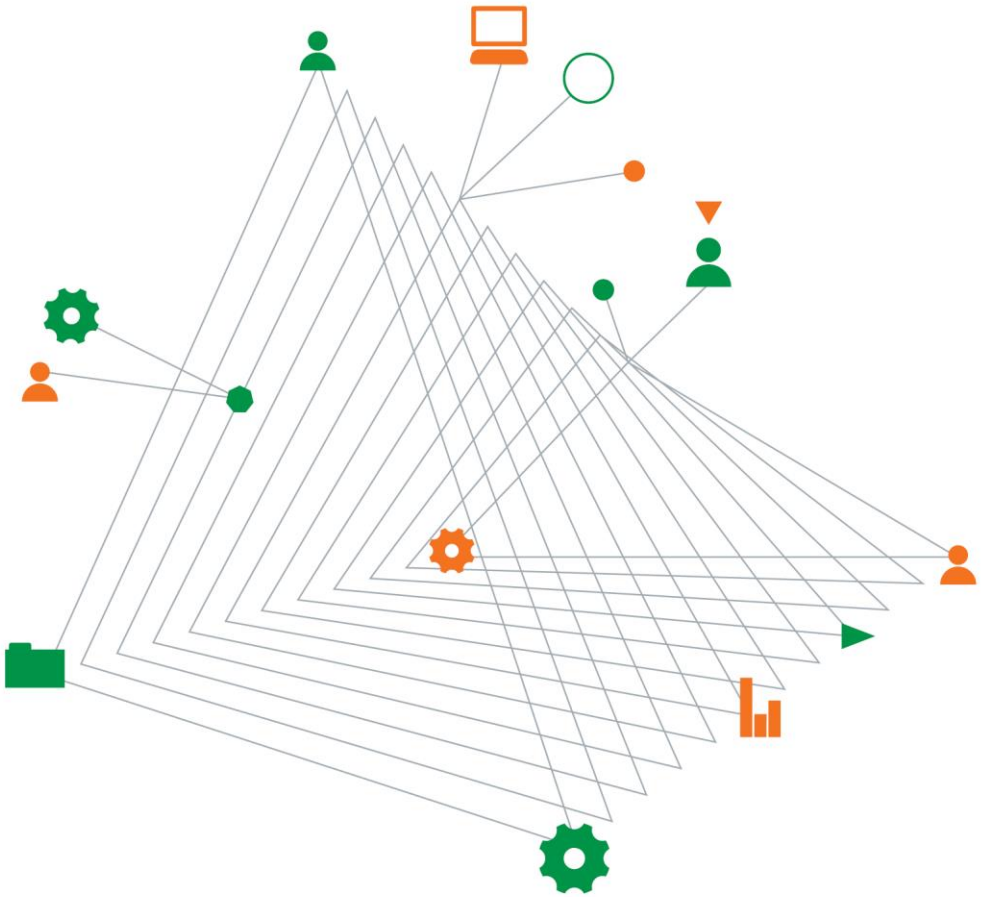
Payce

Melrose Park

Initial Geotechnical Assessment

12 November 2015



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Melrose Park

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For and on behalf of Coffey

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Associate Engineering Geologist

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1. Introduction

Payce Consolidated Limited (Payce) has purchased a number of parcels of land within the Sydney suburb of Melrose Park. Payce has requested that Coffey Geotechnics Pty Ltd (Coffey) prepare this initial geotechnical assessment to assist in the potential redevelopment of the site for residential and commercial uses.

The work was commissioned by Payce, in response to our discussions with Mathew Richards of Northrop, and our subsequent email proposal dated 4 November 2015. The proposed development is in the initial stages at present, however, a concept scheme includes medium density and localised high rise residential development. The design is to include multi-level basements, together with construction of open spaces and local roads.

The objective of the assessment is to provide Payce with advice on the geotechnical risks related to the site.

A review of published information, together with a search of the Coffey archives was performed to assess the potential ground conditions. A site visit was undertaken by an Associate Engineering Geologist from Coffey. The site visit was undertaken to assess likely subsurface conditions and assess potential areas of concern.

2. Site description

The site is currently occupied by a number of large industrial units, generally consisting of low rise warehouses and office units. The site covers an area of approximately 25.1 Hectares, bounded by Wharf Road to the east and Hope Street to the south. The site is bounded to the north by a strip of open ground and a miniature golf business, which itself is adjacent to Victoria Road. Houses along Hughes Avenue form the western boundary.

