Appendix A-10

Discharge to Groundwater Authorization – Ferroblack®-H
Approval and Amendments

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHIL MURPHY
Governor

SHEILA OLIVER
Lt. Governor

Site Remediation and Waste Management Program
Bureau of Ground Water Pollution Abatement
Mail Code: 401-05V
P.O. Box 420
Trenton, NJ 08625-0420
Phone: (609) 292-8427

CATHERINE R. MCCABE
Commissioner

19 February 2019

Jody Overmyer, Project Manager
PPG Industries, Inc.
440 College Park Drive
Monroeville, PA 15146

Re: Discharge to Ground Water Authorization
Hudson County Chrome Site 107/Site 108
18 Chapel Avenue
Jersey City, Hudson County
Program Interest Number: PI# G000008728
Subject Item ID: DGWD0000000006

Dear Ms. Overmyer,

This New Jersey Pollutant Discharge Elimination System/Discharge to Ground Water (NJPDES/DGW) authorization is hereby issued under the authority of the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq. and the implementing regulations, N.J.A.C. 7:14A-1 et seq. N.J.A.C. 7:14A-7.5 authorizes the discharge described below which will allow the application of backfill amendments at the above referenced site.

Pursuant to N.J.A.C. 7:14A-22.4(b)5, a Treatment Works Approval is not required for discharges to ground water authorized pursuant to N.J.A.C. 7:14A-7.5 or 8.5 and a licensed operator is not required pursuant to N.J.A.C. 7:10A-1.10(c)1. The discharge approved through this authorization will be to the backfill of an excavation. The discharge shall be conducted as proposed in the 13 February 2019 Discharge to Groundwater Permit-by-Rule Authorization Request and DGW proposal, received on 13 February 2019. This document was submitted on your behalf by James McLaughlin of Arcadis.

Consistent with N.J.A.C. 7:14A-7.5(b) and N.J.A.C. 7:26E-5.6(c), the duration of the approved discharge to ground water is not to exceed 180 calendar days. Be advised that the time period for the discharge begins on the day the discharge first occurs, not on the date this discharge approval letter is issued or received.

The Department shall be notified of the date when the discharge begins as instructed in section IV of this letter. Only the discharge described in Section I below is authorized. The discharge shall be

conducted in conformance with the DGW proposal and shall comply with the requirements of Sections II, III, and IV, farther below.

Regardless of whether the approved discharge is ever initiated and regardless of the date when the discharge first occurs, pursuant to N.J.A.C. 7:14A-2.7 NJDEP authorization for the permittee to initiate and conduct this approved discharge does not extend beyond five years from the date of this letter. If the approved discharge has not been initiated or completed after five years from the date on this letter, a new discharge proposal must be submitted and a new authorization letter obtained if the permittee still intends to initiate or conduct any type of discharge into or onto the ground that is subject to N.J.A.C. 7:14A-7.5(b) and N.J.A.C. 7:26E-5.6(c).

I. DISCHARGE DESCRIPTION

The authorized discharge is FerroBlack®-H (Ferrous Sulfide slurry) to soil within subsurface treatment cells. Soil impacted by chromate ore processing residue (COPR) will be excavated and removed from the Site. Under this proposal, clean backfill would be blended with a low dose of FerroBlack®-H (0% to 0.5% by weight). The application of backfill amendments is intended to reduce hexavalent chromium in groundwater to the less toxic and less mobile trivalent form (Cr(III)), preventing re-contamination of soil in the excavated area and to provide groundwater remediation.

FerroBlack®-H was used at this Site in 2018 under the DGW Authorization ID: DGWD0000000003, approved by the New Jersey Department of Environmental Protection (NJDEP) on 9 May 2018. The discharge was initiated on 2 August 2018. Discharge was extended by two weeks via email communications made on 28 January 2019, and expired on 12 February 2019. As of 31 January 2019, approximately 3,130 cubic yards of backfill have been amended with 45,700 lbs of FerroBlack®-H and placed in some the areas.

