S2C2 inc.

Streamlined Site Characterization & Closure

February 28, 2010

Mr. Gregory B. MacLean, P.E.
Environmental Engineer II
New York State Department of Environmental Conservation
Division of Environmental Remediation – Region 8
6274 East Avon-Lima Road
Avon, New York 14414

RE: Supplemental Work Plan for Initial Bedrock Evaluation Activities - Addendum to the Voluntary Cleanup Program Remedial Investigation Work Plan, 100 Carlson Road – Rochester, New York.
NYSDEC VPN Number V00514-8

Dear Mr. MacLean:

On behalf of 100 Carlson Road, LLC, S2C2 Inc. is pleased to submit this Addendum to the existing Voluntary Cleanup Program Remedial Investigation (RI) Work Plan, dated October 2004, and incorporated herein by reference. Supplemental RI activities to be conducted under this Addendum are intended to represent an initial evaluation of groundwater quality conditions within bedrock at the Carlson Park property located at 100 Carlson Road, Rochester, New York (the Site). This work plan addendum presents the approach, procedures, sampling requirements, and scope of work for the subject initial phase of bedrock evaluation activities to be conducted at the Site.

As described in more detail below, previous RI activities conducted at the Site indicated the presence of chlorinated volatile organic compounds (CVOCs) within both unsaturated and saturated overburden at selected portions of the Site. The primary objective of this initial bedrock evaluation phase is to determine if such CVOCs have impacted the underlying bedrock groundwater quality along the downgradient property boundary of the Site. This information will be used to initially assess the possibility for potentially impacted bedrock groundwater (if any is present) to migrate off the property. In addition to the primary objective of this initial bedrock evaluation program, a variety of data will be obtained which will subsequently assist with completing a more comprehensive evaluation of site-specific hydrostratigraphic conditions and groundwater flow patterns within the bedrock.

Background

The Site is located within the City of Rochester approximately 2.5 miles east from center city, approximately 2.3 miles west-southwest of Irondequoit Bay, and approximately 5.8

5 Johnson Drive, Suite 12, Raritan, NJ 08869 (908) 253-3200 FAX (908) 253-9797

miles south of Lake Ontario. The Site location and surrounding area are presented on Figure 1. The Site is bounded by Carlson Road and a parking lot to the east, railroad tracks to the south, and commercial/industrial facilities and the Channel 8 WROC News Office to the west. Humboldt Road is located along the north boundary of the site. Land use in the surrounding area includes mixed residential, commercial, and light industrial.

The Site consists of approximately 39 acres, of which approximately 35 acres are improved with the former manufacturing buildings, parking areas, and landscaped areas. Buildings occupy approximately 800,000 square feet of the Site. Figure 2 presents a Site facility map. The current property is a multi-tenant facility with commercial office, warehouse, and light industrial uses.

Previous Related RI Activities

Previous RI activities conducted at the Site included an extensive evaluation of CVOC impacts within the shallow unconsolidated overburden outside the footprint of the facility buildings. The locations and number of all testing points, and associated analytical results, have been presented in previous progress reports, and have been incorporated by reference herein. Based upon the results of these activities, two distinct dissolved CVOC plumes were identified to be present within the saturated overburden (as described below), while more limited isolated impacts were also identified in a small area west of Buildings 4 and 8. The primary CVOC identified to be present at all locations was Trichloroethene (TCE).

Of the two distinctly defined shallow groundwater plume areas, one was identified to be present beneath a parking area west of Building 7. At this location, the highest dissolved CVOC concentrations measured in shallow groundwater were found to be present in a very limited area at the water table. Dissolved CVOC concentrations in shallow groundwater were generally found to decline sharply with depth just below the water table. The overall shallow dissolved plume at this location generally appears to be migrating in a northeasterly direction based upon the configuration of the plume and limited hydraulic gradient measurements taken from temporary points in this area. A very shallow unsaturated fill/soil layer (i.e., less than three feet below ground surface) overlying the limited, most highly impacted, shallow groundwater zone was identified based upon high density soil sampling and found to contain elevated concentrations of TCE. Such fill/soil is currently the target of a soil removal IRM.

The second distinctly defined shallow groundwater plume is believed to originate beneath a loading dock area situated near the eastern edge of Building 2. At this location, dissolved TCE concentrations were found to be lower at the water table and increased with depth until probe refusal at an approximate depth of 19 feet below grade. A very limited area was identified where small droplets of TCE in the form of a Dense Non-Aqueous Phase Liquid (DNAPL) were found to be present in groundwater grab samples collected just above refusal. At this very limited area, dissolved TCE concentrations were measured to be at, or close to, solubility limits. Probe refusal is anticipated to be the underlying bedrock surface at this location. Based on the plume dimensions and measured dissolved TCE concentration gradients, the dissolved shallow groundwater plume originating from this area was found to initially be migrating in an east-northeast direction under a parking area before bending towards the north-northwest. It is suspected that the observed bending of the downgradient edge of this overburden shallow plume may be the result of ongoing pumping from a sump that is located beneath the basement floor in Building 10. Based on preliminary observations, this sump appears to be situated within shallow bedrock. [All water removed from this sump is passed through an on-site carbon treatment system.]

Based upon existing site-specific overburden information, none of the dissolved CVOC impacts observed to be present in shallow groundwater within unconsolidated geologic materials were found to extend to the property boundary. As stated above, the primary objective of the subject initial bedrock evaluation phase is to determine if shallow groundwater quality impacts (previously identified to be present within shallow soils and/or saturated overburden on-site) have extended into the underlying bedrock, and if any such potential bedrock groundwater quality impacts have reached the downgradient property boundary of the Site.

Geologic Setting

The Site is located within the Interior Lowlands Physiographic Province which is characterized by generally flat to gently dipping sedimentary rocks overlain by glacial and post-glacial sedimentary deposits (Van Diver 1985). This Physiographic Province encompasses all of northwestern New York in the vicinity of Lake Ontario. The Lowlands Province is bounded by the Appalachian Plateau Province to the south, the Adirondack Highlands Province to the east and the Canadian Shield to the north. Sedimentary rocks observed within the Lowlands Province of northwestern New York are part of the Niagaran Provincial Series which includes the Medina, Clinton and Lockport Groups. This Series consists of approximately 400 feet of fossiliferous dolomite, limestone, shale and sandstone deposited in shallow epeiric seas during the Silurian (439-408 Ma.) (Brett et al, 1995). In the Rochester vicinity, sedimentary rocks of the Lockport Group through the Clinton Group are observed and are present in a homoclinal structure known as the Niagara Escarpment with a generally east-northeast strike and south-southwest dip of approximately 55 feet per mile (Kappel and Young, 1988).

