4) Valve Box

☐ Leaks / water present
☐ Sediment / debris present
☐ Cracks / mechanical damage
☐ Safety chains condition
 Other: _____

5) Swale Outlet Catch Basin

☐ Clogged catch basin grate or insert
☐ Sediment / debris build-up in bottom of catch basin
☐ Cracks / mechanical damage
 Other: _____

6) Downstream Manholes (2)

☐ Sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
 Other: _____

Inspection Summary and Comments: No issues. Basin still flowing, pump
kicked on ^{and} during inspection

OVERALL FACILITY RATING (Circle One)

☒ 0 = No Deficiencies Identified 2 = Routine Maintenance Required
 1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Mike Greasyntee
 Location/Facility ID: T4 - Basin M
 Weather: cloudy, dry ~ 40°F
 Date of Last Rainfall: 12/10/22

Date: 12/12/22
 Time: 9:48 am
 Amount: 1.21 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

X Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
 1 = Monitor (potential for future problem) N/A = Not applicable
 2 = Routine maintenance required

FEATURES

1) Basin Inlet

0 Structure damaged
0 Structure clogged or obstructed
0 Other: _____

2) Sediment Forebay

0 >3 inches of sediment / debris accumulation
0 Vectors / pests present
0 Structural integrity
0 Other: _____

3) Basin Divider

0 Sediment / debris blocking weir
0 Weir integrity
0 Erosion
0 Weep holes not functioning
0 Other: _____

4) Media Bed

0 > 2 inches of sediment / debris accumulation
0 Trash accumulation
0 Crusting of surface of media bed
0 Holes / loss of media / channelization / scour
0 Evidence of burrowing animals / vectors / pests
0 Standing water / saturated patches
0 Other: _____

5) Vegetation

0 Trimming or detritus removal needed
0 Loss of vegetation cover
0 Noxious weeds
0 Abnormal plant mortality
0 Other: _____

6) Side Slopes

0 Rill / gully erosion
0 Evidence of burrowing animals / pests
0 Slope slippage
0 Structural integrity
0 Other: _____

7) Outlet

0 Structure damaged, grate displaced
0 Structure clogged or obstructed
0 Standpipe and pressure transducer condition
0 Other: _____

8) Overflow Weir & Swale

0 Structure damaged
1 Weir / riprap integrity
1 Swale - erosion
0 Swale - noxious weeds
2 Other: Very little rip 12/12 *see notes below

Inspection Summary and Comments: Sediment accumulation in overflow weir
riprap; some erosion issues in swale; almost no grasses survived
for slope/bed stability

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Mike Geosyntec
Location/Facility ID: TA Basin W
Weather: cloudy, dry ~40°F
Date of Last Rainfall: 12/10/22 + 12/9/22

Date: 12/12/22
Time: 10:04 am

Amount: 1.21 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
1 = Monitor (potential for future problem) N/A = Not applicable
2 = Routine maintenance required

FEATURES

1) Upstream Manhole / Catch Basin

- ☐ Clogged catch basin grate or insert
☐ Sediment / debris build-up in bottom of catch basin
☐ Cracks / mechanical damage
☐ Other: _____

2) Intercept Manhole

- ☐ Access Problems
☐ > 11 inches of sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
☐ Evidence of improper weir height (see Design Drawings)
☐ Standpipe and pressure transducer condition
☐ Other: _____

3) Wet Well and Pumps

- ☐ Sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
☐ Access problems
☐ Safety chains condition
☐ Other: _____

4) Valve Box

- ☐ Leaks / water present
☐ Sediment / debris present
☐ Cracks / mechanical damage
☐ Safety chains condition
☐ Other: _____

5) Swale Outlet Catch Basin

- ☐ Clogged catch basin grate or insert
☐ Sediment / debris build-up in bottom of catch basin
☐ Cracks / mechanical damage
☐ Other: _____

6) Downstream Manholes (2)

- ☐ Sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
☐ Other: _____

Inspection Summary and Comments: None

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Jack Lisin Date: 12/27/2022
Location/Facility ID: T4 Basin M Infiltration Basin Time: 1610
Weather: Overcast, Light Rain
Date of Last Rainfall: Rain on 12/25, 12/26, and 12/27/2022 Amount: 3.43 inches (Over preceding 48 hours)

Reason for Inspection (Circle): Routine Complaint **Major Event (spill or >1" in 24hrs)**

Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
1 = Monitor (potential for future problem) N/A = Not applicable
2 = Routine maintenance required