Due to observations of COPR-impacted material in the sidewalls of the original planned excavations and test pits completed between the excavation areas, over-excavation is now planned to chase COPR-impacted material beyond the original planned excavation limits within unsaturated and saturated areas. Amendment of clean backfill with a low dose of FerroBlack®-H is proposed for the saturated over-excavation areas, as shown on the attached figure. The estimated volume of soil removed from these locations is 6,650 cubic yards. Assuming a FerroBlack®-H dose of 0.5% (by weight) and a backfill soil density of 1.77 tons per cubic yard, the anticipated dosing quantity is 118,000 pounds. To account for potential modification of excavation areas and depths during field execution, a safety factor for reagent application of two is being utilized to calculate the maximum reagent quantities that are considered during implementation of this PBR. The anticipated maximum dosing quantity would be 236,000 pounds.

In addition to the over-excavation areas, COPR-impacted material has been encountered in the western sidewall of Area A extending into the Conrail 15-ft offset. Due to the proximity to the railroad tracks and structural restrictions, the COPR-impacted material within the 15-ft offset will be left in place. To address the potential for transport of COPR-impacted water from the Conrail 15-ft offset, amendment of clean backfill with a low dose of FerroBlack®-H is proposed along the easement, as shown on the attached figure.

II. SYSTEM OPERATION AND MONITORING

The area of discharge shall be monitored for evidence of malfunction. Said evidence shall include, but is not limited to: breakout, wet areas, ponding, odors, and elevated PID readings in the nearby work area or building.

The discharge shall not cause any of the following negative impacts: adverse impact on the behavior of free product or the plume; adverse impacts to a water supply well or have a long term adverse impact on ground water quality; create an unpermitted discharge to any surface water of the State or violation of Surface Water Quality Standards; create a persistent standing, ponded or surface-flowing fluid condition; or cause adverse vapor intrusion to occur.

Pursuant N.J.A.C. 7:14A-6.2(a)5 and 11, if free product in ground water, vapors or odors in any building, or any malfunction resulting in a potential impact to a receptor are detected and are a result of the discharge authorized by this approval, the discharger will immediately: (1) cease the discharge or make necessary adjustments to the discharge rate or system operation; and (2) repair or mitigate any negative impacts.

After completion of the discharge, the property should be returned to its previous condition, or as agreed to with property owner if the permittee is not the property owner.

III. GROUND WATER MONITORING REQUIREMENTS

The Permittee shall perform the following ground water sampling as was specified in the DGW proposal (including all addendums and modifications) for the purpose of complying with this Discharge to Ground Water Permit-By-Rule authorization.

Baseline Sampling, before the discharge:

Baseline groundwater samples were collected from 12 temporary wells installed in January 2018.

Post Treatment Sampling, after completion of the discharge:

The post-mixing monitoring process will include the collection of groundwater samples for laboratory analyses of total and dissolved Cr, total and dissolved Cr(IV), and total target analyte list (TAL) metals and field parameters including pH, dissolved oxygen, conductivity, turbidity, temperature, and oxidation reduction potential (in accordance with the NJDEP Technical Guidance: *In Situ Remediation: Design Considerations and Performance Monitoring Technical Guidance Documents*, dated October 2017). Samples will be collected in accordance with the *Quality Assurance Project Plan - Addendum* included as part of the *Technical Execution Plan* (TEP) package submittal in April 2018. Monitoring wells will be installed at well locations equivalent to where elevated Cr(IV) was identified in the temporary wells installed in January 2018 to conduct the post-mixing monitoring.

The first post-mixing monitoring event will be incorporated into a groundwater investigation tentatively planned for September 2019 (approximately three months following completion of all proposed backfill amendments). The frequency and locations of initial and subsequent groundwater monitoring will be presented in the *Groundwater Remedial Investigation Workplan* (currently scheduled to be submitted to the NJDEP in May 2019).

Pursuant to the Tech Regs, the Permittee shall measure ground water elevations at all sampled wells upon each sampling event and shall construct ground water flow maps with the water elevation data to document the direction of ground water flow. Any product observed, including sheen, shall be documented. If measurable product is observed, injections shall be suspended until all of the recoverable product is removed from the treatment area.