At the Site, a thin veneer of unconsolidated artificial fill and/or native glacial and post-glacial deposits exist with a thickness that ranges from approximately four to 20 feet below ground surface (bgs). Native glacial deposits consist primarily of sands and silts that were deposited during deglaciation that began when the Wisconsin ice sheet receded approximately 12,000 years ago. Based upon geologic maps of the area (Grossman and Yarger, 1953) as shown on Figure 3, unconsolidated fill and native unconsolidated sediments at the Site are believed to be directly underlain by the Lockport Group. As described below, it is currently anticipated that only the two lowermost formations of the Lockport Group (i.e., the Goat Island Dolomite and the Gasport Dolomite) are believed to be present beneath the Site. The Lockport Group is underlain by the Clinton Group. A detailed description of the Lockport and Clinton Groups through the Irondequoit Limestone is provided below.

The Lockport Group consists of about 160-175 feet of massive to medium-bedded, argillaceous dolomite with minor amounts of dolomitic limestone and shale. This Group outcrops in a belt that extends from Niagara Falls to Ilion, NY approximately 200 miles to the east where it pinches out (Zenger, 1965). The Lockport Group can be further subdivided into the Guelph Dolomite, Eramosa Dolomite, Goat Island Dolomite, and the Gasport Dolomite Formations with individual Members present within some of these formations. Figure 4 presents a descriptive section for the Lockport Group taken from a composite section as presented in Brett et al., 1995. Descriptions given below are from Brett et al (1995). [Older publications commonly refer to the Goat Island and Gasport Dolomite Formations as the Penfield Formation in the Rochester area.]

The upper contact of the Lockport Group is gradational, and defined by the interfingering of the Guelph Dolomite with the greenish to black shale found in the overlying Vernon Shale Formation (i.e., the lowest unit of the Salina Group). The Guelph Dolomite consists of laminated, fine-grained, oolitic dolomite with a thickness of approximately 40 feet. Below the Guelph Dolomite is the Eramosa Dolomite which consists of approximately 50 feet of dark grayish to a brownish weathered, medium to massive bedded bituminous dolomites with intervals of vuggy and stromatolitic dolomite that can form local biostromes or bioherms.

The Goat Island Dolomite underlies the Eramosa Dolomite, and consists of the following three members: the Vinemount Member, the Ancaster Member and the Niagara Falls Member. The Goat Island Dolomite has a thickness of approximately 26 to 55 feet. The Vinemount Member consists of light to dark-gray, medium to thin-bedded, very fine-grained, argillaceous dolomite with thin shale partings with a thickness of approximately 20 feet. The Ancaster Member is approximately 2 to 25 feet thick and consists of medium ash-gray, thin to medium-bedded, fine-grained dolomite with chert nodules and marine fossils. The Niagara Fall Member is approximately 3 to 15 feet in thickness and is characterized as a light-olive to brownish-gray, medium-grained, thick to massive-bedded dolomite that is commonly porous and vuggy. Locally the unit can have abundant stromatopod bioherms. The base of the Lockport Group is comprised of the Gasport Dolomite which is further subdivided into the following three Members: Pekin Member and Gothic Hill Member. The Pekin Member is characterized as an argillaceous, dark-gray, fine-grained, thin to medium-bedded dolomudstone with a thickness of approximately 20 to 30 feet. Directly below the Pekin Member is the basal member of the Lockport Group, the Gothic Hill Member. The Gothic Hill Member can be subdivided into three parts: an upper coarse grainstone; a middle zone of thinner bedded, argillaceous, darker gray dolomite; and a basal crinoidal- and brachiopod-rich grainstone that typically contains dolomicrite clasts. The base of the Lockport Group is defined by an unconformity at the bottom of the Gasport Dolomite with the top of the Decew Dolomite, which is upper most formation of the Clinton Group.

The Clinton Group consists of approximately 100 to 110 feet of thin to medium-bedded shale, limestone, and dolomite and is subdivided into the following eight Formations: Decew Dolomite, Rochester Shale, Irondequoit Limestone, Rockway Dolomite, Williamson Shale, Merritton Limestone, Reynales Limestone, and Neahga Shale. The Decew Dolomite is the upper most formation of the Clinton Group and has a thickness that ranges from 8 to 12 feet. It consists of variably bedded, dark-gray to olive-gray, argillaceous to sandy, fine-grained dolomite. Directly below the Decew Dolomite lies the Rochester Shale, which can be subdivided into the Lewiston and Burleigh Hill Members. The Rochester Shale ranges in thickness from 50 to 60 feet in the Rochester area and consists of medium-dark gray to black calcareous mudstone with thin interbeds of dolomitic beds. The two members are separated by a fossiliferous zone containing abundant bryozoans and brachiopod-shell fragments. Underlying the Rochester Shale is the Irondequoit Limestone which consists of a thick to massive-bedded, medium greenish-gray limestone with abundant crinoidal and brachiopod fossils. The thickness of the Irondequoit Limestone ranges from approximately 10 to 25 feet. The Rockway Dolomite, Williamson Shale, Merritton Limestone and Reynales Limestone makeup the remaining formations of the Clinton Group and underlie the Irondequoit Limestone. These units consist of argillaceous limestones, dolostones and shale with a combined thickness of approximately 10 to 25 feet.

Based on the location of the Site and the regional dip of sedimentary rocks within Monroe County (55 feet/mile), it is estimated that the surface of the Rochester Shale is approximately 75 to 100 feet below ground surface in the vicinity of the Site. Given the fact that the surface of the dolomite underlying the Site is estimated to be present at a depth of 5 to 20 feet below ground, it is further anticipated that the dolomite situated between the surficial unconsolidated deposits and the underlying Rochester Shale ranges from about 70 to 80 feet in thickness at the Site. Accordingly, based upon these estimates, it is anticipated that such dolomites are part of the Goat Island and/or Gasport Formations of the Lockport Group and the Decew Dolomite Formation of the Clinton Group, while the upper Guelph and Eramosa Formations of the Lockport Group are expected to be absent at the Site.