The industrial units occupy approximately 60% of the site, with hardstanding areas for external car parking and roadways accounting for an additional 30%. The remainder of the site is occupied by landscaped areas and open grassed areas. The site sits within an industrial area situated between Victoria Road and the Parramatta River, which is approximately 300m to the south of Hope Street. Residential streets are found both east and west of the site boundaries, typically comprising of single dwellings of one to two storeys.

Vegetation across the site is limited to mature trees around the perimeter, with a number of young trees within the centre of the site.

3. Available information

3.1. Published information

The Sydney 1:100,000 Scale Geological Sheet indicates that the site is mainly underlain by Triassic age Hawkesbury Sandstone, with the younger Ashfield Shale extending below the northern extent of the site. The Mittagong Formation is found between the two main geological units, which is typically observed as an interbedded fine grained sandstone and mudstone representing transition beds between the two depositional events. Within the Sydney Basin the Mittagong Formation is typically observed to range from a couple of metres to up to 8m thick, however it is sometimes not detectable.

A review of the Sydney Soil Landscape Series Sheet indicates the site is underlain by soils of the Lucas Heights grouping. The Lucas Heights soil group is attributed to residual soil derived from the Mittagong Formation.

Quaternary age alluvial sediments are shown below the south eastern extent of the site, running along the course of a potential former drainage channel. This alluvial channel appears to run parallel to Cobham Avenue, to the east of the site, to the confluence with the Parramatta River.

The Prospect/Parramatta River Acid Sulfate Soil Risk Map indicates that the site is within the area of No Known Occurrence, indicating that acid sulfate soils are not known or expected to occur in these environments.

3.2. Topography

Topographic survey of the local region indicates the site sits on the southern end of a low ridgeline running from a high point at the intersection of Marsden Road and Stewart Street in West Ryde to the Parramatta River. The area surrounding the site typically falls gently to the south, with a drop to the east, towards the Ryde-Parramatta Golf Course. A localised depression runs through the site, from the north western extent to a position mid-way along Wharf Road, at the intersection with Taylor Avenue. This depression is likely associated with the drainage channel that runs along Codham Avenue to the golf course ponds.

Photograph 1 – Wharf Road looking south, the drainage channel depression in the distance

The highest point of the site is close to the north western extent, at approximately 40m elevation, with the south western extent of Hope Street at an elevation of 15m.

A series of retaining walls form the southern, Hope Street, boundary. These retaining walls were observed up to 2.5m high and consisting of a mixture of brick masonry, concrete crib and sandstone block walls, as shown in the following photographs.

Photograph 2 – Brick masonry wall along Hope Street

Photograph 3 – Sandstone block wall

Photograph 4 – Concrete crib wall

The topography of the site, particularly the level hardstanding areas around the industrial units and the retaining structures, indicates that the site has been subject to significant previous reprofiling/filling.