All sampling shall be performed as proposed and consistent with the methods specified in the most current edition of the Department's *Field Sampling Procedures Manual*. All samples shall be analyzed by a New Jersey Certified Laboratory certified for the methods being used to analyze groundwater samples. Analytical method MDLs shall be less than or equal to the ground water quality standards (N.J.A.C. 7:9C-1.7). Parameters determined in the field (pH, dissolved oxygen, conductivity, turbidity, temperature, and oxidation reduction potential) are to be measured by a certified contractor or laboratory.

Comparison to the vapor intrusion (VI) screening levels is necessary in order to monitor whether or not the discharge activities have the potential to cause VI issues within any nearby structures by means of adversely impacting the behavior of the ground-water contaminants (e.g., unexpected contaminant movement). If there are any exceedances of the VI screening levels caused by the authorized discharge, a VI evaluation shall be conducted of any potentially impacted structures.

Compliance with N.J.A.C. 7:26E-5.7(b) requires that the Permittee satisfy the post-injection ground water monitoring requirements that are set forth in this letter before applying for any Remedial Action Permit for Ground Water. If a Remedial Action Permit application is submitted before the required ground water sampling has been completed, the application will be denied.

Additionally, contingency compliance ground water sampling is required if ground water sampling results indicate that ground water quality criteria (GWQC) have been contravened because of the authorized discharge (e.g., the GWQC for sodium is exceeded as a result of sodium persulfate injection, or the GWQC for iron is exceeded as a result of pH change), or that ground water quality has not returned to baseline conditions (when baseline concentrations are greater than GWQC) in the expected timeframe. Ground water sampling must continue until it can be demonstrated that the GWQC have been met or until the ground water quality has returned to baseline conditions. To demonstrate either of these conditions, a minimum of two consecutive ground water sampling events spaced far enough apart to account for seasonal fluctuations, must be conducted.

Furthermore, if the Permittee is planning to apply for a Ground Water Remedial Action Permit for Natural Attenuation in the future, and exceedances of the GWQC that are due to the discharge remain, those exceedances must be treated similarly to any other site related contaminants (i.e., a sufficient number of samples are required and a decreasing concentration trend must be evident) consistent with the Department’s Remedial Action Permits for Ground Water Guidance.

IV. REPORTING REQUIREMENTS AND INFORMATION SUBMITTALS

All information, including a detailed summary of the discharge and ground water sampling results, as well as the QA/QC package specified at N.J.A.C. 7:26E-2.1(a)15 shall be submitted with the Remedial Action Report prepared for the Site.

Consistent with N.J.A.C. 7:14A-2.11(a) and 6.2(a)14, within 14 days after initiation of the discharge, notify the Department of the "start date" of the discharge. To report this date, send an email to David.VanEck@dep.nj.gov stating the start date of the discharge.

Consistent with N.J.A.C. 7:14A-2.11(a) and 6.2(a)14, any malfunctions or non-compliance should be reported by telephone within 24 hours to the Bureau of Ground Water Pollution Abatement at (609) 292-8427 and in writing within seven days. Written submissions must include the facility name and PI Number. Failure to report this information is a violation of N.J.A.C. 7:14A and the permit-by-rule.