Hydrogeologic Conditions

Regional groundwater flow is described for the glacial and post-glacial unconsolidated aquifer in numerous reports (Grossman and Yarger, 1953; Dunn, 1965; Waller et al., 1982; Yager et al., 1985; Kappel and Young, 1988; and Sherwood, 1999). Potentiometric surface maps included in these reports all indicate a northeasterly flow direction in the vicinity of the site consistent with flow towards Irondequoit Bay. At the site, shallow groundwater flow is generally estimated to have a northeasterly flow direction based on hydraulic gradients measured from temporary points and observations of dissolved plume configurations in saturated overburden. In the northern portion of the site, the unconsolidated geologic deposits have been found to be unsaturated based upon numerous unsuccessful attempts to collect saturated overburden samples in that area. It is anticipated that such unsaturated conditions may be a result of thinner unconsolidated deposits (i.e., a shallower bedrock surface) in that area, combined with the possible dewatering effects from ongoing pumping of a sump situated in the basement of Building 10. [It is also possible that pumping from this sump may ultimately indicate an influence on groundwater flow in shallow bedrock.] However, overall shallow groundwater flow direction within the overburden at the Site, as inferred from the above-stated observations, does appear to correspond to regional predictions.

Specific groundwater flow patterns within the bedrock aquifer at the Site are currently unknown. However, groundwater flow within the dolomite of the Lockport Group has been studied in detail at a number of other sites within the region and is reported to flow in weathered upper bedrock zones as well as in several underlying horizontal, bedding-parallel fracture zones at or near stratigraphic contacts (Yager, 1997). In addition, single bedding plane fractures can also serve as substantial water-bearing zones. Groundwater flow in the Lockport Group is primarily related to secondary porosity related to fractures and vugs. These openings are widened by chemical dissolution in areas where water with low dissolved solids concentrations circulates through the bedrock. Flow within the rock matrix itself is negligible due to very low primary porosity (Yager, 1997).

The weathered bedrock flow zone (i.e., the upper portion of bedrock immediately underlying unconsolidated geologic deposits), where present, typically ranges from 10 to 25 feet in thickness and has an increased density of horizontal fractures that are connected by high-angle fractures. Typical hydraulic conductivity values for this upper weathered zone range from 0.003 to 570 ft/day based on aquifer test and slug test results summarized in Yager (1997). Horizontal-fracture zones within the Lockport dolomite are typically located at lithologic contacts and facies changes and are characterized by an increase in the frequency of horizontal fractures that develop from structural weaknesses at these contacts. Horizontal flow zones tend to have thicknesses of approximately 2 feet and transmissivity values that range from 30 to 700 ft^2/day. As reported in Yager (1997), horizontal fracture zones within dolomite of the upper sections of the Lockport Group (i.e., Guelph and Eramosa Formations) show a significant decrease in transmissivity at depths greater than 80 feet. Within the dolomite of the lower sections of the Lockport Group (i.e., Goat Island and Gasport Formations), horizontal fracture zones are relatively unaffected by overburden weight to depths of approximately 150 feet below ground surface. Connection between horizontal fracture zones is primarily from both regional and local high-angle joint sets.

In the Rochester area, the best locality for observing dolomite of the Lockport Group is at the Dolomite Products Quarry located in Penfield approximately four miles southeast of Irondequoit Bay. Figure 5 presents photographs taken of the Lockport Dolomite at the Dolomite Products Quarry as part of an initial limited visit to the Quarry. These photographs illustrate horizontal flow zones as well as fracture patterns. A single horizontal fracture zone located in the upper section of dolomite within the Lockport Group is identified in these photographs as well as a regional high-angle joint set with an approximate east-northeast strike and a local unloading cross joint set that has a strike perpendicular to the regional joint set (approximately north-northwest strike).

As stated above, the estimated thickness of the shallow dolomites that underlie the Site (i.e., the Goat Island and/or Gasport Formations of the Lockport Group and the Decew Dolomite Formation of the Clinton Group) is estimated to range between 70 and 80 feet in thickness, while the contact between this dolomite and the underlying Rochester Shale is anticipated to be approximately 75 to 100 feet below ground surface at the Site. Based on outcrop patterns, proximity to Irondequoit Bay, fracture patterns and strike and dip of this dolomite in the vicinity of the site, the general overall groundwater flow pattern within the Lockport is currently anticipated to be in a northeast to east-northeast direction.

Initial Bedrock Evaluation Approach

As previously stated, the primary objective of the subject initial bedrock evaluation phase is to determine if the previously identified shallow groundwater quality impacts observed within saturated overburden on-site have extended into water-bearing fracture zones within the underlying bedrock, and if any such potential bedrock groundwater quality impacts have reached the downgradient property boundary of the Site. Based upon a literature review of regional geologic conditions and a preliminary visit to the Dolomite Products Quarry located in Penfield, NY, an initial conceptual model of structural geologic conditions and associated suspected groundwater flow conditions within bedrock immediately underlying the Site has been developed. This conceptual model suggests that overburden groundwater that may infiltrate into the underlying dolomite, along with dissolved-phase constituents that may be present within the groundwater, is likely to migrate to water-bearing zones associated with bedding plane fractures within the dolomite, and then flow laterally within these zones. Accordingly, the focus of this initial phase of the bedrock evaluation program will be on assessing bedrock structural characteristics and bedrock groundwater quality conditions along the suspected downgradient property boundary within the dolomite underlying the Site and overlying the Rochester Shale.

A variety of remedial investigation activities are being proposed in order to accomplish the stated objectives of this initial phase of the bedrock evaluation program. These activities will be conducted in accordance with NYSDEC Draft DER 10 Technical Guidance for Site Investigation and Remediation, November 2009, as applicable. It is proposed that activities associated with this initial phase of bedrock evaluation will be conducted at five locations situated along the suspected downgradient property boundary of the Site, as approximately shown on Figure 6. Actual locations may be adjusted slightly in the field pending access considerations, and utility clearance, etc. The following sections provide a description of the approach, procedures, sampling requirements, and scope of work to complete this initial phase of bedrock evaluation activities. To a certain extent, the actual scope of work will be adjusted and finalized in the field as information becomes available. Accordingly, the proposed field program is somewhat "adaptive" in nature, and will rely upon the generation of some "real-time" depth-discrete data in order to make final determinations regarding borehole abandonment and/or completion requirements, and the number and depths of groundwater monitoring wells to be installed, etc. The following activities are proposed to be conducted as part of this program:

- Additional Regional Evaluation of the Lockport Dolomite
- Bedrock Coring and Packer Testing
- Downhole Geophysical Logging
- Borehole Completion/Groundwater Monitoring Well Installation
- Groundwater Monitoring Well Sampling

Additional Regional Evaluation of the Lockport Dolomite

Prior to the initiation of on-site field activities, an attempt will be made to conduct additional evaluation of the dolomite overlying the Rochester Shale and surrounding bedrock. This may include a second site visit to the Dolomite Products Quarry in Penfield, NY to gather additional stratigraphic and structural data, if access to the quarry can be obtained. Local structural data will be incorporated into the site conceptual model to assist with the prediction of expected bedrock fracture patterns at the Site. In addition to visiting the quarry, an attempt will be made to identify and review additional published reports pertaining to the quarry and/or other bedrock evaluation studies previously conducted in the area.