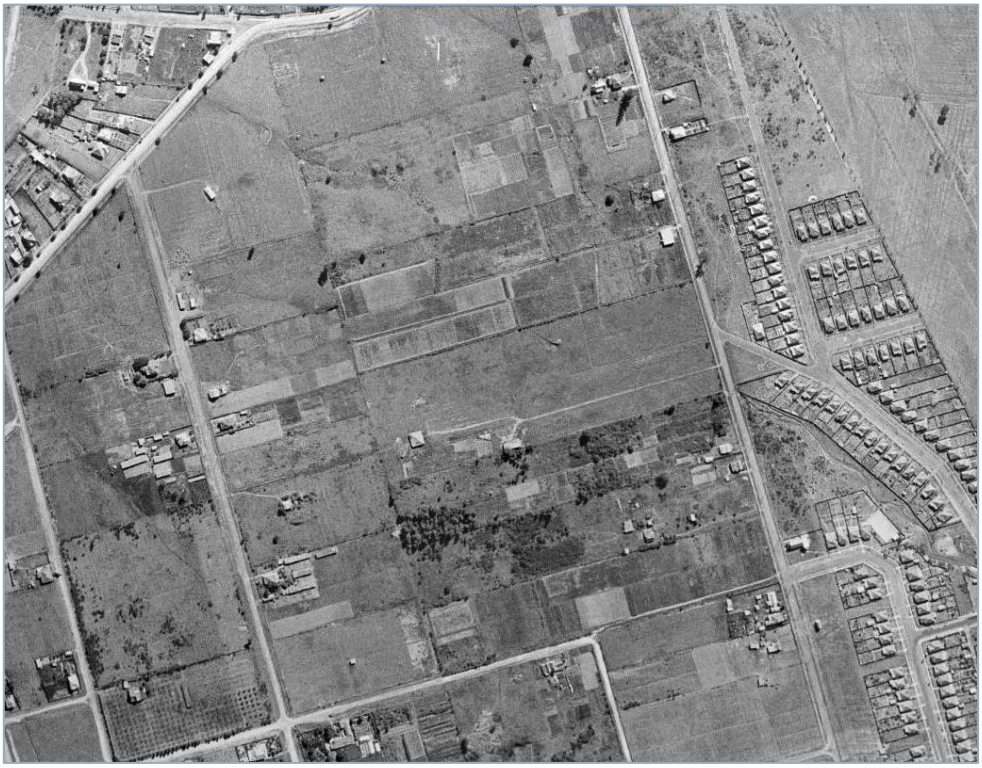
3.3. Coffey archive information

A review of our archive system indicated that no investigations have been performed by Coffey on the site itself. Results of a limited number of investigations, performed in the area at residential properties, are available.

A review of these projects indicates shale bedrock present in boreholes close to the Hope Street/Wharf Road intersection.

3.4. Aerial photography review

A review of the publically available 1943 aerial photograph of the site (accessible on the NSW SIX database) indicates the site was used predominantly as market gardens with houses on large plots. The photograph also shows the original course of the, potentially ephemeral, creek running along the alignment of the north-west to south-east trending topographical depression. The aerial photograph is reproduced below:



Photograph 5 – 1943 Aerial photograph (reproduced from www.maps.six.nsw.gov.au)

4. Preliminary site geotechnical model

During the site walkover a number of recent, shallow excavations were observed, with cuttings of bedrock found along both Hope Street and Hughes Avenue. These bedrock samples indicate the presence of shale, potentially derived from Mittagong Formation bedrock, along the eastern section of Hope Street, and sandstone along Hughes Avenue. Figure 1 has been prepared showing the likely subsurface conditions based on the results of the site walkover and nearby borehole drilling. Due to the significant reprofiling and filling of the site for the construction of the industrial units we have chosen not to show the man made fill across the site. Additionally, due to this working of the site we have not shown the presence of alluvium within the local depression, as this material may have been removed during construction.

Based on the landforms observed during the site walkover and experience at similar sites, we expect subsurface conditions at the site will comprise the following:

Table 1 – Preliminary Geotechnical Model

Geotechnical Unit	Description	Indicative thickness
Fill	Where reprofiling of the site has occurred, fill may consist of gravelly clay, with possible sandstone cobbles and boulders. The fill may also include demolition rubble from previous structures on site, such as bricks, tiles, sheeting.	Fill across such a large site is difficult to assess, however, from the site walkover filling of up to 3m was estimated, and may be found at greater depths.
Residual soil	Silty clay and sandy clay, low to high plasticity, likely stiff to hard. Residual soil will be derived from both shale and sandstone bedrock.	Typically found between 0.5m and 2m thick.
Shale bedrock	Shale, grey and dark grey, interlaminated with fine grained sandstone, grading from extremely weathered to, potentially, fresh. Low to medium strength (including the Mittagong Formation bedrock)	Shale bedrock is limited to discrete areas of the site, possibly found up to 10m thick. Likely isolated to the northern and south eastern extents.
Sandstone bedrock	Sandstone, fine to medium grained, likely contains interbeds of mudstone, grading from highly weathered to fresh, typically low to high strength, increasing with depth	To depths greater than the proposed basement level

No information is available on local groundwater levels, however, it is likely that groundwater seepage may be present at the interface of the soil and bedrock. Groundwater is likely to be found within the sandstone bedrock, possibly at depths commensurate with the nearby Parramatta River.

5. Geotechnical discussion and recommendations

5.1. Suitability for development

Based on our site observations, preliminary geotechnical model, and experience on similar projects, the proposed development, including basements is considered feasible from a geotechnical perspective. Provided appropriate site investigation, design assessments, and construction monitoring normally associated with this type of development are carried out, the risks to adjacent structures and services should be able to be managed.

5.2. Potential impacts of excavation

Following demolition it is anticipated that the site will be reprofiled to form the finished ground levels for service roads and parklands. The reprofiling will likely include a significant amount of soil movement, potentially including rock excavation. Large sandstone boulders at the existing Hope Street entrance to the site indicates that previous excavations and reprofiling has resulted in excavation of sandstone bedrock.