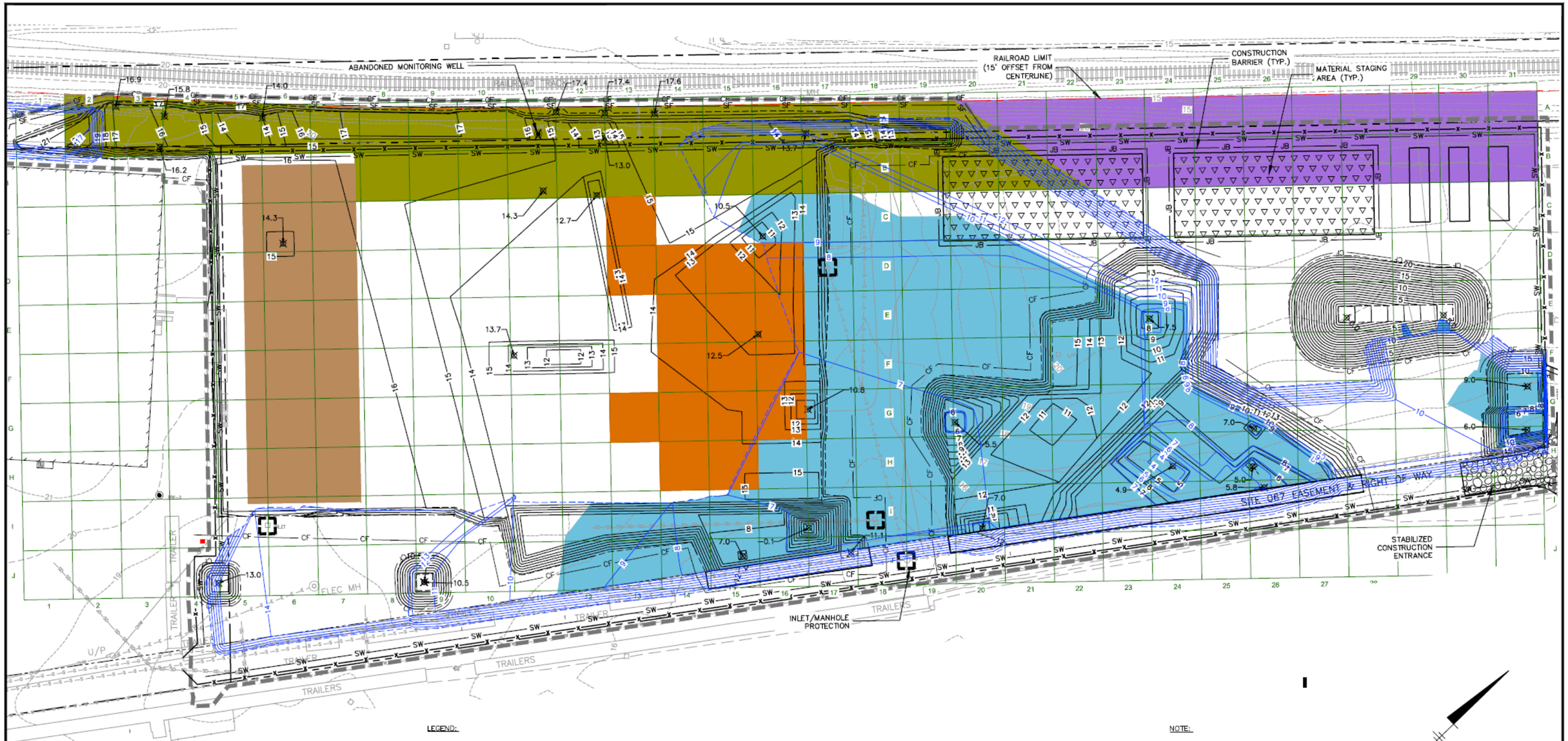
If you have any questions or concerns associated with this Discharge Authorization, please contact David Van Eck at (609) 633-2427.

Sincerely,

Mary Anne Kuserk, Chief
Bureau of Ground Water Pollution Abatement

Enclosure

c: James McLaughlin, Arcadis
David McCall, Conrail
Andrew Campbell, Site 107 Owner
John Del Monaco, Site 108 Owner



LEGEND:

- COMPLETED 0.5% FERROBLACK–H® (VADOSE)
- COMPLETED 0.5% FERROBLACK–H® (SATURATED)
- PROPOSED 0.5% FERROBLACK–H® (VADOSE–WEST SIDEWALL)
- PROPOSED SECONDARY 0.5% FERROBLACK–H®, IF REQUIRED (VADOSE – WEST SIDEWALL)
- PROPOSED 0.5% FERROBLACK–H® (SATURATED)
- LIMIT OF DISTURBANCE
- 10 PROPOSED OVER–EXCAVATION CONTOUR (12/24/2018)
- 10 PROPOSED EXCAVATION CONTOUR (4/19/2018)
- PROPOSED EXCAVATION GRADE BREAK (4/19/2018)
- 12.0 PROPOSED SPOT ELEVATION (4/19/2018)
- SW STRAW WATTLE
- SF SILT FENCE
- MATERIAL STAGING AREA
- TEMPORARY CONSTRUCTION ENTRANCE
- 6' HIGH TEMPORARY CHAIN LINK FENCE
- CF HIGH VISIBILITY ORANGE CONSTRUCTION FENCE
- TRAILERS
- RAILROAD LIMIT (15' OFFSET FROM CENTERLINE)
- EXCAVATION AREAS ADJACENT TO PROPERTY BOUNDARIES
- JB JERSEY BARRIER
- INLET PROTECTION
- PROPERTY BOUNDARY
- EASEMENT
- 17 EXISTING CONTOUR
- EXISTING ELECTRIC
- EXISTING WATER
- EXISTING GAS
- EXISTING STORM DRAIN
- EXISTING SANITARY SEWER
- SW EXISTING OVERHEAD WIRE
- EXISTING UNKNOWN UTILITY
- U/P EXISTING UTILITY POLE
- L/P EXISTING LIGHT POST
- EXISTING BOLLARD
- EXISTING RAILROAD TRACK
- EXISTING MANHOLE
- EXISTING INLET
- EXISTING BUILDINGS
- EXISTING MONITORING WELL
- ABANDONED MONITORING WELL

NOTE:

1. MONITORING WELL LOCATIONS WILL BE PROPOSED AS PART OF THE REMEDIAL ACTION WORK PLAN FOR GROUNDWATER TO BE SUBMITTED IN FALL 2019.

0 30' 60'
GRAPHIC SCALE

XREFS: IMAGES: PROJECTNAME:
EXC-DESIGN-NOEASE-X-BASEMAP
DTGWP-X-TITLE
EXC-DESIGN-NOEASE-X-SESC

PPG SITE 107
18 CHAPEL AVENUE, JERSEY CITY, NEW JERSEY
DISCHARGE TO GROUNDWATER PERMIT-BY-RULE

FERROBLACK® APPLICATION

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Site Remediation and Waste Management Program
Bureau of Ground Water Pollution Abatement
Mail Code: 401-05V
P.O. Box 420
Trenton, NJ 08625-0420
Phone: (609) 292-8427

PHIL MURPHY
Governor

SHEILA OLIVER
Lt. Governor

CATHERINE R. MCCABE
Acting Commissioner

9 May 2018

Jody Overmyer, Project Manager
PPG Industries, Inc.
440 College Park Drive
Monroeville, PA 15146

Re: Discharge to Ground Water Authorization
HCC 107 - Fashionland (aka Eastern Millwork)
18 Chapel Avenue
Jersey City, Hudson County
Program Interest Number: PI# G000008728
Subject Item ID: DGWD0000000003

Dear Ms. Overmyer,

This New Jersey Pollutant Discharge Elimination System/Discharge to Ground Water (NJPDES/DGW) authorization is hereby issued under the authority of the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq. and the implementing regulations, N.J.A.C. 7:14A-1 et seq. N.J.A.C. 7:14A-7.5 authorizes the discharge described below which will allow the application of backfill amendments at the above referenced site.

Pursuant to N.J.A.C. 7:14A-22.4(b)5, a Treatment Works Approval is not required for discharges to ground water authorized pursuant to N.J.A.C. 7:14A-7.5 and a licensed operator is not required pursuant to N.J.A.C. 7:10A-1.10(c)1. The discharge approved through this authorization will be to the backfill of an excavation. The discharge shall be conducted as proposed in the 19 April 2018 Discharge to Groundwater Permit-by-Rule Authorization Request and DGW proposal, received on 19 April 2018, and clarified by email on 26 April 2018. These documents were submitted on your behalf by James McLaughlin of Arcadis.

Consistent with N.J.A.C. 7:14A-7.5(b) and N.J.A.C. 7:26E-5.6(c), the duration of the approved discharge to ground water is not to exceed 180 calendar days. Be advised that the time period for the discharge begins on the day the discharge first occurs, not on the date this discharge approval letter is issued or received.

The Department shall be notified of the date when the discharge begins as instructed in section IV of this letter. Only the discharge described in Section I below is authorized. The discharge shall be

conducted in conformance with the DGW proposal and shall comply with the requirements of Sections II, III, and IV, farther below.