Bedrock Coring and Packer Testing

As stated above, for the purpose of this initial bedrock evaluation stage, it is proposed that borings will be advanced at a total of five locations situated along the anticipated downgradient property boundary of the Site. These initial locations have been selected relative to expected bedrock groundwater flow directions and the relationship to previously defined on-site shallow groundwater quality impacts. Prior to the start of any on-site bedrock evaluation activities, all proposed drilling locations will be cleared for underground utilities. In addition, a single continuous soil boring will be advanced to “refusal” with the use of a 6000-series direct-push unit at each of the five bedrock evaluation locations. Overburden soil will be geologically logged, and scanned with a PID to evaluate the presence of VOCs. A screen point sampler will then be advanced to refusal within the soil borehole in an effort to obtain a groundwater grab sample at the overburden/ weathered bedrock interface. [It should be noted that the screen point sampler may be able to be advanced slightly deeper than the soil boring.] Any groundwater grab samples collected in this manner will be analyzed as described below.

The next step of this program will involve the installation of a 6-inch diameter steel casing to be set into competent bedrock at each of the five proposed boring locations. For the purpose of this program, “competent” bedrock will be defined as the depth of auger refusal by the rig to be utilized to install the steel casings. It is anticipated that each of these steel casings will be grouted in place to a depth of about five feet into competent bedrock in order to seal off the overlying overburden, and/or the incompetent weathered bedrock, from the bedrock evaluation activities being proposed herein. Based upon our existing understanding of overburden conditions at the proposed drilling locations for this program, we anticipate that the overburden will either be unsaturated or minimally saturated, and that any saturated overburden will be un-impacted or minimally impacted by VOCs. However, in the event that highly impacted overburden and/or unconsolidated shallow rock is found to be present, then the proposed boring location may be slightly adjusted or the depth of the 6-inch diameter steel casing may be set slightly deeper into rock at that location. In any such situation, a shallow well may ultimately be installed within the saturated overburden/unconsolidated shallow rock zone.

Once the steel casings have been set, an integrated bedrock coring and packer-testing program will be implemented at each boring location. The primary purpose of this program is to obtain visual rock core samples for inspection, estimate the vertical distribution and associated hydraulic conductivity of groundwater flow zones within the rock, and obtain preliminary vertical groundwater quality profiling data from specific fracture intervals within the on-site dolomite of the Lockport Group and the Decew Dolomite Formation overlying the Rochester Shale. As such, it is generally anticipated that bedrock coring and packer-testing activities will extend from the competent dolomite surface to the contact with the underlying shale. As previously stated, this contact is expected to be present at an approximate depth of 75 to 100 feet below grade, while the thickness of the dolomite to be evaluated is estimated to range between approximately 70 and 80 feet.

Although this bedrock coring and packer-testing program is generally anticipated to extend to the top of the Rochester Shale, there are two circumstances which may result in terminating these activities at a shallower depth at any given testing location. One such circumstance is if elevated dissolved TCE concentrations are encountered in groundwater before the shale is reached. For the purpose of this program, bedrock coring and packer-testing will be terminated at any location where the dissolved TCE concentration is found to exceed 25 mg/L. It is also possible that such activities may be terminated if dissolved TCE concentrations are found to be present in groundwater samples at concentrations ranging between 10 and 25 mg/L within a specific packer zone. As described in more detail below, in such situations, a field decision will be made as to the specific depth to terminate the corehole based upon a variety of field information and/or observations. The other circumstance where a corehole may be terminated prior to reaching the Rochester Shale, is if the shale has not yet been encountered at a depth of 120 feet below grade (i.e., about 20 feet deeper than the greatest projected depth of the Rochester Shale), and the previous two successive packer testing intervals have indicated no, or very low, concentrations of dissolved CVOCs (i.e., less than 10 ug/L).

Bedrock coring will be advanced with the use of either a double or triple-barrel HQ coring configuration. The use of a triple-barrel system is preferred, as such a system will help limit the number of “artificial” breaks/fractures that may be caused during the coring process, and will thereby help obtain more representative rock cores. Bedrock coring may be accomplished with either the use of air and/or water to remove rock cuttings. To the extent possible, an air method (with limited water to reduce dust) will be used to help limit the potential introduction of coring water into the rock formation. However, the presence of any high yield fracture zones, and greater coring depths, may require the use of water for bedrock coring.

The initial bedrock coring to be conducted at each location will be advanced a minimum of 10 feet before any packer testing activities are initiated at each location. This depth will be required to accommodate the packer testing equipment. All bedrock cores will be logged by the project geologist, and selected cores will also be photo-documented as appropriate. All rock cores will be stored at the Carlson Park facility until at least all RI activities have been completed and all data has been fully evaluated. The following observations and/or measurements will be included as part of the logging process:

- Rock Quality Designation (RQD)
- Rock Description (color, type, bedding features, fossils, etc.)
- Fracture patterns and features
- Determination of potential water-bearing fractures

The specific depths of any suspected water-bearing fracture zones will be identified over the length of each 10-foot core run in order to identify discrete zones to undergo packer testing procedures. If no suitable fracture intervals are identified for such procedures over any given 10-foot core interval, then bedrock coring will be advanced at additional 5-foot intervals until suitable packer testing intervals have been identified.

Packer testing will be accomplished with the use of inflatable straddle or single packers that will fit within the HQ-size core holes. Based upon the depth interval to be tested, either both packers of the "straddle" system, or a single packer will be inflated to isolate the vertical groundwater quality profiling interval to be tested. Based upon current estimates for the thickness of the dolomite to be evaluated as part of this program (i.e., 70 to 80 feet), it is anticipated that approximately 5 to 8 depth-discrete saturated intervals will undergo packer testing at each of the five testing locations. However, as mentioned above, the actual number and depths of intervals to undergo packer testing at each location will be determined in the field, and based upon observed conditions.