Based on likely two level basement, potentially extending to 6m below ground level, we expect that the excavation will be through fill, residual soil and shale/sandstone bedrock. Conventional excavation methods and plant should be able to be used to excavate the soil and low strength rock materials. Use of high powered excavation plant fitted with rippers and rock breakers will be required for the excavations into higher strength rock, which may be encountered at many parts of the site. Strength tests on Mittagong Formation bedrock has previously found material up to very high strength, which may be problematic to excavate using conventional plant and may require rock sawing or similar.

Appropriate investigations, designs, and monitoring will be required to assess the foundations of existing adjacent structures and services and to protect them from adverse impacts from ground

movements and vibrations. Conventional retention systems and excavation methods should be able to be adopted to mitigate the risks to adjacent structures and services.

We recommend that prior to the commencement of the bulk excavation works dilapidation surveys of the adjacent structures be carried out to provide a baseline for excavation monitoring and management works.

5.3. Excavation support

Where excavations extend close to the site boundaries, shoring will be required to support the excavations in soil and weathered rock. For a project such as this shoring systems such as sheet piles, secant pile or diaphragm walls are considered possible.

Where sufficient space is available during construction, excavations may be constructed by battering of soils and weathered bedrock.

5.4. Building foundations

Basement excavation of about 6m may be necessary for a two level basement. At this level, we expect to encounter sandstone bedrock across much of the site. Where sandstone bedrock is present at footing level a minimum allowable bearing pressure of 1,000 kPa is likely, however, with an appropriate, investigation including cored boreholes, higher design parameters are likely to be able to be assigned to the bedrock.

Reduced allowable bearing capacity would be assigned for the weathered shale bedrock and residual soils, and may be suitable for lightly loaded structures.

Where low density residences are planned a site classification, assessed as per AS2870, will be required. Where fill is present below building footprints the site will be classified as Class P, however, where stripping of fill to the underlying natural in-situ soil the site will likely be classified as Class M.

5.5. Groundwater

The construction of basements at the site will be highly dependent on groundwater conditions, particularly static levels and permeability of soils and bedrock. Groundwater inflows into basement excavations will be dependent on a number of factors, including groundwater level, size, location and depth of excavation, wall depth and permeability, defects in the rock mass (e.g. fractures) intersected by the excavation.

Testing in the Sydney region shows that the sedimentary rocks of the Ashfield Shale and Hawkesbury Sandstone are generally of low permeability and as a result it is anticipated that seepage rates from these formations into excavations are expected to be low. It is also anticipated, due to the likely low permeability, that the extent of impacts to the surrounding groundwater system from excavations would be limited and likely to be to low significance. It is recommended that groundwater be assessed during subsequent field investigations to assess the nature of the conditions and the degree of consistency with above expectations.

5.6. Further site investigations

We recommend that geotechnical site investigations, and land contamination investigations, be carried out to support planning and design. For a site of this size with basements, it is recommended that geotechnical investigations would comprise of targeted drilling of cored boreholes is performed. Typically a spacing of 35m is considered appropriate, however, for larger buildings with greater loads this may be reduced. The aim of such investigation would be to assess the depth and

consistency/strength of the soil profile, depths and quality of the bedrock across the site, and provide data for the design.

Due to the presence of historic fill materials, of generally unknown depth, we would recommend an initial investigation of the site adopting a limited number of borehole combined with geophysics to gain a high level appreciation of the ground conditions and risks across the site. This can then be used to assist in the concept design of particular site structures, with the targeted investigations performed at a later time to assist detailed design.

Standpipes should be installed into selected boreholes to assess groundwater levels across the site and to perform groundwater inflow testing. Furthermore, water samples can be collected for water quality/chemistry testing if required. To assist with gaining approval for drained basement systems, continuous groundwater monitoring using down hole data loggers over a minimum three month period is recommended.

6. Limitations

The initial geotechnical assessment and recommendations presented in this report are based on a desk study limited to regional information, and subsurface investigation data from outside of the site boundaries. Subsurface conditions can be complex, vary over relatively short distances and over time. Additional, site specific investigations will be required to support detailed design. Detailed design and construction should not proceed on the basis of this desk study report without further advice from Coffey.

The attached document entitled “Important Information about Your Coffey Report” forms an integral part of this report and presents additional information about the uses and limitations of the report.

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Important information about your **Coffey** Report

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction,
speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Figures

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coffey

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project: INITIAL GEOTECHINCAL ASESSEMENT
PAYCO MELROSE PARK
MELROSE PARK, NSW

title: INITIAL ASSESSMENT OF SUBSURFACE GEOLOGY

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