FEATURES

1) Basin Inlet

0 Structure damaged
0 Structure clogged or obstructed
0 Other: _____

2) Sediment Forebay

0 >3 inches of sediment / debris accumulation
0 Vectors / pests present
0 Structural integrity
0 Other: _____

3) Basin Divider

0 Sediment / debris blocking weir
0 Weir integrity
0 Erosion
0 Weep holes not functioning
0 Other: _____

4) Media Bed

0 > 2 inches of sediment / debris accumulation
0 Trash accumulation
0 Crusting of surface of media bed
0 Holes / loss of media / channelization / scour
0 Evidence of burrowing animals / vectors / pests
1 Standing water / saturated patches
0 Other: _____

5) Vegetation

0 Trimming or detritus removal needed
0 Loss of vegetation cover
0 Noxious weeds
0 Abnormal plant mortality
0 Other: _____

6) Side Slopes

0 Rill / gully erosion
0 Evidence of burrowing animals / pests
0 Slope slippage
0 Structural integrity
0 Other: _____

7) Outlet

0 Structure damaged, grate displaced
0 Structure clogged or obstructed
0 Standpipe and pressure transducer condition
Other: _____

8) Overflow Weir & Swale

0 Structure damaged
0 Weir / riprap integrity
1 Swale - erosion
0 Swale - noxious weeds
0 Other: _____

Inspection Summary and Comments:

The forebay was full of water throughout the inspection. Following pump operation, water in the forebay overflowed the weir to the infiltration basin. Water was actively discharging from the weep holes as expected throughout the inspection. Several inches of water was ponded within/throughout the infiltration basin throughout the inspection. Side slope soils within the infiltration basin were saturated several feet above the base of the basin indicating a higher ponding depth during the rainfall event preceding the inspection. Exposed soils and erosion evident in flat area south of the facility that drains to the swale. Relatively turbid observed water in the swale and forebay.

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Jack Lisin Date: 12/27/2022
Location/Facility ID: T4 Basin M Infiltration Basin Time: 1610
Weather: Overcast, Light Rain
Date of Last Rainfall: Overcast, Light Rain Amount: 3.43 inches (Over preceding 48 hours)

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
1 = Monitor (potential for future problem) N/A = Not applicable
2 = Routine maintenance required

FEATURES

1) Upstream Manhole / Catch Basin

0 Clogged catch basin grate or insert
0 Sediment / debris build-up in bottom of catch basin
0 Cracks / mechanical damage
0 Other: _____

2) Intercept Manhole

0 Access Problems
0 > 11 inches of sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Evidence of improper weir height (see Design Drawings)
0 Standpipe and pressure transducer condition
0 Other: _____

3) Wet Well and Pumps

0 Sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Access problems
0 Safety chains condition
0 Other: _____

4) Valve Box

0 Leaks / water present
0 Sediment / debris present
0 Cracks / mechanical damage
0 Safety chains condition
0 Other: _____

5) Swale Outlet Catch Basin

0 Clogged catch basin grate or insert
0 Sediment / debris build-up in bottom of catch basin
0 Cracks / mechanical damage
0 Other: _____

6) Downstream Manholes (2)

0 Sediment / debris build-up
0 Cracks / mechanical damage
0 Inlet / outlet piping damaged
0 Poor seal to piping
0 Other: _____

Inspection Summary and Comments: _____

Light rainfall during inspection and wet well was actively filling. Pumps ran several times during inspection. Pumps were alternating duty as expected with only 1 pump operating at a time. Pumps ran for approximately 1 minute at a time.
Turbid water from swale entering catch basin on south side of the facility.

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Mike Du Bose
 Location/Facility ID: T4 Basin M
 Weather: Cloudy ~ 38°F
 Date of Last Rainfall: 3/13/23

Date: 3/14/23
 Time: 9:20 am

Amount: 1.25 inches

Reason for Inspection (Circle): Routine Complaint **Major Event (spill or >1" in 24hrs)**

Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
 1 = Monitor (potential for future problem) N/A = Not applicable
 2 = Routine maintenance required

FEATURES

1) Basin Inlet

☐ Structure damaged
☐ Structure clogged or obstructed
 Other: _____

2) Sediment Forebay

☐ >3 inches of sediment / debris accumulation
☐ Vectors / pests present
☐ Structural integrity
 Other: _____

3) Basin Divider

☐ Sediment / debris blocking weir
☐ Weir integrity
☐ Erosion
☐ Weep holes not functioning
 Other: _____