Vertical groundwater quality profiling will be accomplished by obtaining groundwater grab samples from discrete fracture zones that have been isolated with the inflated packers. As indicated above, testing intervals identified in the upper and/or lower zones of each core hole may be isolated by inflating a single packer of the straddle packer configuration. A submersible pump will be placed within the isolated sampling zones in order to purge and collect groundwater grab samples to undergo rapid sample analysis. In addition, observations made of groundwater pumping rates and/or yields from specific packer testing intervals will be used to help estimate the vertical distribution and associated hydraulic conductivity of groundwater flow zones within the rock Selected indicator field parameters will be monitored during purging activities in an effort to collect groundwater samples that are representative of the specific fracture zones being evaluated. Such indicator parameters will include: temperature, pH, and specific conductivity. In addition, packer integrity will be monitored to help determine if a short circuit or bad seal is present during purging and sampling. At a minimum, such monitoring will include the use of an m-scope to measure fluctuations in water levels above the inflated packer, as well as monitoring packer inflation pressures. In addition, pressure transducers may also be utilized to track pressure differentials within and outside the packer intervals. Pressure data obtained from a transducer set within the packer interval, evaluated in conjunction with pumping rate information, may be used to enhance the evaluation of hydraulic conductivity conditions of the test interval.

All purge water generated from packer testing activities will be containerized on-site until a determination of water quality has been made. Once the water quality at each core hole has been determined, purged water will either be placed back on the ground, treated on-site with the existing carbon treatment system associated with the sump in the basement of Building 10, or disposed of off-site, as appropriate.

Following purging of each discrete isolated interval, groundwater grab samples will be collected and analyzed on-site for VOCs on a rapid turnaround basis within a mobile laboratory. Such analysis will be accomplished with the use of USEPA SW-846 Method 8260B modified (as was done for the previous saturated overburden evaluation program). The use of rapid turnaround analytical testing will allow real-time decisions to be made with respect to bedrock coring and packer testing logistics. As stated above, in the event that any given packer testing interval indicates the presence of dissolved TCE in groundwater at concentrations ranging between 10 to 25 mg/L, then a field evaluation will be made regarding the specific depth at which to terminate bedrock coring activities at that location. The reason for terminating the further advancement of any particular corehole in response to the presence of elevated dissolved TCE concentrations is to reduce the potential for introducing groundwater quality impacts from shallower to deeper intervals, while striving to meet program objectives. The final field decision as where to terminate the corehole will be made by the Field Team Leader (FTL), and will be based upon a variety of information and/or field observations, including: the depth, fracture patterns and other observations made of the rock core, groundwater yield, dissolved CVOC concentrations, etc. In the event that coring activities are terminated due to the presence of groundwater quality impacts, Carlson Park will evaluate the need and the approach for conducting any further vertical delineation activities in a manner that effectively reduces the potential risk of exacerbating groundwater quality impacts. The results of such evaluation will be discussed with NYSDEC at the conclusion of this initial program, and any additional delineation activities which may be required would be addressed as part of a subsequent bedrock evaluation stage.

Downhole Geophysical Logging

Once bedrock coring and packer testing activities have been completed, and prior to the installation of groundwater monitoring wells, downhole geophysical logging of the borehole will be conducted, as described below. Ideally, such logging will be conducted in the coreholes before any reaming is conducted. Geophysical measurements are typically more representative of the surrounding formation when collected from a borehole with as small a diameter as practical. However, the geophysical logging can also be conducted in the borehole after it has been reamed to a larger diameter for casing or well installation if necessary. An example of such situations is if there is an obstruction due to caving in the corehole that could be removed by reaming.

Downhole geophysical logging will be used, in conjunction with other techniques (e.g., rock coring, packer testing, etc.) to help evaluate the lithology and stratigraphy of the bedrock, correlate stratigraphy between locations, indicate potential fractures and fracture zones, and identify potential water-bearing zones. Unlike rock cores which often have incomplete recovery (particularly in relatively highly fractured zones), the geophysical logs will provide a continuous record of bedrock characteristics correlated with depth.

The downhole geophysical logging tools planned for use in this investigation are:

- Caliper
- Single-point electrical resistance
- Spontaneous potential (SP)
- Natural gamma
- Temperature gradient, differential temperature
- Fluid resistivity

The single-point resistance logging probe contains an electrode, and as the probe is lowered down the borehole, electric currents are generated that pass through the borehole into the rock. The electrical resistance between the electrode in the borehole and the ground is measured versus depth. Resistance will vary depending on factors such as rock grain size, fluid-filled porosity, frequency of water-filled fractures, dissolved solids in the borehole fluid, and borehole diameter. Also, depending on lithology and other factors, variations in resistance versus depth can be used to identify stratigraphic correlations between boreholes. Spontaneous potential (SP) logs measures electrical potentials that can develop at the contacts between different rock types when penetrated by the fluid-filled borehole. Under certain circumstances, the SP log is useful in detecting permeable horizons, such as a permeable sandstone in a shale sequence. Both single-point resistance and SP logging require an uncased, fluid-filled borehole for proper operation.

The caliper log is a mechanical device which measures borehole diameter with depth. It is a useful tool for identifying horizontal fractures, while vertical fractures are generally not detected by this devise. This log is also useful for identifying intervals within the borehole that are larger than the drill bit diameter. Such intervals are often associated with relatively less consolidated formations. This devise must be operated in the uphole direction.

Temperature logging probes will be used to attempt to locate sections in the borehole where fluids enter or exit. Two temperature logging devices, (i.e., gradient and differential), will be used during the investigation. The gradient device measures the actual temperature of borehole fluid, and the differential device measures relative changes in borehole fluid temperature. While both temperature logging devices typically respond to temperature changes, the differential device is sensitive to slight changes in borehole fluid temperature. Such changes are often indicative of fluid migration into the borehole, and may be an indicator of a potential water-bearing zone intersecting the borehole. The most useful data are from logs conducted in open boreholes, although data from the screened intervals of a well can provide some value. To the extent practicable, prior to logging with the temperature tools, the fluid in the borehole will be left undisturbed for several hours. This allows the temperatures to stabilize to provide better resolution of temperature anomalies associated with groundwater flowing into the borehole. Further, the temperature tools will be run in the downhole direction to avoid fluid mixing by the probe itself.

Fluid resistivity logs measure the electrical resistance of fluid in the borehole versus depth. Changes in the fluid resistivity with depth are typically associated with changes in the concentration of dissolved solids in the borehole fluid. Changes in fluid resistivity often correspond to depths where fluid is entering or exiting the borehole, which may represent potential water-bearing zones. The most useful data are from logs conducted in open boreholes, although data from the screened intervals of a well can provide some value.

The natural gamma tool detects the rate of naturally occurring gamma ray emissions versus depth in the borehole. An electrical signal which is proportional to the number of gamma rays counted per unit time is sent continuously up hole from the tool to the logging unit. Clay and shale typically contain a greater amount of naturally-occurring gamma-emitting isotopes compared to other sedimentary deposits or rock types, (e.g., limestone and/or sandstone). The gamma response is, therefore, a useful indicator of the shale or clay content of the formations within the borehole and can facilitate correlation of stratigraphy between boreholes. Natural gamma logs are responsive through steel or PVC casing, although the signal is attenuated somewhat relative to an open borehole. Natural gamma logs do not require the borehole to be filled with fluid for data acquisition.