Regardless of whether the approved discharge is ever initiated and regardless of the date when the discharge first occurs, pursuant to N.J.A.C. 7:14A-2.7 NJDEP authorization for the permittee to initiate and conduct this approved discharge does not extend beyond five years from the date of this letter. If the approved discharge has not been initiated or completed after five years from the date on this letter, a new discharge proposal must be submitted and a new authorization letter obtained if the permittee still intends to initiate or conduct any type of discharge into or onto the ground that is subject to N.J.A.C. 7:14A-7.5(b) and N.J.A.C. 7:26E-5.6(c).

I. DISCHARGE DESCRIPTION

The authorized discharge is emulsified vegetable oil (EVO) and FerroBlack®-H (Ferrous Sulfide slurry) to soil within a subsurface treatment cell. Under this proposal, prior to backfill, a dilute solution of 0.5% EVO would be placed at the bottom of the open excavations within the unsaturated zone. The total volume of 0.5% EVO solution is expected to be approximately 81,500 gallons. Additionally, clean backfill would be blended with a low dose of FerroBlack®-H (0% to 0.5% by weight). Assuming a FerroBlack-H dose of 0.5% (by weight) and a soil density of 1.5 tons per cubic yard, the anticipated dosing quantity is 34,000 pounds. To account for potential modification of excavation areas and depths during field execution, twice the above anticipated amount of reagent application is being utilized to calculate the maximum reagent quantities that are considered during implementation of this PBR.

The application of backfill amendments is intended to chemically and biologically reduce and immobilize hexavalent chromium in groundwater that is related to legacy chromate ore processing residue (COPR), preventing re-contamination of soil in the excavated area and to provide groundwater remediation.

Extracted groundwater will be transported off-site to PPG Site 137 (45 Halladay Street) for treatment. Treated water will either be discharged to the sewer system in accordance with approved permits, or amended for reinjection at Site 114 in accordance with the 21 September 2017 Permit-By-Rule for the Garfield Avenue Group sites.

II. SYSTEM OPERATION AND MONITORING

The area of discharge shall be monitored for evidence of malfunction. Said evidence shall include, but is not limited to: breakout, wet areas, ponding, odors, and elevated PID readings in the nearby work area or building.

The discharge shall not cause any of the following negative impacts: adverse impact on the behavior of free product or the plume; adverse impacts to a water supply well or have a long term adverse impact on ground water quality; create an unpermitted discharge to any surface water of the State or violation of Surface Water Quality Standards; create a persistent standing, ponded or surface-flowing fluid condition; or cause adverse vapor intrusion to occur.

Pursuant to N.J.A.C. 7:14A-6.2(a)5 and 11, if free product in ground water, vapors or odors in any building, or any malfunction resulting in a potential impact to a receptor are detected and are a result

of the discharge authorized by this approval, the discharger will immediately: (1) cease the discharge or make necessary adjustments to the discharge rate or system operation; and (2) repair or mitigate any negative impacts.

After completion of the discharge, the property should be returned to its previous condition, or as agreed to with property owner if the permittee is not the property owner.

III. GROUND WATER MONITORING REQUIREMENTS

The Permittee shall perform the following ground water sampling as was specified in the DGW proposal (including all addendums and modifications) for the purpose of complying with this Discharge to Ground Water Permit-By-Rule authorization.

Baseline Sampling, before the discharge:

Baseline groundwater samples were collected from 12 temporary wells installed in January 2018.

Post Treatment Sampling, after completion of the discharge:

The first post-mixing monitoring event will be incorporated into a groundwater investigation tentatively planned for March 2019 (approximately three months following completion of all proposed backfill amendments). The post-mixing monitoring process will include the collection of groundwater samples for laboratory analyses of antimony, Cr(VI), total Cr, ferrous iron, total iron, nickel, thallium, vanadium, alkalinity, sulfate, and field parameters including pH, dissolved oxygen, conductivity, turbidity, temperature, and oxidation reduction potential. Monitoring wells will be installed at well locations equivalent to where elevated Cr(IV) was identified in the temporary wells installed in January 2018 to conduct the post-mixing monitoring. The frequency and locations of initial and subsequent groundwater monitoring will be presented in the Groundwater Remedial Investigation Workplan (to be submitted to the NJDEP in October 2018).