4) Media Bed

☐ > 2 inches of sediment / debris accumulation
☐ Trash accumulation
☐ Crusting of surface of media bed
☐ Holes / loss of media / channelization / scour
☐ Evidence of burrowing animals / vectors / pests
☐ Standing water / saturated patches
 Other: _____

5) Vegetation

☐ Trimming or detritus removal needed
☐ Loss of vegetation cover
☐ Noxious weeds
☐ Abnormal plant mortality
 Other: _____

6) Side Slopes

☐ Rill / gully erosion
☐ Evidence of burrowing animals / pests
☐ Slope slippage
☐ Structural integrity
 Other: _____

7) Outlet

☐ Structure damaged, grate displaced
☐ Structure clogged or obstructed
☐ Standpipe and pressure transducer condition
 Other: _____

8) Overflow Weir & Swale

☐ Structure damaged
☐ Weir / riprap integrity
☒ Swale - erosion
☐ Swale - noxious weeds
 Other: _____

Inspection Summary and Comments: ~0.5-1 in standing water in veg. basin, however, flow still entering basin from coal bin area. Safety high-viz fencing around swale need repair.

OVERALL FACILITY RATING (Circle One)

☒ 0 = No Deficiencies Identified

☐ 1 = Monitor (potential for future problem exists)

☐ 2 = Routine Maintenance Required

☐ 3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Mike DuBoise
 Location/Facility ID: T4 Basin M
 Weather: Cloudy, ~38°F
 Date of Last Rainfall: 3/13/23

Date: 3/14/23
 Time: 9:40 am
 Amount: 1.25 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:	
0 = No deficiencies identified	3 = Immediate repair necessary
1 = Monitor (potential for future problem)	N/A = Not applicable
2 = Routine maintenance required	

FEATURES

1) Upstream Manhole / Catch Basin

- ☒ Clogged catch basin grate or insert
☒ Sediment / debris build-up in bottom of catch basin
☒ Cracks / mechanical damage
 Other: _____

2) Intercept Manhole

- ☒ Access Problems
☒ > 11 inches of sediment / debris build-up
☒ Cracks / mechanical damage
☒ Inlet / outlet piping damaged
☒ Poor seal to piping
☒ Evidence of improper weir height (see Design Drawings)
☒ Standpipe and pressure transducer condition
 Other: _____

3) Wet Well and Pumps

- ☒ Sediment / debris build-up
☒ Cracks / mechanical damage
☒ Inlet / outlet piping damaged
☒ Poor seal to piping
☒ Access problems
☒ Safety chains condition
 Other: _____

4) Valve Box

- ☒ Leaks / water present
☒ Sediment / debris present
☒ Cracks / mechanical damage
☒ Safety chains condition
 Other: _____

5) Swale Outlet Catch Basin

- ☒ Clogged catch basin grate or insert
☒ Sediment / debris build-up in bottom of catch basin
☒ Cracks / mechanical damage
 Other: _____

6) Downstream Manholes (2)

- ☒ Sediment / debris build-up
☒ Cracks / mechanical damage
☒ Inlet / outlet piping damaged
☒ Poor seal to piping
 Other: _____

Inspection Summary and Comments: _____

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified

1 = Monitor (potential for future problem exists)

2 = Routine Maintenance Required

3 = Immediate Repair Necessary

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Mike Groszntec

Date: 4/11/2023

Location/Facility ID: T4 Basin M

Time: 1200

Weather: Partly cloudy, some sun 48°F

Date of Last Rainfall: 4/11/2023

Amount: 1.34 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified

3 = Immediate repair necessary

1 = Monitor (potential for future problem)

N/A = Not applicable

2 = Routine maintenance required

FEATURES

1) Basin Inlet

- ☒ Structure damaged
☒ Structure clogged or obstructed
Other: _____

2) Sediment Forebay

- ☐ >3 inches of sediment / debris accumulation
☐ Vectors / pests present
☐ Structural integrity
Other: filled to weir w/ water

3) Basin Divider

- ☐ Sediment / debris blocking weir
☐ Weir integrity
☐ Erosion
☐ Weep holes not functioning
Other: _____

4) Media Bed

- ☐ > 2 inches of sediment / debris accumulation
☐ Trash accumulation
☐ Crusting of surface of media bed
☐ Holes / loss of media / channelization / scour
☐ Evidence of burrowing animals / vectors / pests
☐ Standing water / saturated patches
Other: _____