All geophysical logging tools and associated cable will be decontaminated between each logging run and between each borehole.

Borehole Completion/Groundwater Monitoring Well Installation

Following completion of the rock coring, packer testing, and geophysical survey activities at each borehole location, open core holes will either be abandoned, partially abandoned, and/or completed as permanent groundwater monitoring wells. The determination to abandon or install a groundwater monitoring well in any given borehole will be primarily based on depth-discrete groundwater quality information, flow characteristics observed at individual water-bearing zones, and information regarding structural characteristics of the bedrock obtained at each testing location. For the purpose of this Work Plan Addendum, it is anticipated that a minimum of one permanent groundwater monitoring well will be installed at each of the five testing locations, provided that sufficient water-bearing fractures are identified within the dolomite at each location. If Carlson Park decides to install more than one permanent bedrock groundwater monitoring well at any given location, the deeper of the wells will be installed within the bedrock corehole (as described below), while any shallower wells will be installed within approximately 10 feet adjacent to the deeper well. Any such shallower wells will not require additional bedrock coring, but will be drilled to the desired well depths with a 6-inch diameter air rotary bit.

Prior to well installation of the deepest well at a particular location, the corehole will first be reamed to 6-inches in diameter to the proposed depth of the well. In the event that the proposed screen placement of a permanent groundwater monitoring well is going to be situated above the final depth of the corehole advanced at that location, then the base of the corehole will be abandoned with a cement/bentonite slurry prior to reaming the corehole and installing the well.

Specific well construction details, such as screen settings and lengths, will be determined based on depth-discrete groundwater quality results, bedrock fracture patterns, and the hydraulic characterization observations obtained during packer testing activities conducted at each boring location. The specific well construction configurations will be selected to allow chemical and hydraulic monitoring of groundwater in distinct water-bearing zones. Given the anticipated use of these wells, it is proposed that each of these wells will be constructed of 2-inch diameter schedule 40, flush-joint PVC screen and riser. The top of each riser will be fitted with a locking gripper plug. It is anticipated that well screens will range between 5 and 10 feet in length, and will consist of manufactured 20-slot PVC. Sand pack will be placed in the annular space around the screens, and will be brought approximately 3 to 5 feet above the top of the well screens. A 2 to 3-foot thick bentonite seal will be placed above the sand pack, and the remainder of the annular space will be filled with a bentonite/cement grout. It is anticipated that each of these wells will be completed with a flush-mount manhole cover set into a concrete pad. The concrete pad will be sloped gently away from the manhole cover to help direct surface runoff away from the wells.

Once the permanent groundwater monitoring wells have been installed, each well will be developed. Well development will be conducted in order to help remove fine-grained geologic cuttings/materials in order to enhance the hydraulic connection between the wells and the water-bearing fracture zones in which they are installed. It is anticipated that development activities will be accomplished with the use of a submersible pump utilized in a surging motion. After well development activities have been completed, the wells will be allowed to stabilize for a period of at least two weeks prior to the initial collection of groundwater samples.

All borehole locations will be surveyed using a survey-grade GPS unit and auto-leveled to existing sampling locations. All permanent groundwater monitoring wells installed as part of this program will be surveyed by a NY-licensed surveyor.

Groundwater Monitoring Well Sampling

In order to obtain representative groundwater samples from the groundwater monitoring wells to be installed as part of this initial bedrock evaluation program, it is proposed that such sampling be conducted in general accordance with American Society of Testing Materials (ASTM) Standard D6771-02 (Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations). [Any subsequent groundwater sampling activities conducted in these wells may be accomplished with the use of passive diffusion bags (PDBs), as will be discussed with NYSDEC in advance]. Initial purging will be accomplished with the use of a submersible bladder or centrifugal pump. The pump will typically be set in the center of the screened interval, unless a specific water-bearing fracture interval has been targeted during packer-testing activities. Water level drawdown will be monitored during all purging activities. In addition, purged water will pass through a low-flow cell and be monitored at approximate 5-minute intervals for a variety of field parameters. Such field parameters will include: temperature, pH, specific conductance, dissolved oxygen (DO), oxidation reduction potential (ORP), and turbidity.

All purge water will be containerized on-site until a determination of water quality has been made. Once the water quality at each well has been determined, purged water will either be placed back on the ground, treated on-site with the existing carbon treatment system, or disposed of off-site, as appropriate.

An attempt will be made to allow all the above field parameters to stabilize to within specific variance ranges for three consecutive readings prior to initiating groundwater sample collection. Such ranges include: <0.3’ for water level drawdown; +/- 3% for temperature and specific conductivity; +/- 0.1 unit for pH; +/- 10% for DO; +/- 10 millivolts for ORP; and +/- 1 NTU for turbidity. Groundwater samples will be analyzed for the presence of Volatile Organic Compounds (VOCs) by a NYSDOH Environmental Laboratory Approval Program (ELAP) certified laboratory in accordance with USEPA SW-846 Method 8260B. QA/QC samples consisting of a field duplicate, a field blank, and a trip blank will be included with the sampling event. Analytical results will be validated and a Data Usability Summary Report (DUSR) will be prepared.

Data Evaluation

Following completion of field activities for this initial bedrock evaluation program, all information obtained will be evaluated and data will be incorporated into the project database and used to update the site conceptual model. Results from this evaluation will be presented and discussed with representatives of NYSDEC to determine additional activities that may be required based upon these data. Additional work plan addenda will be prepared as necessary. Information obtained from this initial bedrock evaluation program (and any subsequent RI activities) will ultimately be included in a final Remedial Investigation Report to be prepared at the conclusion of all RI activities for the Site.

Schedule

It is currently anticipated that the subject supplemental RI activities will be initiated in April 2010. The actual start date will be somewhat dependent upon seasonal weather conditions, the presence of snow on the areas where subsurface evaluation activities are scheduled to occur, and final approval of this supplemental RI Work Plan addendum by NYSDEC. It is anticipated that a minimum of up to several weeks of field work may be required to complete the initial subject scope of work (i.e., through groundwater monitoring well installation). The actual time required to complete this work will be influenced by the information obtained in the field, and the impacts such information has on the final scope of work. Several variables may influence the scope of work and the duration of field activities. Such variables include: the actual thickness of the dolomite and the depth of the underlying Rochester Shale which can impact the required boring depths, the groundwater quality conditions encountered, and the actual number of permanent groundwater monitoring wells to be installed. All the subject initial field activities should be completed by May 2010. Final analytical results should be available from the NY-certified lab within a month of sample collection. A summary of evaluation results will be discussed with NYSDEC within one month of receipt of validated analytical results.