Where possible, the Permittee shall measure ground water elevations at all sampled wells upon each sampling event and shall construct ground water flow maps with the water elevation data to document the direction of ground water flow pursuant to N.J.A.C. 7:26E-1.5(b). Pursuant to N.J.A.C. 7:26E-2.1(a)14 and N.J.A.C. 7:14A-6.2(a)14 any product observed, including sheen, shall be documented. If measurable product is observed, discharges shall be suspended until all of the recoverable product is removed from the treatment area.

Pursuant to N.J.A.C. 7:26E-1.5(b) all sampling shall be performed as proposed and consistent with the methods specified in the most current edition of the Department's Field Sampling Procedures Manual. Pursuant to N.J.A.C. 7:26E-2.1 all samples shall be analyzed by a New Jersey Certified Laboratory certified for the methods being used to analyze groundwater samples. Analytical method MDLs shall be less than or equal to the ground water quality standards (N.J.A.C. 7:9C-1.7). Parameters determined in the field (pH, dissolved oxygen, conductivity, turbidity, temperature, and oxidation reduction potential) are to be measured by a certified contractor or laboratory.

Comparison to the vapor intrusion (VI) screening levels is necessary in order to monitor whether or not the discharge activities have the potential to cause VI issues within any nearby structures by means

of adversely impacting the behavior of the ground-water contaminants (e.g., unexpected contaminant movement). Pursuant to the requirements specified in section II above, if there are any exceedances of the VI screening levels caused by the authorized discharge, a VI evaluation shall be conducted of any potentially impacted structures.

Contingency compliance ground water sampling is required if ground water sampling results indicate that ground water quality criteria (GWQC) have been contravened because of the authorized discharge (e.g., the GWQC for iron is exceeded because of backfilling ferrous sulfide within an excavation), or that ground water quality has not returned to baseline conditions (when baseline concentrations are greater than GWQC) in the expected timeframe. Ground water sampling must continue until it can be demonstrated that the GWQC have been met or until the ground water quality has returned to baseline conditions. To demonstrate either of these conditions, a minimum of two consecutive ground water sampling events spaced far enough apart to account for seasonal fluctuations, must be conducted.

Furthermore, if the Permittee is planning to apply for a Ground Water Remedial Action Permit for Natural Attenuation in the future, and exceedances of the GWQC that are due to the discharge remain, those exceedances must be treated similarly to any other site related contaminants (i.e., a sufficient number of samples are required and a decreasing concentration trend must be evident) consistent with the Department's Remedial Action Permits for Ground Water Guidance.

IV. REPORTING REQUIREMENTS AND INFORMATION SUBMITTALS

All information, including a detailed summary of the discharge and ground water sampling results, as well as the QA/QC package specified at N.J.A.C. 7:26E-2.1(a)15 shall be submitted with the Remedial Action Report prepared for the Site.

Consistent with N.J.A.C. 7:14A-2.11(a) and 6.2(a)14, within 14 days after initiation of the discharge, notify the Department of the "start date" of the discharge. To report this date, send an email to David.VanEck@dep.nj.gov stating the start date of the discharge.