5) Vegetation

- ☐ Trimming or detritus removal needed
☐ Loss of vegetation cover
☐ Noxious weeds
☐ Abnormal plant mortality
Other: _____

6) Side Slopes

- ☐ Rill / gully erosion
☐ Evidence of burrowing animals / pests
☐ Slope slippage
☐ Structural integrity
Other: _____

7) Outlet

- ☐ Structure damaged, grate displaced
☐ Structure clogged or obstructed
☐ Standpipe and pressure transducer condition
Other: _____

8) Overflow Weir & Swale

- ☐ Structure damaged
☐ Weir / riprap integrity
☐ Swale - erosion
☐ Swale - noxious weeds
Other: _____

Inspection Summary and Comments: Weep holes still flowing. ~1 in standing water at centerline of media bed.

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified

2 = Routine Maintenance Required

1 = Monitor (potential for future problem exists)

3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Mike Greasyntec
 Location/Facility ID: T4 Basin M
 Weather: Partly cloudy, sun 248°F
 Date of Last Rainfall: 4/11/23

Date: 4/11/23
 Time: 1217
 Amount: 1.34 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified	3 = Immediate repair necessary
1 = Monitor (potential for future problem)	N/A = Not applicable
2 = Routine maintenance required	

FEATURES

1) Upstream Manhole / Catch Basin

- ☒ Clogged catch basin grate or insert
- ☒ Sediment / debris build-up in bottom of catch basin
- ☒ Cracks / mechanical damage
- ☒ Other: _____

2) Intercept Manhole

- ☒ Access Problems
- ☒ > 11 inches of sediment / debris build-up
- ☒ Cracks / mechanical damage
- ☒ Inlet / outlet piping damaged
- ☒ Poor seal to piping
- ☒ Evidence of improper weir height (see Design Drawings)
- ☐ Standpipe and pressure transducer condition
- ☐ Other: _____

3) Wet Well and Pumps

- ☒ Sediment / debris build-up
- ☒ Cracks / mechanical damage
- ☒ Inlet / outlet piping damaged
- ☒ Poor seal to piping
- ☒ Access problems
- ☒ Safety chains condition
- ☐ Other: _____

4) Valve Box

- ☒ Leaks / water present
- ☒ Sediment / debris present
- ☒ Cracks / mechanical damage
- ☒ Safety chains condition
- ☐ Other: _____

5) Swale Outlet Catch Basin

- ☒ Clogged catch basin grate or insert
- ☒ Sediment / debris build-up in bottom of catch basin
- ☒ Cracks / mechanical damage
- ☐ Other: _____

6) Downstream Manholes (2)

- ☒ Sediment / debris build-up
- ☒ Cracks / mechanical damage
- ☒ Inlet / outlet piping damaged
- ☒ Poor seal to piping
- ☐ Other: _____

Inspection Summary and Comments: none

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified	2 = Routine Maintenance Required
1 = Monitor (potential for future problem exists)	3 = Immediate Repair Necessary

VEGETATED INFILTRATION BASIN INSPECTION FORM

Inspector's Name: Mike Georgynte
 Location/Facility ID: T4 Basin M
 Weather: Clear sky, 26°F
 Date of Last Rainfall: 6/20/23

Date: 6/21/23
 Time: 11:30

Amount: 0.2 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

Step 1: Take photos from all 4 sides of facility

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
 1 = Monitor (potential for future problem) N/A = Not applicable
 2 = Routine maintenance required

FEATURES

1) Basin Inlet

☒ Structure damaged
☒ Structure clogged or obstructed
 Other: _____

2) Sediment Forebay

☒ >3 inches of sediment / debris accumulation
☒ Vectors / pests present
☒ Structural integrity
 Other: _____

3) Basin Divider

☒ Sediment / debris blocking weir
☒ Weir integrity
☒ Erosion
☒ Weep holes not functioning
 Other: _____

4) Media Bed

☒ > 2 inches of sediment / debris accumulation
☒ Trash accumulation
☒ Crusting of surface of media bed
☒ Holes / loss of media / channelization / scour
☒ Evidence of burrowing animals / vectors / pests
☒ Standing water / saturated patches
 Other: _____

5) Vegetation

☒ Trimming or detritus removal needed
☒ Loss of vegetation cover
☒ Noxious weeds
☒ Abnormal plant mortality
 Other: _____

6) Side Slopes

☐ Rill / gully erosion
☐ Evidence of burrowing animals / pests
☐ Slope slippage
☐ Structural integrity
 Other: _____

7) Outlet

☐ Structure damaged, grate displaced
☐ Structure clogged or obstructed
☒ Standpipe and pressure transducer condition
 Other: _____

8) Overflow Weir & Swale

☒ Structure damaged
☒ Weir / riprap integrity
☒ Swale - erosion
☒ Swale - noxious weeds
 Other: _____

Inspection Summary and Comments: Standpipe should be cleaned out.
Sediment and algae growth issues.
Swale show has minimal vegetation and high erosion/channelization
protective fence is still down.