If you have any questions or comments regarding this Work Plan Addendum or require any additional information, please feel free to contact either of us at (908) 253-3200 ext. 18 and 11, respectively.

Sincerely,
S_2C_2 Inc.,

JCR

Jason C. Ruf
Sr. Geologist

Steven B. Gelb

Steven B. Gelb
Project Manager/Principal Hydrogeologist

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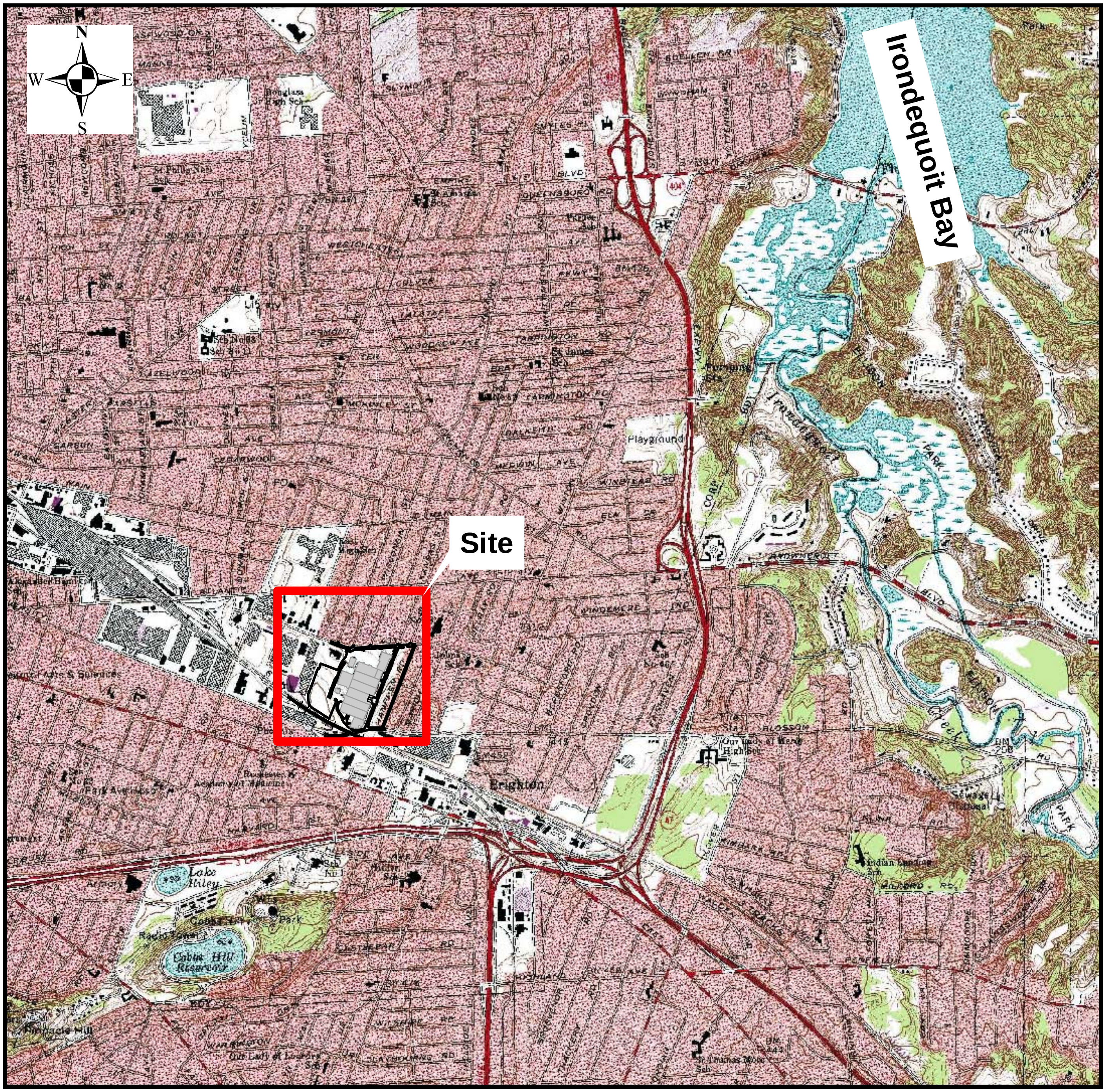