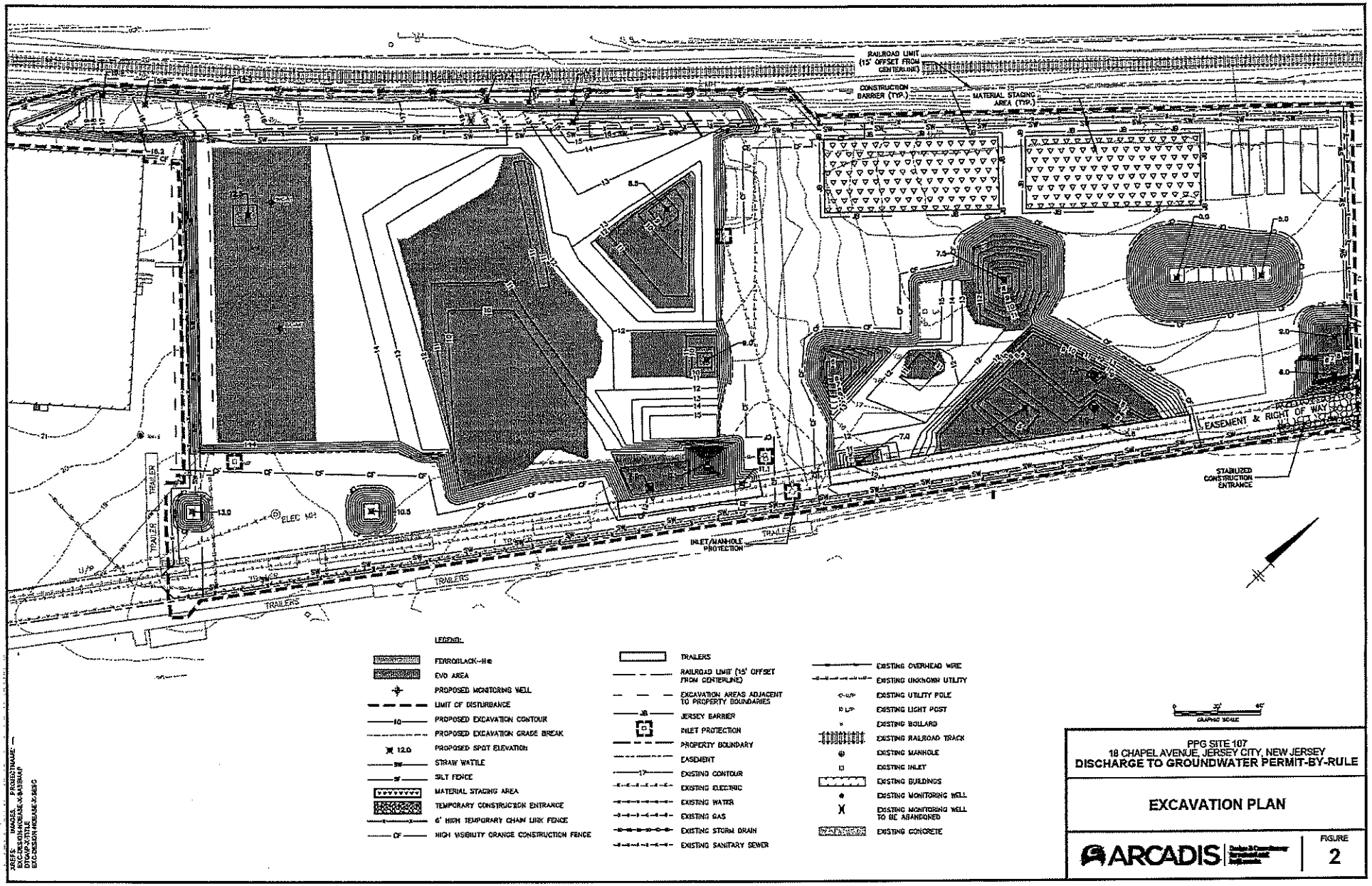
Consistent with N.J.A.C. 7:14A-2.11(a) and 6.2(a)14, any malfunctions or non-compliance should be reported by telephone within 24 hours to the Bureau of Ground Water Pollution Abatement at (609) 292-8427 and in writing within seven days. Written submissions must include the facility name and PI Number. Failure to report this information is a violation of N.J.A.C. 7:14A and the permit-by-rule.

If you have any questions or concerns associated with this Discharge Authorization, please contact David Van Eck at (609) 633-2427.

Sincerely,

Mary Anne Kuserk, Chief
Bureau of Ground Water Pollution Abatement

c: James McLaughlin, Arcadis
R. Greenberg, Greenberg Prop. LLC



XREFS: IMAGES: PROJECTNAME: —
EXC-DESIGN-MODBASE-X-BASEMAP
DTOMP-XSTYLE
EXC-DESIGN-MODBASE-X-BASE

PPG SITE 107
18 CHAPEL AVENUE, JERSEY CITY, NEW JERSEY
DISCHARGE TO GROUNDWATER PERMIT-BY-RULE

EXCAVATION PLAN

ARCADIS

FIGURE
2