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required
 1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

CONVEYANCES INSPECTION FORM

Inspector's Name: Mike Geosynthe
 Location/Facility ID: T4 Basin M
 Weather: Clear sky, ~65°F
 Date of Last Rainfall: 6/20/23

Date: 6/21/23
 Time: 11:50
 Amount: 0.2 inches

Reason for Inspection (Circle): Routine Complaint Major Event (spill or >1" in 24hrs)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified 3 = Immediate repair necessary
 1 = Monitor (potential for future problem) N/A = Not applicable
 2 = Routine maintenance required

FEATURES

1) Upstream Manhole / Catch Basin

- ☒ Clogged catch basin grate or insert
☐ Sediment / debris build-up in bottom of catch basin
☐ Cracks / mechanical damage
 Other: _____

2) Intercept Manhole

- ☒ Access Problems
☐ > 11 inches of sediment / debris build-up
☐ Cracks / mechanical damage
☒ Inlet / outlet piping damaged
☒ Poor seal to piping
☒ Evidence of improper weir height (see Design Drawings)
☐ Standpipe and pressure transducer condition
 Other: _____

3) Wet Well and Pumps

- ☒ Sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
☐ Access problems
☐ Safety chains condition
 Other: _____

4) Valve Box

- ☐ Leaks / water present
☐ Sediment / debris present
☐ Cracks / mechanical damage
☐ Safety chains condition
 Other: _____

5) Swale Outlet Catch Basin

- ☐ Clogged catch basin grate or insert
☐ Sediment / debris build-up in bottom of catch basin
☐ Cracks / mechanical damage
 Other: _____

6) Downstream Manholes (2)

- ☐ Sediment / debris build-up
☐ Cracks / mechanical damage
☐ Inlet / outlet piping damaged
☐ Poor seal to piping
 Other: _____

Inspection Summary and Comments: No issues

OVERALL FACILITY RATING (Circle One)

☒ 0 = No Deficiencies Identified 2 = Routine Maintenance Required
☐ 1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

APPENDIX B

Relevant Photographs

Photo Log for Basin M Bio-infiltration Basin Year 2 (7/2022 – 6/2023)

Photo B-1

Date:

9/16/2022

Direction: W

Description:

Bioinfiltration basin prior to the start of the wet season



Photo B-2

Date:

9/16/2022

Direction: SE

Description:

Healthy vegetation at the end of the 2022 dry season



Photo Log for Basin M Bio-infiltration Basin Year 2 (7/2022 – 6/2023)

Photo B-3

Date:

11/7/2022

Direction: W

Description:

Bioinfiltration basin on the first business day after a 2-year 24-hour storm



Photo B-4

Date:

11/7/2022

Direction: E

Description:

Some ponding in basin following a 2-year 24-hour storm



Photo Log for Basin M Bio-infiltration Basin Year 2 (7/2022 – 6/2023)

Photo B-5 Date: 12/7/2022 Direction: W Description: Mesh added to bottom of media basin stilling well to prevent migration of solids into standpipe	
Photo B-6 Date: 12/12/2022 Direction: W Description: Conveyance swale showing minimal vegetation growth	

Photo Log for Basin M Bio-infiltration Basin Year 2 (7/2022 – 6/2023)

Photo B-7

Date:

12/27/2022

Direction: W

Description:

Full forebay following 5-year 24-hour storm event



Photo B-8

Date:

12/27/2022

Direction: SW

Description:

Ponding in media basin following 5-year 24-hour storm event



Photo Log for Basin M Bio-infiltration Basin Year 2 (7/2022 – 6/2023)

Photo B-9

Date:

3/14/2023

Direction: S

Description:

Stilling well
added to wet
well to protect
wet well
pressure
transducer



Photo B-10

Date:

6/21/2023

Direction: W

Description:

Condition of
pretreatment
forebay at the
start of the
2023 dry
season