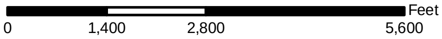

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Figure 1
Site Location Map

Supplemental Work Plan for
Initial Bedrock Evaluation Activities

100 Carlson Road
Rochester, New York

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Site Facility Map

Supplemental Work Plan for
Initial Bedrock Evaluation Activities

100 Carlson Road, Rochester, New York

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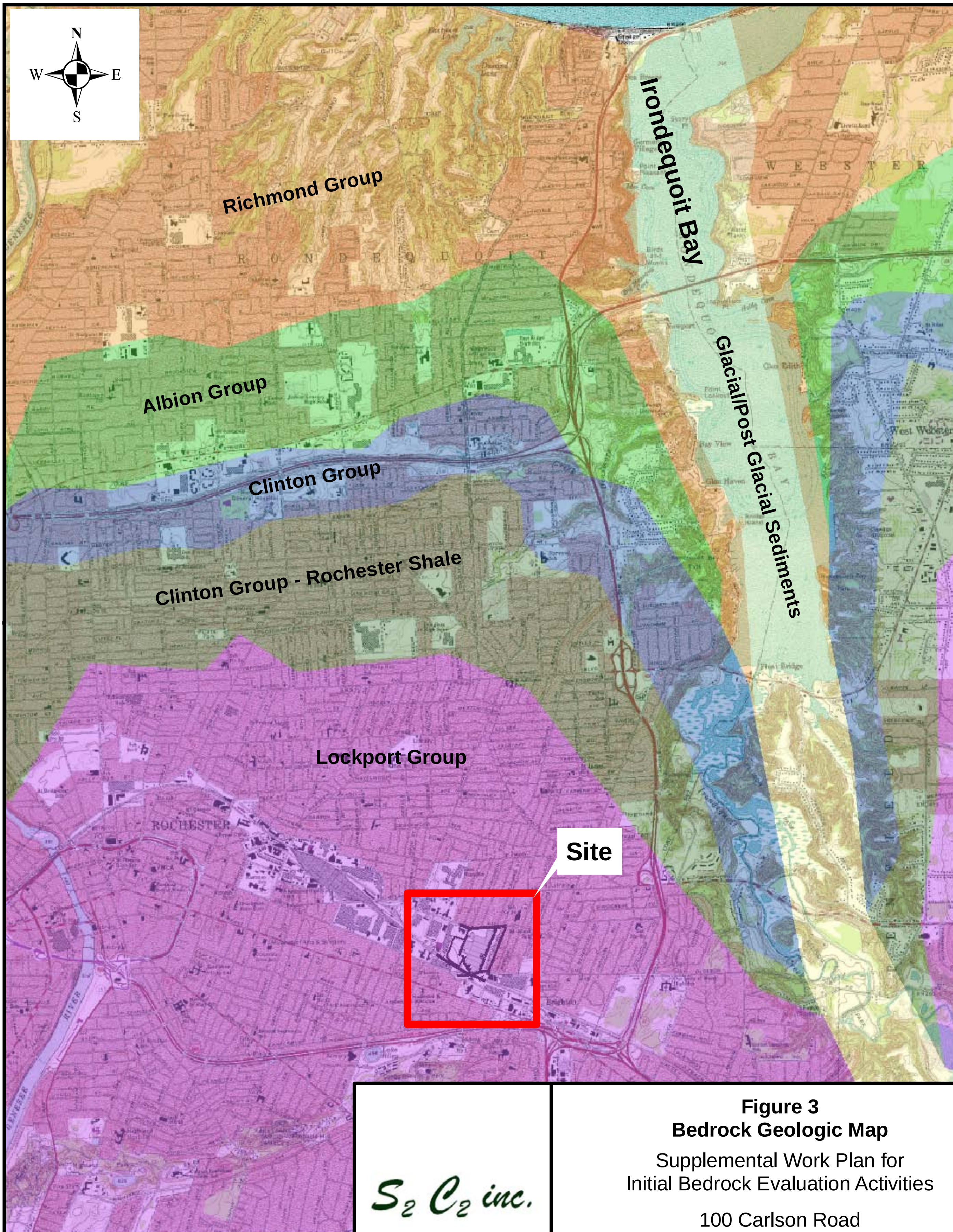

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Figure 3
Bedrock Geologic Map

Supplemental Work Plan for
Initial Bedrock Evaluation Activities

100 Carlson Road
Rochester, New York

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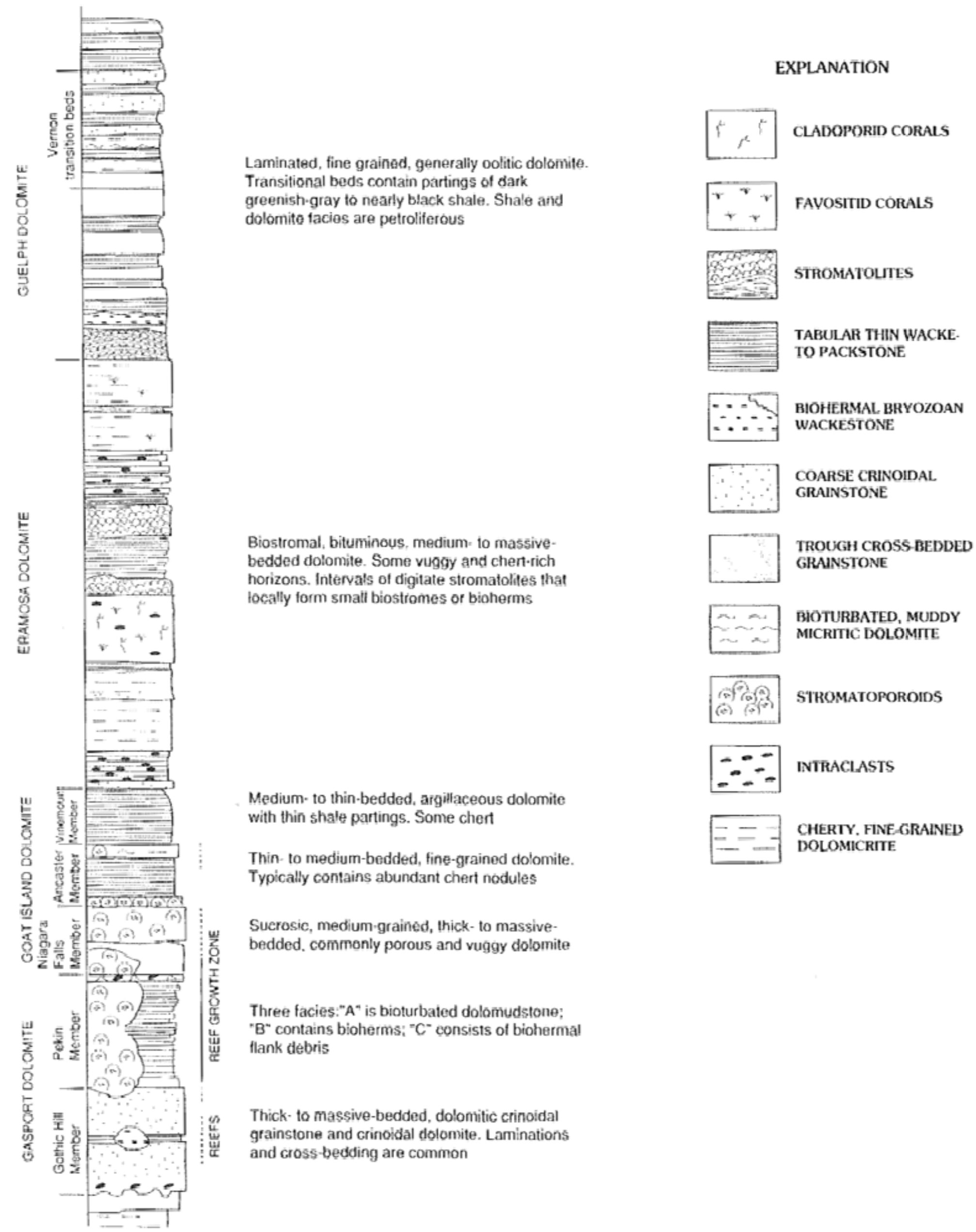

Figure 4: Descriptive Stratigraphic columns for the Lockport Group taken from Brett et al 1995.

Figure 5: Photograph of Dolomite Products Quarry located in Pennfield, NY with examples of vertical joint sets and horizontal fracture zones.

Proposed Bedrock Evaluation Borings

Supplemental Work Plan for
Initial Bedrock Evaluation Activities

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